ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

College of Engineering

Department of Electromechanical Engineering

Internship Report

By:

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Acknowledgment

I would like to express my heartfelt gratitude to Ethiopian Airlines for providing me with the invaluable opportunity to undertake my internship within the Maintenance, Repair, and Overhaul (MRO) department. The experience I gained during my time here has significantly contributed to my professional development and understanding of the aviation industry.

I am especially thankful to the management team for their support and encouragement throughout my internship. Their commitment to fostering a learning environment allowed me to engage in various projects and gain hands-on experience that will undoubtedly benefit my future career.

I would also like to extend my sincere appreciation to **Commander [Manager's Name]** for their guidance and leadership during my internship. Their insights and direction were instrumental in helping me navigate the complexities of the MRO operations. Their passion for excellence and commitment to safety has inspired me to strive for the same level of professionalism in my future endeavors.

A special thanks to my supervisor, **Mr. Muluken**, whose mentorship and support made my internship a truly enriching experience. His patience, expertise, and willingness to share knowledge were invaluable as I worked on various maintenance tasks and projects. He provided me with constructive feedback that helped me improve my skills and gain confidence in my abilities.

Finally, I would like to acknowledge the entire team in the MRO department for their collaboration and camaraderie. The welcoming and supportive atmosphere created by my colleagues made my internship a memorable and enjoyable experience.

Thank you all for being a significant part of my journey at Ethiopian Airlines.

Chapter One

Introduction of the hosting company

Ethiopian Airlines, commonly referred to as Ethiopian, is Africa's leading aviation group with a rich history spanning over 78 years. Established on December 21, 1945, and commencing operations on April 8, 1946, with a debut flight to Cairo via Asmara using five C-47 aircraft, Ethiopian Airlines has evolved into a global leader in aviation. Today, Ethiopian operates a modern fleet of over 146 aircraft with an average fleet age of less than seven years, including some of the most advanced aircraft like the Boeing 787 Dreamliner, Boeing 777, and Airbus A350 XWB. The airline continues to maintain its position as the pioneer of cutting-edge aviation technology in Africa.

Ethiopian Airlines serves 136 international passenger and cargo destinations, including 63 cities across Africa, offering unmatched intra-African connectivity. The airline's expansive network, combined with its strategic hub at Bole International Airport in Addis Ababa, connects Africa to the rest of the world. Ethiopian has been a member of Star Alliance since 2011, enhancing its global reach as part of the world's largest airline network.

As a multi-award-winning airline, Ethiopian has received accolades such as Skytrax's Four-Star Airline Certification and the Best Airline in Africa title. The airline has achieved an average growth rate of 25% over the past decade and, having surpassed its Vision 2025 goals ahead of schedule, it is now pursuing an even more ambitious strategic plan—Vision 2035.

Ethiopian Airlines is committed to offering world-class services, including its premium Cloud Nine (combining First and Business Class) and Economy Class options, alongside the ShebaMiles frequent flyer program. Additionally, Ethiopian operates the largest Maintenance, Repair, and Overhaul (MRO) facility in Africa and has a state-of-the-art cargo operation that serves over 70 dedicated cargo destinations.

The airline's Aviation University (EAU) is the largest and most modern aviation training center in Africa, providing professional training for pilots, aircraft technicians, cabin attendants, and management personnel. With a dedicated workforce of over 17,000 employees, Ethiopian Airlines continues to expand its operations while playing a pivotal role in transforming Africa's aviation sector.

As an intern at Ethiopian Airlines, I had the opportunity to experience firsthand the innovative practices and operational excellence that have positioned the airline as a leader in the aviation industry. Working in this dynamic environment has allowed me to enhance my technical skills and gain a deeper understanding of the complex world of aviation.

