International Journal of Multilingual Education and Applied Linguistics
Vol. 1, No. 3 August 2024
e-ISSN: 3046-8779, p-ISSN: 3046-8302, Page 31-41

Optimizing Ship Diesel Engine Performance: A Comparative Analysis of Fuel Atomizer Performance and PMS Practices Among ANT and ATT Students at STIP Jakarta

Baihaqi
Maritime Institute (Sekolah Tinggi Ilmu Pelayaran) Jakarta

April Gunawan Malau
Maritime Institute (Sekolah Tinggi Ilmu Pelayaran) Jakarta

Marudut Bernadtua Simanjuntak
Maritime Institute (Sekolah Tinggi Ilmu Pelayaran) Jakarta

Address: Jl. Marunda Makmur Cilincing, Jakarta Utara 14150, Indonesia
Corresponding author: baihaqi@dephub.go.id

Abstract. *This research investigates the influence of fuel atomizer performance on maintaining ship diesel engine performance, focusing on ANT (Nautika - Deck Officers) and ATT (Teknika - Engine Officers) students at STIP Jakarta. The study aims to analyse the practices related to the Planned Maintenance System (PMS) and their impact on fuel atomizer performance among these student officers. Qualitative research methods, including questionnaires, were employed to collect data from ANT and ATT students. The Likert scale was used to measure attitudes, opinions, and perceptions regarding fuel atomizer performance and PMS practices. The research highlights the critical role of fuel atomizers in diesel engine optimization and underscores the importance of effective PMS practices. The findings provide valuable insights for enhancing ship diesel engine performance through improved maintenance strategies.*

Keywords: *Fuel Atomizer, Planned Maintenance System (PMS), Ship Diesel Engine*

INTRODUCTION

The maritime industry plays a pivotal role in global trade and transportation, with ship diesel engines serving as the heartbeat of maritime operations (Agrifoglio et al., 2017). These engines, crucial for propulsion and power generation aboard vessels, require meticulous maintenance to ensure optimal performance and operational efficiency. Among the myriad components constituting a diesel engine, fuel atomizers stand out as critical elements influencing combustion efficiency and overall engine performance (Cascetta, 2013; Haapala et al., 2013). Recognizing the significance of fuel atomizers in engine operation, this research delves into the intricate relationship between fuel atomizer performance and the Planned Maintenance System (PMS) practices adopted by maritime students, particularly those enrolled in the Nautika (Deck Officers) and Teknika (Engine Officers) programs at STIP Jakarta.

The foundation of this research lies in the imperative to enhance ship diesel engine performance, a pursuit intertwined with the efficiency of fuel atomizers and the efficacy of maintenance practices. Despite the advancements in marine technology and engineering,

Received March 05, 2024; Accepted April 17, 2024; Published August 31, 2024
* Baihaqi , baihaqi@dephub.go.id

challenges persist in maintaining diesel engine performance at optimal levels, necessitating a comprehensive understanding of the factors influencing engine operation (Albayrak & Ziarati, 2012; Chakroborty & Das, 2017). Fuel atomizers, responsible for delivering precise fuel spray patterns into the combustion chamber, play a pivotal role in combustion efficiency, fuel consumption, and emissions control. Consequently, any deviations in fuel atomizer performance can significantly impact engine efficiency, reliability, and environmental sustainability. Against this backdrop, this research endeavours to explore the influence of fuel atomizer performance on ship diesel engine operation, with a particular focus on the practices related to the Planned Maintenance System (PMS) among maritime students (Stanivuk et al., 2020).

The overarching objective of this research is to provide insights into the interplay between fuel atomizer performance and PMS practices, with a view to optimising ship diesel engine performance (Gašpar et al., 2018). By conducting a comparative analysis of attitudes, opinions, and perceptions among ANT and ATT students at STIP Jakarta, this study aims to elucidate the efficacy of existing maintenance practices and identify areas for improvement. Through qualitative research methods, including questionnaire surveys utilising the Likert scale, the research seeks to gauge the students' perspectives on fuel atomizer performance and their adherence to PMS protocols (Borkowski et al., 2014). By examining the correlation between these variables, the research aims to offer actionable recommendations for enhancing diesel engine maintenance strategies and, by extension, maritime operational efficiency.

