

Internship Report

Pakistan Aeronautical Complex (PAC), Kamra

Submitted By

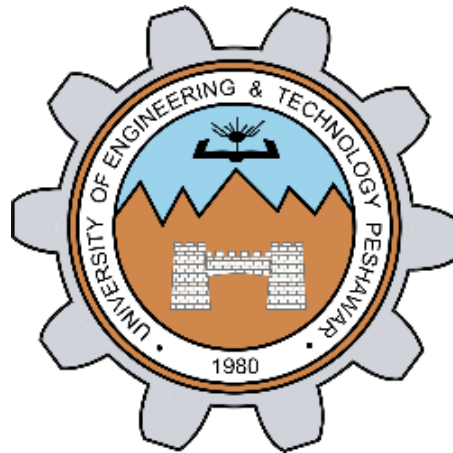
Khayam Ullah

21PWIND0682

Industrial Engineering

Summer 2024


Submission Date: 21/9/2024



University of Engineering and Technology, Peshawar

Declaration Form

I (**Khayam Ullah**), Registration No: **21PWIND0682** from **Industrial Department of UET Peshawar** has completed my internship report of 4 weeks at **Pakistan Aeronautical Complex (PAC) Kamra** under supervision of Focal Person **Shazaib Ahmad** from HR department.



Signed by Student:



Signed by Industrial liaison officer

1. Acknowledgment

I would like to express my sincere gratitude to **Dr. Imran Ahmad**, my university professor, for providing me with this invaluable opportunity to intern at **Pakistan Aeronautical Complex (PAC), Kamra**. His guidance and encouragement played a crucial role in securing this internship and making it a meaningful learning experience.

I am also deeply thankful to the **faculty and staff at PAC**, particularly those at the **Aircraft Manufacturing Factory (AMF)**, for their support, mentorship, and willingness to share their expertise. Their patience and dedication allowed me to gain firsthand insights into the aerospace industry, making this internship both educational and inspiring.

Additionally, I would like to extend my appreciation to the **engineers, technicians, and supervisors** who guided me through various departments, providing practical knowledge and hands-on experience. Their professionalism and expertise enhanced my understanding of aircraft manufacturing and quality control processes.

Lastly, I am grateful to my **family and friends** for their unwavering support and motivation throughout this internship. Their encouragement has always been a driving force in my academic and professional journey.

This internship has been an incredible opportunity for growth, and I deeply appreciate everyone who contributed to making it a valuable experience.

2. Executive Summary

This report presents a comprehensive account of my two-week internship **at the Pakistan Aeronautical Complex (PAC)**, Kamra—one of the most prominent aerospace and defense organizations in Pakistan. I was fortunate to be placed in the Aircraft Manufacturing Factory (AMF), a core facility within PAC that is responsible for the production and assembly of various aircraft models, **most notably the JF-17 Thunder and the MFI-17 Mushshak.**

Throughout the internship, I gained valuable practical experience in a variety of domains crucial to aircraft manufacturing, including **CNC machining, precision engineering, quality assurance protocols, and large-scale assembly line operations.** I had the opportunity to rotate through several departments, which allowed me to witness a diverse range of engineering practices. In the CNC section, I learned about high-precision manufacturing processes and the operational use of **Coordinate Measuring Machines (CMM)** for dimensional verification of complex aircraft parts. I also gained insight into how **Computer-Aided Design (CAD)** data is translated into physical components with exacting tolerances.

My time at PAC also introduced me to the importance of supporting systems in industrial operations. I observed the functioning and maintenance of critical infrastructure such as industrial boilers, air compressors, and cooling systems—vital to ensuring seamless production workflows. This exposure broadened my understanding of the interdependence between core manufacturing activities and auxiliary support systems in a high-performance engineering environment.

One of the highlights of the internship was observing the structured and rigorous quality control measures applied to both raw materials and final assemblies. I found the detailed inspection protocols, documentation practices, and use of advanced measurement tools particularly fascinating. These systems are not only essential for ensuring safety and performance but also form the backbone of any high-reliability manufacturing facility.

In addition to technical skills, the internship played a significant **role in strengthening my soft skills.** Working alongside experienced engineers and technicians, I learned the value of effective communication, collaboration, and adaptability. I was encouraged to ask questions, participate in discussions, and offer input when appropriate, all of which helped improve my confidence and professional demeanor.

Overall, my internship at PAC Kamra was an eye-opening experience that bridged the gap between academic learning and real-world application. It not only deepened **my interest in industrial engineering and aerospace manufacturing** but also equipped me with hands-on skills, technical knowledge, and a better understanding of industrial dynamics. This experience has further solidified my commitment to pursuing a career in engineering, especially in sectors that demand high precision, continuous innovation, and strict quality assurance.

3. Table of contents

List the important section titles and sub-titles in the report with their respective page numbers in a tabular format.

