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Research Article

Evaluation of the Lighting System on Boeing 737-300 Aircraft PT. Mulya Sejahtera Technology Bandung

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Abstract:

Background of study: Aircraft maintenance is vital for flight safety. To connect theory with practice, students at Medan Aviation Polytechnic undergo Field Work Practice at PT. Mulya Sejahtera Technology, focusing on aircraft lighting systems.

Aims and scope of paper: This paper discusses the evaluation of the Boeing 737-300 lighting system at PT. Mulya Sejahtera Technology Bandung, based on Field Work Practice involving trainees in maintenance, inspection, and troubleshooting across multiple divisions.

Methods: Using a descriptive observational approach, trainees engage in one month of daily maintenance, document tasks, and receive supervisor evaluations. Data is gathered through observation, practice, and feedback.

Result: Fieldwork Practice provides valuable hands-on experience, which significantly enhances trainees' technical skills, problem-solving abilities, and understanding of the complexity and importance of lighting systems. Trainees successfully apply classroom theory into real-life maintenance scenarios, develop effective communication skills, and adapt to a professional work environment.

Conclusion: Evaluation of the Boeing 737-300 lighting system at PT. Mulya Sejahtera Technology Bandung confirms its crucial role in flight safety and comfort. While most components meet standards, some require periodic maintenance and replacement due to aging. Routine inspections are essential to maintain optimal performance and regulatory compliance.

Keywords: Aviation Safety; Flight Nurse; Job Training; Lighting System; Practical Skills

1. INTRODUCTION

Safety and comfort in the world of aviation is a top priority that must be maintained consistently. One of the important aspects that directly contributes to the safety and operational efficiency of aircraft is the lighting system. The system includes different types of lighting, both for external needs such as navigation and landing, as well as internal ones such as cabin, cockpit, and emergency evacuation system lighting (Jaminan., 2022) The Boeing 737-300 aircraft is one type of commercial aircraft that has been widely used by various airlines in the world, including in Indonesia.

Although it is included in the category of previous generation aircraft, it is still widely operated and requires periodic maintenance to ensure that all its systems, including the lighting system, are working optimally. Over time, components in lighting systems may experience degradation in function due to wear, corrosion, or other technical failures. Therefore, evaluation of these systems is essential to ensure compliance with aviation safety standards set by aviation regulators such as the FAA and ICAO (FAA., 2012).

PT. Mulya Sejahtera Technology Bandung is one of the companies engaged in aircraft maintenance and repair, including handling electrical aspects and lighting systems. Through the evaluation of the lighting system on the Boeing 737-300 aircraft carried out at this company, it is hoped that accurate data can be obtained regarding the performance, reliability, and potential problems that arise in the system. The results of this evaluation are not only useful in aircraft maintenance efforts, but also as a consideration in decision-making related to repairs, component replacements, and improvement of operational efficiency and safety. Thus, this study aims to evaluate the condition and performance of the lighting system on the Boeing 737-300 aircraft as

a whole, as well as provide technical recommendations based on field findings at PT. Mulya Sejahtera Technology Bandung.

It has a strong theoretical basis in understanding and evaluating the lighting system on Boeing 737-300 aircraft, especially those used in PT. Mulya Sejahtera Technology Bandung. This literature aims to explain the working principles and functions of different types of aircraft lighting, including interior, exterior, emergency, and cockpit lighting, and relate them to internationally applicable civil aviation standards and regulations. In addition, this literature is also intended to review the results of previous relevant research on the reliability and maintenance of lighting systems on similar types of aircraft, in order to provide an accurate technical and operational picture. Thus, this literature is expected to support the evaluation process of the condition of the lighting system, as well as provide a reference in analyzing the effectiveness of the treatment and troubleshooting procedures applied, so that the lighting system can function optimally for flight safety and comfort (PT. Mulya., 2017).

Based on the results of the evaluation carried out on the lighting system of the Boeing 737-300 aircraft at PT. Mulya Sejahtera Technology Bandung, found that there are several gaps between the actual conditions in the field and the ideal standards set by international aviation regulations and aircraft manufacturers. Ideally, the aircraft's lighting system should function optimally, both in terms of intensity, light distribution, and component reliability, to ensure flight safety and comfort. However, the results of the inspection showed that some external lighting components such as landing lights and taxi lights had decreased in intensity due to the age of the lights that were close to the operational limit. In addition, there were delays in replacing cabin lights due to limited stock and suboptimal documentation of maintenance activities carried out by technicians.