Chapter two

Overall internship experience

During my internship at Ethiopian Airlines, I was assigned to the Maintenance, Repair, and Overhaul (MRO) department, specifically within the Electromechanical Equipment Maintenance section. This department is responsible for ensuring the functionality and safety of various mechanical and electrical systems that are essential for aircraft maintenance and operations. My time in this section provided me with valuable exposure to the inner workings of a leading aviation company, offering hands-on experience with cutting-edge technologies and systems.

Work Flow in the Electromechanical Equipment Maintenance Section

The workflow within the Electromechanical Equipment Maintenance section is highly structured and methodical, as it involves the handling of crucial equipment and systems that must adhere to strict safety and operational standards. Each day begins with a team briefing where tasks are assigned based on priority, and any ongoing issues are discussed. Preventive maintenance schedules are strictly followed to ensure that equipment remains operational, and any reactive maintenance tasks are immediately addressed when issues arise.

Communication and collaboration are key components of the workflow. The team includes senior engineers, technicians, and support staff, all of whom work closely together to resolve problems and maintain equipment. Clear documentation is required for every task to ensure compliance with safety regulations and to track the performance and condition of the systems.

Tasks Executed and Work Pieces Involved

Throughout my internship, I was involved in several key tasks, which included:

- **Pump Maintenance:** I carried out preventive maintenance on hydraulic pumps, inspecting them for wear and tear, cleaning components, and replacing any faulty parts to ensure smooth operation.
- **Nitrogen Plant Maintenance:** I assisted in routine inspections and troubleshooting of the nitrogen generation system, ensuring that nitrogen production met the required standards for aircraft maintenance operations.
- **Waste Treatment:** I worked on the waste treatment system, ensuring proper disposal and processing of waste in compliance with environmental standards. This involved the operation and maintenance of pumps and filtration systems.
- **LED Installation:** I helped install energy-efficient LED lighting throughout the maintenance facilities, ensuring proper wiring, positioning, and connection to the main electrical systems.
- **Landing Gear Grinding Machine Installation:** I assisted in the installation of a landing gear grinding machine, a critical piece of equipment used for precisely machining and grinding the landing gear components. This task required the assembly, calibration, and initial testing of the machine to ensure it operated accurately and safely.

- **Plating Machine Installation:** I was involved in the assembly and calibration of a plating machine used for coating and protecting aircraft parts. This task required mechanical setup and thorough testing to ensure functionality.
- **Hoist Maintenance:** I performed routine maintenance on hoists, including checking lifting mechanisms, testing load-bearing capacity, and ensuring that safety measures were in place.

Procedures and Methods Used

The tasks I performed required strict adherence to established procedures and industry best practices. These included:

- **Standard Operating Procedures (SOPs):** Each task followed a clearly defined SOP to ensure safety, efficiency, and compliance with regulatory standards. This was especially important in tasks involving hazardous equipment or processes, such as the installation of the landing gear grinding machine and nitrogen plant maintenance.
- **Technical Manuals and Guidelines:** For more complex systems, such as the plating machine and landing gear grinding machine, I referred to technical manuals and guidelines provided by manufacturers and the airline's engineering team.
- **Collaboration with Senior Technicians:** I worked closely with senior technicians and engineers who provided guidance on troubleshooting techniques, assembly methods, and equipment calibration, ensuring that I followed correct procedures at every stage of the tasks.

Challenges Faced

One of the key challenges I encountered was the complexity of the aircraft systems and equipment. Some systems, such as the nitrogen plant and landing gear grinding machine, required a deep understanding of both mechanical and electrical engineering principles. Adapting to the precision and high standards of aviation maintenance, especially in systems that directly affect aircraft safety, was challenging at first.

Measures Taken to Overcome Challenges

To overcome the challenges I faced, I took the following measures:

- **Active Learning:** I made a conscious effort to learn from experienced engineers and technicians. By asking questions, seeking clarification, and observing their methods, I was able to gradually build my understanding of complex systems.
- **Thorough Documentation Review:** I dedicated extra time to reviewing technical manuals and operating guidelines for the equipment I was working with. This helped me better understand the procedures and processes involved in the maintenance tasks.
- **Hands-on Practice:** Practice was key to overcoming the challenges. I focused on gaining as much hands-on experience as possible under the guidance of senior technicians. This helped me become more comfortable with the tools and equipment, and I was able to develop the confidence to execute tasks independently.