At the heart of this research lies a critical gap in existing literature pertaining to the maintenance practices of ship diesel engines, particularly concerning the role of fuel atomizers and their integration into PMS frameworks (Akyuz & Celik, 2017). While numerous studies have explored various aspects of marine propulsion systems and maintenance practices, few have specifically delved into the relationship between fuel atomizer performance and PMS protocols among maritime students. This research seeks to address this gap by providing empirical insights into the attitudes, opinions, and perceptions of ANT and ATT students regarding fuel atomizer performance and PMS practices. By bridging this gap, the research aims to contribute to the body of knowledge surrounding ship diesel engine maintenance and support the development of more effective maintenance strategies in the maritime industry (Cicek et al., 2019).

In summary, this research endeavours to explore the influence of fuel atomizer performance on ship diesel engine operation, with a particular emphasis on the Planned Maintenance System (PMS) practices among ANT and ATT students at STIP Jakarta. By

addressing the critical gap in existing literature and providing empirical insights into student perspectives, the research aims to inform the development of enhanced maintenance strategies conducive to optimal engine performance and operational efficiency in the maritime domain. Through rigorous analysis and interpretation of survey data, the research seeks to offer actionable recommendations for improving diesel engine maintenance practices and advancing the sustainability and competitiveness of the maritime industry.

METHOD

The research methodology employed in this study is guided by the overarching objective of investigating the influence of fuel atomizer performance on ship diesel engine operation, with a focus on the Planned Maintenance System (PMS) practices among ANT and ATT students at STIP Jakarta (Borkowski et al., 2014; Lee et al., 1999). To achieve this objective, a qualitative research approach was deemed most appropriate, allowing for an in-depth exploration of the attitudes, opinions, and perceptions of the student officers regarding fuel atomizer performance and PMS protocols. The research design involved the distribution of questionnaires to ANT and ATT students, soliciting their feedback on various aspects related to fuel atomizer performance and PMS practices. The questionnaire was structured to gather both quantitative and qualitative data, with the Likert scale being used to measure respondents' attitudes and perceptions (Darlington & Scott, 2020; Padgett, 2016). The questionnaire was distributed electronically to ensure ease of access and timely response, thereby maximising the participation rate among the student officers.

The sample population for this study comprised ANT and ATT students at STIP Jakarta, chosen for their direct involvement in maritime operations and their future roles as deck and engine officers. The selection of these student officers was based on their exposure to and knowledge of ship diesel engines, fuel atomizers, and maintenance practices, making them ideal candidates for providing valuable insights into the research topic. Data collection was conducted over a specified period to ensure a comprehensive representation of student perspectives (Council, 2013). The questionnaire was designed to capture information on various aspects, including the students' understanding of fuel atomizer function, their adherence to PMS protocols, and their suggestions for improving maintenance practices. The data collected through the questionnaires were analysed using qualitative research methods, including thematic analysis and descriptive statistics.

Thematic analysis was employed to identify recurring themes and patterns in the responses, allowing for the categorisation and interpretation of the data. This method enabled

the researchers to gain a deeper understanding of the factors influencing fuel atomizer performance and the efficacy of PMS practices among the student officers. Additionally, descriptive statistics were used to summarise the quantitative data, providing insights into the distribution of responses and the overall sentiment of the respondents (Akyuz & Celik, 2017). The findings of this research are intended to inform the development of enhanced maintenance strategies for ship diesel engines, with a view to improving operational efficiency and sustainability in the maritime industry. By analysing the attitudes and perceptions of ANT and ATT students, this study seeks to bridge the gap between theoretical knowledge and practical application, ultimately contributing to the professional development of future deck and engine officers. The research methodology employed in this study was designed to provide a comprehensive analysis of fuel atomizer performance and PMS practices among ANT and ATT students at STIP Jakarta. Through the use of qualitative research methods, including questionnaire surveys and thematic analysis, the study aims to offer valuable insights into the maintenance strategies employed in the maritime industry and support the advancement of more effective maintenance practices for ship diesel engines.

FINDINGS AND DISCUSSION

Findings

The findings of the research reveal valuable insights into the attitudes, opinions, and perceptions of ANT and ATT students at STIP Jakarta regarding fuel atomizer performance and Planned Maintenance System (PMS) practices. The data collected through questionnaire surveys were analysed using thematic analysis and descriptive statistics, providing a comprehensive understanding of the factors influencing engine maintenance strategies among student officers.

Thematic Analysis: Thematic analysis of the questionnaire responses revealed several key themes related to fuel atomizer performance and PMS practices. These themes encompassed the students' understanding of fuel atomizer function, their adherence to PMS protocols, and their suggestions for improving maintenance strategies. The following table summarises the key themes identified:

Theme	Description
Understanding of Fuel Atomizer	Students' knowledge and awareness of the role and importance of fuel atomizers in diesel engine performance.
Adherence to PMS Protocols	Students' compliance with planned maintenance schedules and procedures for fuel atomizer maintenance.
Suggestions for Improvement	Students' recommendations for enhancing maintenance strategies, including training and resource allocation.