Furthermore, the evaluation also revealed that the lighting technology used is still dominated by conventional types of lamps such as halogens, even though LED technology is currently available that is more efficient and durable. This gap shows the need for improvement in terms of component modernization, the development of a more structured maintenance documentation system, and the implementation of inspection and component replacement schedules based on performance and service life data. By closing these gaps, it is hoped that the aircraft lighting system can meet the established reliability and safety standards, and support the company's overall operational efficiency (Manajer, 2020).

Evaluation of the Lighting System on Boeing 737-300 Aircraft at PT. Mulya Sejahtera Technology Bandung is carried out because the lighting system on the aircraft has a crucial role in ensuring safety, operational efficiency, and comfort during flights, especially in emergency conditions and night flights. As the Boeing 737-300 aircraft that have been widely used in the aviation industry age, it is important to ensure that all lighting components, both inside and outside the aircraft, continue to function properly in accordance with airworthiness standards. In addition, with the development of aviation technology, an evaluation of the lighting system is also needed to find out whether the system used is still relevant or needs to be improved. Through this study, it is hoped that a comprehensive picture of the actual condition of the lighting system can be obtained and provide recommendations for maintenance and system improvement so that flight safety and comfort are maintained.

The purpose of this study is to evaluate the performance and reliability of the lighting system on the Boeing 737-300 aircraft used and/or handled by PT. Mulya Sejahtera Technology Bandung. This study aims to identify the functional conditions of each lighting component, both inside and outside (exterior) of the aircraft, as well as detect potential damage or performance degradation that can affect the safety and operational efficiency of the aircraft. In addition, this study also aims to assess the effectiveness of maintenance procedures implemented by companies in maintaining the performance of the lighting system, as well as provide recommendations for improvement or improvement in accordance with applicable aviation standards.

2. MATERIAL AND METHOD

The method used in this study is an evaluative descriptive method with a qualitative and quantitative approach. Data collection was carried out through direct observation of the lighting system on the Boeing 737-300 aircraft, including the interior, exterior, and cockpit lighting system. In addition, a documentation study was carried out on the maintenance manual, standard operating procedures (SOP), and aircraft Maintenance Manual to compare the actual condition with the applicable standards. Interviews with technicians and engineers at PT. Mulya Sejahtera Technology Bandung is also carried out to obtain technical and operational information related to problems or obstacles found. The collected data is analyzed to evaluate the performance, reliability, and effectiveness of the lighting system, as well as to identify components that require maintenance, repair, or replacement. The evaluation is conducted based on safety standards and regulations issued by civil aviation authorities such as ICAO and FAA.

Analysis of the lighting system on Boeing 737-300 aircraft will be carried out with an evaluative descriptive approach. The initial step begins by identifying all components of the lighting system, both external such as landing lights, taxi lights, navigation lights, strobe lights, to internal components such as cabin lights, cockpit lights, and emergency lights. Each component will be analyzed based on functionality, physical condition, service life, and conformity to applicable standards and

regulations (e.g. FAA or EASA). Furthermore, direct observation and data collection were carried out through maintenance documentation, logbooks, and technician interviews at PT. Mulya Sejahtera Technology Bandung (PT Mulya). The results of the evaluation will be compared with operational standard data to determine the effectiveness and efficiency of the installed lighting system. This analysis aims to provide a comprehensive overview of the performance of the lighting system and recommend necessary repair or maintenance actions to support flight safety and comfort.

The scope of this methodology is focused on the evaluation of the lighting system on Boeing 737-300 aircraft which is within the scope of work of PT. Mulya Sejahtera Technology Bandung. The main scope includes the identification of the types of lights used on the aircraft, the function and placement of each lighting component, as well as the inspection and maintenance procedures implemented in the working environment. The lighting system reviewed includes external lighting such as landing lights, taxi lights, navigation lights, strobe lights, and beacon lights, as well as internal lighting such as cabin lights, cockpit lights, and emergency lighting. The evaluation was carried out through a qualitative and quantitative approach, including direct observation of the aircraft, a study of maintenance manual documentation (Aircraft Maintenance Manual and Illustrated Parts Catalog), as well as technical interviews with maintenance personnel directly involved in the maintenance of the aircraft.