- **Team Collaboration:** Whenever I faced difficulties, I collaborated with my teammates and mentors. The team environment allowed for knowledge-sharing and collective problem-solving, which was crucial in overcoming the challenges of complex tasks like landing gear grinding machine installation and nitrogen plant maintenance.

Overall, my internship experience at Ethiopian Airlines was a rewarding opportunity that allowed me to enhance my technical skills, gain practical experience, and learn how to apply theoretical knowledge in a real-world setting. The challenges I faced only strengthened my problem-solving abilities and gave me a deeper understanding of the aviation maintenance field.

Chapter three

Selected industrial project and its design procedure

Tool Management System for Ethiopian Airlines MRO Department

Short Summary of the Project

The **Tool Management System** (TMS) project was developed to streamline the tracking, allocation, and management of tools within the Maintenance, Repair, and Overhaul (MRO) department of Ethiopian Airlines. The system aimed to address inefficiencies in tool usage by providing real-time monitoring, minimizing tool loss, and ensuring the availability of the right tools when needed. By integrating digital tracking with the existing workflow, the system helped improve operational efficiency and reduce downtime caused by missing or misplaced tools.

Problem Statement & Justification

Problem Statement:
The MRO department at Ethiopian Airlines experienced challenges in managing its large inventory of tools, which are critical for maintaining aircraft and associated equipment. Manual tracking processes often led to misplaced or lost tools, causing delays in maintenance tasks. Additionally, the lack of real-time monitoring hindered efficient tool allocation, leading to increased downtime and operational inefficiency.

Justification:
Given the high cost of aircraft maintenance and the need for precision and timeliness in the MRO environment, an efficient tool management system is essential. Mismanagement of tools not only increases costs but also impacts the safety and reliability of maintenance operations. The proposed Tool Management System addresses these issues by automating tool tracking and providing a more efficient system for tool allocation and usage.

Objective of the Project

The main objective of the **Tool Management System** project was to design and implement a software solution that would:

1. Provide real-time tracking of tools within the MRO department.
2. Minimize tool loss by monitoring tool check-in/check-out procedures.
3. Improve tool allocation and availability for technicians.
4. Enhance operational efficiency by reducing downtime caused by missing tools.
5. Integrate the system into the existing workflow of the MRO department.

Methodology

The design and development of the Tool Management System followed a structured research methodology, involving the following steps:

1. **Problem Identification:**
   Interviews with MRO technicians and management were conducted to understand the key issues faced in tool management. The primary concerns included tool loss, delayed tool allocation, and the lack of a digital system for tracking tools.
2. **Requirement Gathering:**
   A detailed requirements analysis was conducted to outline the features and functionalities needed for the system. This involved consulting with end-users, understanding existing workflows, and identifying the necessary hardware and software components.
3. **Design and Development:**
   Based on the requirements, a system design was created using UML diagrams to map out the architecture, user interface, and database structure. The development was carried out using a combination of front-end and back-end technologies, focusing on user-friendly interfaces and real-time data processing.

Chapter Four

Overall internship achievements and experiences

During my internship at Ethiopian Airlines in the Maintenance, Repair, and Overhaul (MRO) department, specifically in the Electromechanical Equipment Maintenance section, I gained invaluable practical experience and technical skills that have significantly enhanced my academic knowledge and professional development. The hands-on exposure to various maintenance tasks and projects helped me understand how theoretical concepts are applied in real-world aviation engineering environments.