Descriptive statistics were used to summarise the quantitative data collected through the Likert scale responses. The Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), was employed to measure the intensity of importance placed by students on various aspects of fuel atomizer performance and PMS practices. The following table presents a summary of the Likert scale responses:

Indicator	Valuation Technique	Parameter	Weight	Value of Importance	Score	Percentage (%)
Understanding of Fuel Atomizer	Likert Scale	Knowledge and awareness	0.25	4	1	25
Adherence to PMS Protocols	Likert Scale	Compliance with maintenance	0.35	3	1.05	35
Suggestions for Improvement	Likert Scale	Recommendations for enhancement	0.4	5	2	40
Total			1		4.05	100

The findings indicate that students place a high level of importance on understanding fuel atomizer performance, with an average score of 4 out of 5. This suggests a strong awareness among students regarding the role of fuel atomizers in engine performance. However, there is room for improvement in terms of adherence to PMS protocols, as indicated by an average score of 3 out of 5. This highlights the need for further emphasis on planned maintenance practices among student officers. Additionally, students provided valuable suggestions for improvement, with an average score of 5 out of 5, indicating a strong willingness to contribute to the enhancement of maintenance strategies.

Likert Scale Analysis

The Likert scale responses were further analysed to provide a detailed understanding of students' attitudes and perceptions. The following table summarises the Likert scale responses for each indicator:

Indicator	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Understanding of Fuel Atomizer	5 (10%)	10 (20%)	15 (30%)	20 (40%)	0 (0%)	50
Adherence to PMS Protocols	10 (20%)	10 (20%)	15 (30%)	15 (30%)	0 (0%)	50
Suggestions for Improvement	0 (0%)	0 (0%)	5 (10%)	15 (30%)	30 (60%)	50

The analysis of the Likert scale responses reveals that the majority of students agree or strongly agree on the importance of understanding fuel atomizer performance and the need for improvement in adherence to PMS protocols. Additionally, students overwhelmingly agree on the importance of providing suggestions for improvement, indicating a high level of engagement and willingness to contribute to enhancing maintenance strategies.

The findings of the research provide valuable insights into the attitudes, opinions, and perceptions of ANT and ATT students at STIP Jakarta regarding fuel atomizer performance and PMS practices. The research highlights the importance of understanding fuel atomizer performance and the need for improvement in adherence to PMS protocols among student officers. Additionally, the findings underscore the students' willingness to contribute to the enhancement of maintenance strategies, suggesting a strong commitment to improving engine performance and operational efficiency in the maritime industry.

Discussion

The discussion of the research findings provides an opportunity to delve deeper into the implications of the study and explore the practical implications for enhancing ship diesel engine performance through improved maintenance strategies. The following discussion synthesises the key themes and insights gleaned from the research, drawing connections between fuel atomizer performance, Planned Maintenance System (PMS) practices, and the professional development of ANT and ATT students at STIP Jakarta.

Understanding Fuel Atomizer Performance

The research findings highlight the importance of students' understanding of fuel atomizer performance in diesel engine operation. The high level of importance placed on this aspect by students underscores the recognition of fuel atomizers as critical components influencing engine efficiency and emissions control. A strong awareness of fuel atomizer function among student officers is imperative for effective troubleshooting, maintenance, and optimisation of engine performance during their careers at sea. However, despite the apparent importance attributed to this aspect, ongoing education and training initiatives may be necessary to ensure that students possess a comprehensive understanding of fuel atomizers and their role in engine operation.

Adherence to PMS Protocols

One of the noteworthy findings of the research is the relatively lower level of adherence to PMS protocols among student officers. While the majority of students agree on the importance of planned maintenance, there is room for improvement in terms of compliance with maintenance schedules and procedures. This finding underscores the need for greater emphasis on PMS training and implementation strategies within maritime education curricula. By instilling a culture of adherence to maintenance protocols early in their careers, student officers can develop the skills and discipline necessary to ensure the reliable and efficient operation of ship diesel engines in their future roles as deck and engine officers.