However, there are some limitations in the application of this methodology. One of them is the limited time that causes the evaluation to not be carried out thoroughly on all existing Boeing 737-300 aircraft units. In addition, access to historical data on breakdowns and repairs to lighting systems is limited due to the company's data confidentiality policy. Another limitation arises in the functional testing aspect of the lighting system which is only carried out in static conditions on the ground (ground test), without involving simulation in actual flight conditions. In addition, not all lighting components can be inspected in detail due to the limitations of the test equipment or are in an operational state that does not allow them to be disassembled or tested. Therefore, the results of these evaluations are indicative and can serve as a basis for the development of further studies with a broader scope and more comprehensive methodology.

3. RESULT AND DISCUSSION

Result : Field Work Practice (PKL) at PT. Mulya Sejahtera Technology will be held from January 13, 2025 to February 8, 2025, with the main focus on the Lighting System Evaluation on Boeing 737-300 PT. Mulya Sejahtera Technology Bandung. This Field Work Practice is designed to introduce trainees to a real care environment, thus allowing for the direct application of the theoretical knowledge gained during the study period. Field Work Practice activities are spread across several divisions, namely Heavy Maintenance, Workshops, Logistics, PPC & Engineering, and Quality & Safety.

a. Lighting system
Lighting systems on airplanes are basically systems that produce illumination on airplanes. The *exterior light* is used for *lighting* during *landing, in-flight navigation* and *maintenance* when *on the ground* and on the interior is used for lighting on *the instruments, cockpit,* cargo and passenger cabin. *The electrocrtical power is 115 V and 400 hertz from both an ac generator and an inverter. This light* serves to ensure that the aircraft can operate safely and efficiently in various conditions, such as night, bad weather, or emergency situations. Aircraft lighting systems are designed in accordance with international regulations, as set by the International Civil Aviation Organization (ICAO) and *the Federal Aviation Administration* (FAA).

b. Flight Compartment Lighting
Flight Compartment Lighting is a lighting system designed to provide lighting in the cockpit of the aircraft (*flight compartment*). These systems have a critical role in ensuring the comfort, efficiency, and safety of pilots and crew during flight, especially in changing lighting conditions such as nighttime, inclement weather, or flights in low-light intensity areas. This light gets an electrical power supply through the *"P6" and "P8" brake panel circuits where most* of these Lightning Flight Compartments *use 28 volts of AC power.* Such as: *Instrument panel lighting, Floodlight, AFDS floodlight, Map and chart light, Reading light, Circuit braker light, Dome Lights, and Compass light*