Key Achievements:

1. **Practical Skills Development:** I gained experience working on essential electromechanical systems through tasks such as pump maintenance, nitrogen plant maintenance, waste treatment, LED installation, and hoist maintenance. This broadened my understanding of how these systems operate within the aviation sector.
2. **Landing Gear Grinding Machine Installation:** One of my key contributions was assisting with the installation of the landing gear grinding machine. This project helped me develop skills in mechanical installation, equipment alignment, and calibration, as well as teamwork, as it required coordination with technicians and engineers.
3. **Plating Machine Installation:** I was involved in the installation of a plating machine, an essential component in the aircraft part refurbishment process. This experience enhanced my understanding of surface treatment technologies and the importance of precision in restoring aircraft components.
4. **Tool Management System Project:** I contributed to the development and implementation of a **Tool Management System (TMS)**. This project was crucial for improving tool tracking and allocation within the MRO section. It helped reduce tool loss and improved overall efficiency in tool usage, significantly impacting workflow management.
5. **Problem-Solving and Troubleshooting:** I frequently faced challenges related to tool availability, equipment malfunctions, and tight schedules. These experiences helped me develop problem-solving skills, as I had to troubleshoot various issues on-site and find solutions under pressure.

Key Experiences:

1. **Exposure to Aviation Maintenance Procedures:** Being part of the MRO department, I was exposed to the procedures and standards necessary to ensure the safety and operational readiness of aircraft. This included learning about regulatory compliance, safety protocols, and the maintenance cycles for various aircraft components.
2. **Teamwork and Communication:** Working alongside experienced engineers, technicians, and other interns fostered strong communication and collaboration skills. I learned the importance of clear communication and cooperation in a fast-paced and high-stakes environment like aviation maintenance.

3. **Workflow Understanding:** The workflow within the Electromechanical Equipment Maintenance section was highly organized, with tasks prioritized based on urgency and safety requirements. I learned how maintenance tasks are scheduled, tools and resources are allocated, and different teams coordinate their efforts to meet deadlines.
4. **Challenges and Solutions:** Throughout my internship, I encountered challenges such as tool shortages and equipment malfunctions. These challenges forced me to think critically, adapt to changing conditions, and collaborate with my team to find timely solutions.
5. **Professional Growth:** This internship provided me with a strong foundation for my future career as a mechatronics engineer. The technical skills I acquired, combined with the ability to work under pressure, enhanced my problem-solving and critical-thinking abilities, making me more confident in my engineering capabilities.

In conclusion, my internship at Ethiopian Airlines has been a fulfilling and transformative experience. The combination of technical learning, hands-on experience, and professional development has provided me with a solid foundation for future roles in engineering, particularly in the aviation sector.

Chapter Five

Conclusion

The internship experience at Ethiopian Airlines, specifically within the Maintenance, Repair, and Overhaul (MRO) department in the Electromechanical Equipment Maintenance section, provided an invaluable opportunity to gain hands-on experience and practical skills. Throughout the internship, I was able to work on various tasks such as pump maintenance, nitrogen plant maintenance, waste treatment, LED installation, landing gear grinding machine installation, plating machine installation, and maintenance of hoists. Each task helped enhance my understanding of the electromechanical systems and their importance in maintaining the safety and efficiency of airline operations.

The work environment at Ethiopian Airlines MRO is highly structured and professional, with a well-established workflow that ensures maintenance tasks are carried out effectively. The internship offered exposure to real-world engineering challenges, such as tool availability, coordination among teams, and adhering to strict safety standards. By working alongside experienced engineers and technicians, I gained a deeper understanding of the technical aspects of aircraft maintenance, as well as the importance of teamwork and communication in a high-stakes environment.

The skills and knowledge gained during this internship have significantly enhanced my professional growth and have better prepared me for my future career as a mechatronics engineer.

In summary, my internship at Ethiopian Airlines was a rewarding and transformative experience. With some enhancements to the intern experience, Ethiopian Airlines can continue to provide even greater opportunities for future interns to learn, grow, and contribute to the company’s success.