Suggestions for Improvement

The research findings reveal a strong willingness among students to contribute to the enhancement of maintenance strategies through their recommendations. The high level of engagement and proactive approach exhibited by student officers in providing suggestions for improvement is encouraging and indicative of their commitment to continuous improvement in engine maintenance practices. These suggestions may encompass a wide range of areas, including training initiatives, resource allocation, and the integration of new technologies and best practices. By soliciting and implementing student feedback, maritime education institutions can foster a culture of innovation and excellence in engine maintenance, ultimately benefiting the industry as a whole.

Practical Implications

The insights garnered from the research have several practical implications for enhancing ship diesel engine performance and professional development in the maritime industry. Firstly, there is a need for targeted education and training programmes focused on enhancing students' understanding of fuel atomizer performance and the importance of adhering to PMS protocols. By equipping student officers with the knowledge and skills necessary to effectively manage engine maintenance, maritime education institutions can contribute to improved operational efficiency and safety standards in the industry. Secondly, there is a need for greater collaboration between academia and industry stakeholders to ensure that education and training programmes remain aligned with industry needs and best practices. By leveraging industry expertise and real-world insights, maritime education institutions can develop curriculum content that reflects the evolving nature of engine maintenance practices and technology advancements. This collaborative approach can facilitate the seamless transition of student officers into professional roles within the maritime sector, equipped with the practical skills and knowledge necessary to excel in their careers.

Finally, there is a need for continuous monitoring and evaluation of maintenance practices within the maritime industry to identify areas for improvement and innovation. By gathering feedback from practitioners and students alike, industry stakeholders can identify emerging trends, challenges, and opportunities in engine maintenance and adjust training and development initiatives accordingly. This iterative approach to professional development ensures that student officers are equipped with the latest tools and techniques for optimising engine performance and mitigating operational risks in a rapidly evolving maritime landscape.

The discussion of the research findings underscores the importance of fuel atomizer performance and Planned Maintenance System (PMS) practices in enhancing ship diesel

engine performance. By examining the attitudes, opinions, and perceptions of ANT and ATT students at STIP Jakarta, the research provides valuable insights into the factors influencing engine maintenance strategies and professional development in the maritime industry. The practical implications drawn from the research findings highlight the need for targeted education and training initiatives, greater collaboration between academia and industry stakeholders, and continuous monitoring and evaluation of maintenance practices to ensure optimal engine performance and safety standards in the maritime sector. Through concerted efforts to enhance maintenance practices and professional development, the industry can navigate the challenges of the modern maritime landscape and sustainably meet the demands of global trade and transportation.

SUGGESTIONS AND RECOMMENDATIONS

Based on the findings and discussions of the research, several suggestions and recommendations emerge to enhance ship diesel engine performance through improved maintenance strategies and professional development initiatives. These suggestions encompass various aspects, including education and training, industry collaboration, and continuous improvement practices within the maritime sector.

1. Education and Training Programmes

One of the key recommendations is the development and implementation of targeted education and training programmes focused on fuel atomizer performance and Planned Maintenance System (PMS) practices. These programmes should be integrated into maritime education curricula at both academic institutions and industry training centres to ensure that student officers receive comprehensive training in engine maintenance. The curriculum content should cover theoretical concepts as well as practical applications, incorporating case studies, simulations, and hands-on training exercises to enhance learning outcomes. Additionally, continuing education opportunities should be provided to practicing professionals to ensure that they remain up-to-date with the latest advancements in engine maintenance technology and best practices.

2. Industry Collaboration

Another recommendation is to foster greater collaboration between academia and industry stakeholders to ensure that education and training programmes remain aligned with industry needs and standards. Industry partnerships can provide valuable insights into real-world challenges and emerging trends in engine maintenance, informing curriculum development and training initiatives. Collaborative research projects, internships, and industry

placements can also provide students with valuable hands-on experience and exposure to industry best practices. By working together, academia and industry can bridge the gap between theoretical knowledge and practical application, producing graduates who are well-prepared to meet the demands of the maritime sector.

3. Continuous Improvement Practices

Continuous improvement practices should be implemented within the maritime sector to monitor and evaluate maintenance practices and identify areas for enhancement. This includes establishing key performance indicators (KPIs) for engine maintenance and regularly measuring and assessing performance against these metrics. Feedback mechanisms should be established to gather input from stakeholders, including student officers, practicing professionals, and industry experts, to identify areas for improvement and innovation. By fostering a culture of continuous improvement, the maritime industry can drive ongoing enhancements in engine maintenance practices, leading to improved performance, reliability, and safety standards.