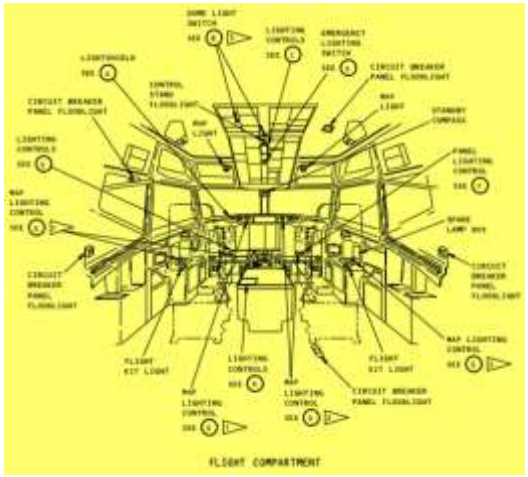

Figure 1 Flight Compartment Lighting

Figure 2 Instrument Panel Lighting

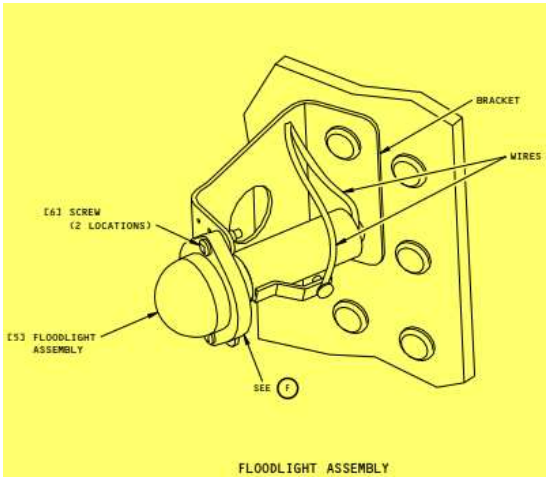

Figure 3 Floodlight

Figure 4 AFDS

Figure 5 Map Light

c. Master Warning and Caution Lights

Master Warning Light and Caution Light are the two main warnings in an aircraft cockpit warning system that are designed to provide visual notice to pilots of specific conditions or problems. The Master Caution system consists of two caution master lights and two caution master annunciators designed to provide the pilot with an indication if there is a system indicator light illuminated on the pilot's instrument panel. The system aims to ensure that any problems or conditions are not missed by the pilot.

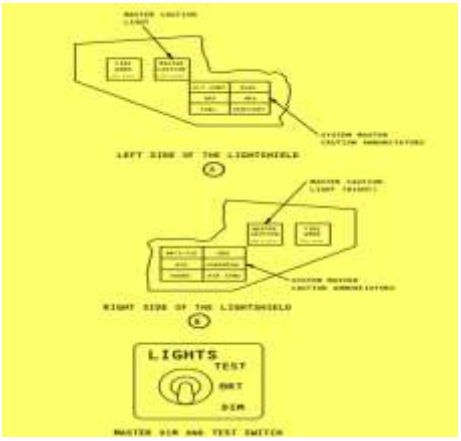

Figure 6 Master Warning and Caution Lights

d. PAX Compartment Lighting

Passenger Compartment Lighting functions to provide comprehensive lighting throughout the passenger cabin. This lighting not only provides general light for passenger comfort, but also special area lighting that includes some important parts of the aircraft, such as the entrance hallway, flight attendant work areas, *lavatories*, and *galleys***.** *Passenger Compartment Lighting* is divided into seven main parts, each of which has different lighting functions and areas such as: Passenger Cabin Illumination, Reading Lights, Passenger Signs.

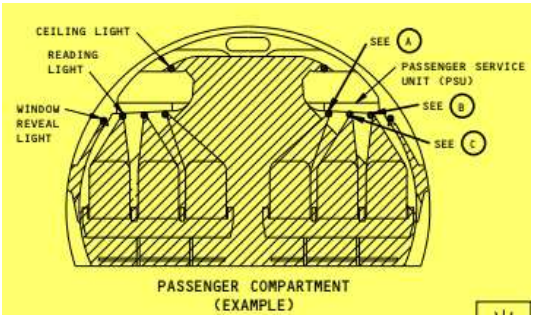

Figure 7 Pax

Figure 8 Passenger Cabin Illumination

Figure 9 Reading Lights

Figure 10 Passenger Sign

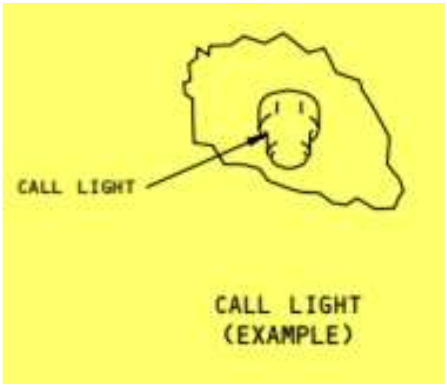

Figure 11 Passenger call lights

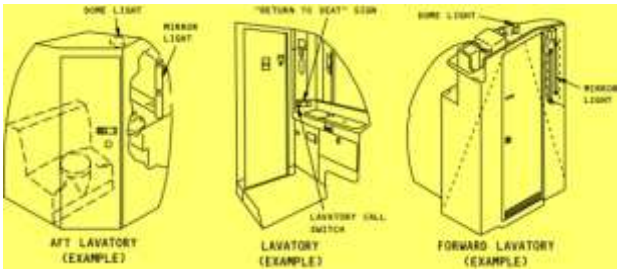

Figure 12 Lavatory Lights

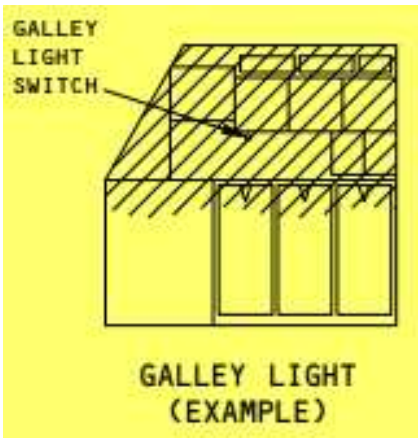

Figure 13 Galley Lights

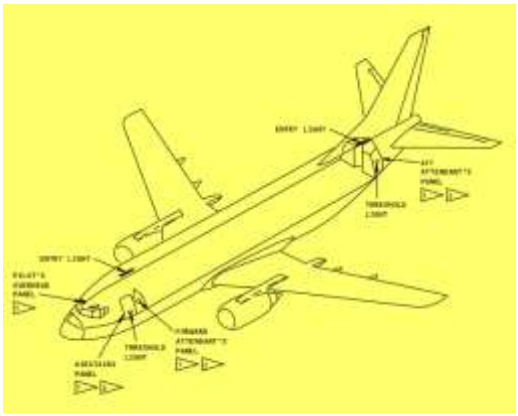

Figure 14 Passenger Loading Lights

e. Exterior Lighting

Exterior lightning can be interpreted as "Exterior" which means "Outside" and "Lighting" which means "Light" which means the lights on the outside of the aircraft function for position, anti-collision, landing, and taxi lights whose purpose is for safety, navigation, and visual communication with ground crew and other aircraft. The use of exterior lighting is used in night situations and in bad weather conditions.

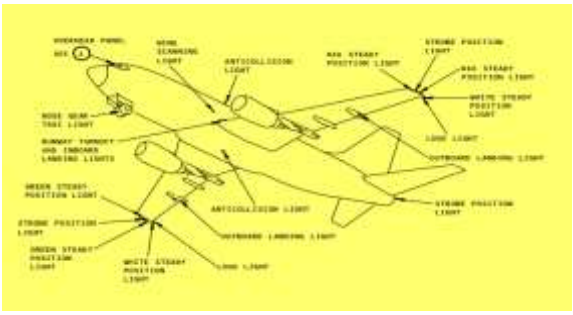

Figure 15 Exterior Lighting

Figure 16 Exterios Lighting Control

f. Taxi Light

Taxi Light is one of the lights on the aircraft's light system that is used to provide lighting while the aircraft is moving on the ground, especially in the taxiway (aircraft movement lane at the airport). These lights are designed to help pilots see taxiway lanes clearly, while improving aircraft visibility for ground personnel and vehicles at the airport. Unlike landing lights, taxi light is diffused at a lower intensity so it is not dazzling. This light is installed on the front wheel strut (nose wheel) and in front of the lower plane grille.

Figure 17 Taxi Light

g. Landing Light

Landing Light is a light installed on an aircraft to provide forward lighting during the *take-off*, landing, low-altitude flight and *taxiing*. These lights are similar to floodlights, to illuminate areas far in front of the aircraft, where *landing lights* are mounted at the end of the wing near the *fuselage*, or what is called *a wingroot*.

Figure 18 Landing Lights

h. Emergency Lights

The aircraft's Emergency Light automatically turns on to provide illumination and mark the location of the *exit* in the event of an electrical power failure. In these conditions, the Emergency *Light System* will replace *the normal light* to ensure sufficient visibility for the crew and passengers. In addition to the automatic function, flight crew and flight attendants can also operate emergency *lights* and exit signs manually through the available switches. The power source for the *emergency light* system comes from a 6-volt battery, which works independently of the aircraft's generator and battery bus, so it remains functional even if the aircraft's main electrical system is disrupted.