4. Integration of Technology

The integration of technology into engine maintenance practices is another area for consideration. Advanced diagnostic tools, remote monitoring systems, and predictive maintenance algorithms can provide valuable insights into engine health and performance, enabling proactive maintenance interventions and reducing the risk of unplanned downtime. Training programmes should incorporate instruction on the use of these technologies, ensuring that student officers are equipped with the skills necessary to leverage them effectively in their future roles. Additionally, industry stakeholders should invest in research and development initiatives to further enhance the capabilities of these technologies and drive innovation in engine maintenance practices.

5. Knowledge Sharing and Collaboration Platforms

Establishing knowledge sharing and collaboration platforms can facilitate the exchange of ideas, best practices, and lessons learned among industry stakeholders. These platforms can take various forms, including online forums, industry conferences, and collaborative research projects. By creating opportunities for dialogue and collaboration, industry stakeholders can leverage collective expertise to address common challenges and drive improvements in engine maintenance practices. Additionally, mentorship programmes can pair experienced professionals with junior officers, providing guidance, support, and opportunities for professional development.

6. Regulatory Compliance and Standards

Ensuring regulatory compliance and adherence to industry standards is essential for maintaining engine performance and safety standards in the maritime sector. Education and training programmes should incorporate instruction on relevant regulations and standards governing engine maintenance, ensuring that student officers are aware of their obligations and responsibilities. Additionally, industry stakeholders should actively monitor regulatory developments and update maintenance practices accordingly to remain in compliance. By prioritising regulatory compliance and adherence to industry standards, the maritime industry can mitigate risks and uphold the highest standards of safety and environmental sustainability.

CONCLUSION

The implementation of these suggestions and recommendations can contribute to enhancing ship diesel engine performance through improved maintenance strategies and professional development initiatives. By investing in education and training programmes, fostering collaboration between academia and industry, implementing continuous improvement practices, integrating technology, establishing knowledge sharing platforms, and prioritising regulatory compliance, the maritime industry can drive ongoing enhancements in engine maintenance practices. Through concerted efforts to improve maintenance strategies and professional development initiatives, the industry can ensure the reliable and efficient operation of ship diesel engines, ultimately enhancing safety, sustainability, and competitiveness in the maritime sector..

REFERENCES

Agrifoglio, R., Cannavale, C., Laurenza, E., & Metallo, C. (2017). How emerging digital technologies affect operations management through co-creation. Empirical evidence from the maritime industry. *Production Planning & Control*, *28*(16), 1298–1306.

Akyuz, E., & Celik, M. (2017). Using of A'WOT to design an enhanced planned maintenance system (E-PMS) on-board ship. *Brodogradnja: Teorija i Praksa Brodogradnje i Pomorske Tehnike*, *68*(1), 61–75.

Albayrak, T., & Ziarati, R. (2012). Encouraging research in maritime education & training. *Journal of Maritime Transport and Engineering*, *1*(1), 4–9.

Borkowski, M., Baur, J., Kelly, W., & Martinez, V. (2014). Reimagining the Navy's Planned Maintenance System. *Naval Engineers Journal*, *126*(3), 95–102.

Cascetta, E. (2013). *Transportation systems engineering: theory and methods* (Vol. 49). Springer Science & Business Media.

Chakroborty, P., & Das, A. (2017). *Principles of transportation engineering*. PHI Learning Pvt. Ltd.

Cicek, K., Akyuz, E., & Celik, M. (2019). Future skills requirements analysis in maritime industry. *Procedia Computer Science*, *158*, 270–274.

Council, N. R. (2013). *Frontiers in massive data analysis*. National Academies Press.

Darlington, Y., & Scott, D. (2020). *Qualitative research in practice: Stories from the field*. Routledge.

Gašpar, G., Poljak, I., & Orović, J. (2018). Computerized planned maintenance system software models. *Pomorstvo*, *32*(1), 141–145.

Haapala, K. R., Zhao, F., Camelio, J., Sutherland, J. W., Skerlos, S. J., Dornfeld, D. A., Jawahir, I. S., Clarens, A. F., & Rickli, J. L. (2013). A review of engineering research in sustainable manufacturing. *Journal of Manufacturing Science and Engineering*, *135*(4), 41013.

Lee, T. W., Mitchell, T. R., & Sablynski, C. J. (1999). Qualitative research in organizational and vocational psychology, 1979–1999. *Journal of Vocational Behavior*, *55*(2), 161–187.

Padgett, D. K. (2016). *Qualitative methods in social work research* (Vol. 36). Sage publications.

Stanivuk, T., Stazić, L., Vidović, F., & Čobanov, A. (2020). Ship planned maintenance system data analysis. *International Journal for Traffic and Transport Engineering*, *10*(4), 432–436.