Discussion : Field Work Practice (PKL) carried out at PT. Mulya Sejahtera Technology Bandung from January 13 to February 8, 2025 produced a number of important findings related to the Boeing 737-300 aircraft lighting system:

a. Effectiveness of Lighting Systems

Lighting systems play a vital role in flight safety and comfort. Evaluations show that while most systems are functioning well, there is an urgent need for modernization and replacement of obsolete components.

b. The Gap to Inernational Standards

Some components show decreased light intensity and delay in replacement. This indicates a gap between actual conditions and FAA/ICAO standards, which can impact operational safety.

c. Technical and Operational Constraints

Evaluation faces obstacles such as: Limited access to hidden components, Limited test equipment and technical documentation, Testing is only conducted in static conditions (ground test), not flight simulation

d. Student Experience

PKL provides hands-on experience that strengthens technical understanding, communication skills, and adaptation to a

professional work environment. Students learn the importance of documentation, teamwork, and adherence to safety procedures.

e. Recommended Improvements
There are several recommendations for improvement from the findings, namely replacing lighting components with LED technology, increasing the frequency of inspections and documentation, training technicians regularly, expanding the scope of OJT to other aircraft systems.

Suggestion : Based on the results of the evaluation that has been carried out, it is recommended that PT. Mulya Sejahtera Technology Bandung has increased the frequency of regular inspections and maintenance of the Boeing 737-300 aircraft lighting system, especially on components that have a high service life or show decreased performance. The use of more efficient and durable lighting technologies, such as LEDs, can also be considered to replace conventional components to improve energy efficiency and reduce maintenance requirements. In addition, regular training of technicians on lighting system inspection procedures according to international standards will be very helpful in maintaining the performance and safety of the aircraft lighting system as a whole. And To improve the effectiveness of the OJT program in the future, it is recommended to extend the training period to allow for more comprehensive exposure to various maintenance tasks and operational scenarios. Incorporating regular feedback sessions and guidance from experienced technicians can further support the learning process. Expanding the scope of the OJT to include other aircraft systems, such as avionics, hydraulics, and propulsion, will provide a more holistic understanding of aircraft maintenance. Educational institutions must continue to collaborate closely with industry partners to ensure that OJT programs are aligned with the latest industry standards and practices. Evaluation and refinement of ongoing training methodologies is essential to meet the evolving needs of the aviation industry and prepare graduates who are competent, adaptive, and ready to contribute to operational safety and efficiency.

4. CONCLUSION

Based on the problem in the Evaluation of the Lighting System on the Boeing 737-300 Aircraft, PT. Mulya Sejahtera Technology Bandung, Inboard Landing Light Inoperative often occurs due to several factors such as service life, vibration or vibration during flight, environmental factors and because the intensity of this light is very high so that it consumes electrical power and hot temperatures. Based on the Aircraft Maintenance Manual, this damage is recommended to replace damaged components, it is recommended to Remove and Install, Maintenance and adjust/test must be in accordance with the AMM procedure.

Based on the Field Work Practice activities that have been carried out, it can be concluded that the implementation of this activity is very much needed because students can apply the theory that has been obtained on campus with field work practices in the company. The implementation of this activity is very useful in terms of:

1. Workability
Students can apply theories gained from education to real practice in the field. By participating in this activity, students can measure their own work ability.

2. Development of Insight and Creativity
With this activity, students can develop insight and creativity so that they can foster professionalism. Therefore, this activity is very important for students to gain insight and experience in the world of work.

3. Initiative and Creativity
From the above explanation, it can be concluded that work experience in a company, regardless of the field, strongly supports a career, especially the courage to speculate on the opportunities for success that exist. Creativity to gain knowledge must be applied in order to gain extensive knowledge in the world of aviation, especially when entering the field.

4. Discipline and Responsibility
In addition, this activity can improve discipline, time discipline, work efficiency and be used to comply with applicable regulations, as well as learn to be responsible for every action and decision taken.

5. ACKNOWLEDGEMENT

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6. AUTHOR CONTRIBUTION STATEMENT

All the authors involved in this study Riadi Parasian Sirait, Catra Indra Cahyadi, Rofi Juliatma, and Ayub Wimatra are fully responsible for all stages of research and reporting. RPS designs and implements Field Work Practice activities, observes and collects data, analyzes the results of the evaluation of the lighting system on Boeing 737-300 aircraft.

REFFERENCE

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