Section	Page No.
1. Acknowledgment	1
2. Executive Summary	2
3. Table of Contents	2
4. Introduction of the Organization	3
4.1 A Brief Introduction of the Organization's Business Sector	3
5. Overview of the Organization	4
a. Brief History	4
b. Competitors	5
c. Brief Summary of All Departments	6
6. Plan of Your Internship Program	6
7. Internship Weekly Schedule	7
8. Learning Experience	8
a. Knowledge Acquired	8
b. Skills Learned	9
c. Observed Attitudes and Gained Values	10
d. The Most Challenging Task Performed	11
9. Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis	12
10. Problem Identification and Solution	12
11. Conclusion	13
12. References and Sources Used	13
13. Appendices	14
a. Reference Letter from EDC	14
b. Certificate Copy	

1. Introduction of organization:

4. Brief Introduction of the Organization's Business Sector

The aerospace industry in Pakistan encompasses the development, production, and maintenance of aircraft and related systems, serving both military and civilian sectors. This industry is pivotal for national defense, technological advancement, and economic growth. Key players include state-owned enterprises like the Pakistan Aeronautical Complex (PAC) and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), as well as private sector companies contributing to various aerospace projects.

In recent years, Pakistan's aerospace sector has made significant strides in innovation and self-reliance. Collaborative efforts with international partners have led to the development of indigenous aircraft, such as the JF-17 Thunder fighter jet, enhancing the country's defense capabilities and reducing dependence on foreign suppliers. Additionally, the sector has expanded into areas like satellite technology and unmanned aerial vehicles (UAVs), contributing to both security and economic growth. Public-private partnerships have further bolstered the industry's capacity for research, development, and production, positioning Pakistan as a growing player in the global aerospace arena.

5. Overview of the Organization

a. Brief History

The Pakistan Aeronautical Complex (PAC), established in 1971 in Kamra, Punjab, is a cornerstone of Pakistan's aerospace industry. Founded by the Pakistan Air Force (PAF), PAC was created to achieve self-sufficiency in aircraft maintenance and production, reducing reliance on foreign entities. Over the decades, PAC has evolved into a comprehensive aerospace and defense manufacturer, engaging in the design, development, and production of military and civilian aircraft, as well as avionics systems. Notably, PAC has collaborated with international partners, such as the Chengdu Aerospace Corporation of China, to co-produce the JF-17 Thunder fighter jet, a testament to its growing capabilities and strategic importance.

b. Competitors

As a state-owned enterprise, PAC primarily serves the defense needs of Pakistan and, to a lesser extent, the civilian aerospace sector. While it does not face direct competition within Pakistan due to its unique mandate, on the international stage, PAC competes with global aerospace manufacturers for defense contracts and exports. Competitors include established firms from countries like the United States, Russia, and European nations, which offer a range of military aircraft and aerospace technologies. PAC's competitive edge lies in its ability to provide cost-effective solutions tailored to the specific needs of developing countries, as evidenced by its recent contract to supply JF-17 fighter jets to Azerbaijan.

c. Brief Summary of All Departments

PAC is organized into four main factories, each specializing in different aspects of aerospace manufacturing and maintenance:

1. **Aircraft Rebuild Factory (ARF):** Dedicated to the overhaul and parts manufacturing of Chinese-origin aircraft in service with the PAF, including the F-7 and FT-5. ARF ensures these aircraft remain operational through comprehensive maintenance and the production of necessary components.
2. **Mirage Rebuild Factory (MRF):** Focuses on the overhaul of French-origin aircraft, specifically the Mirage III and Mirage V. MRF also services and overhauls engines, such as the Pratt & Whitney F100 turbofan used in the F-16 Fighting Falcon, playing a crucial role in extending the service life of these aircraft.
3. **Aircraft Manufacturing Factory (AMF):** Responsible for the production of various aircraft, including the MFI-17 Mushshak basic trainer, the K-8 Karakorum intermediate/advanced jet trainer, and the JF-17 Thunder multirole combat aircraft. AMF's capabilities highlight PAC's progression from maintenance to indigenous aircraft production.
4. **Avionics Production Factory (APF):** Specializes in the assembly, overhaul, and testing of avionics and radar systems for both airborne and ground applications. APF has been instrumental in upgrading existing aircraft with modern avionics, enhancing their operational capabilities.

Each of these factories operates in synergy to fulfill PAC's mission of achieving self-reliance in aerospace technologies, supporting the operational readiness of the Pakistan Air Force, and contributing to the nation's defense and economic objectives.

2. Activities and schedules:

6. Plan of Your Internship Program

a. Brief Introduction of the Department

During my internship at the Pakistan Aeronautical Complex (PAC) Kamra, I was assigned to the Aircraft Manufacturing Factory (AMF). The AMF is a pivotal unit within PAC, responsible for the production and assembly of various aircraft, notably the JF-17 Thunder and the MFI-17 Mushshak. This facility oversees the entire aircraft lifecycle, from initial manufacturing to comprehensive overhauls, ensuring that the Pakistan Air Force (PAF) maintains a fleet of modern and efficient aircraft.

b. Internship Duration

My internship commenced on August 1, 2024, and concluded on August 14, 2024, spanning a total of two weeks.

c. Departments and Training Duration

Throughout the internship, I received training in the following departments within the AMF:

- **CNC Machining Department:** 3 days
- **Quality Assurance and Inspection (CMM Lab):** 3 days
- **Utilities and Maintenance (Boilers and Compressors Section):** 2 days
- **Assembly Line:** 4 days

7. Internship Weekly Schedule

Week One:

- **Days 1-3: CNC Machining Department**
 - Gained hands-on experience with advanced CNC machines, understanding their programming and operation.
 - Collaborated with technicians to produce precision components for aircraft assembly.

- **Days 4-6: *Quality Assurance and Inspection (CMM Lab)***
 - Learned the principles of Coordinate Measuring Machines (CMM) and their application in ensuring component accuracy.
 - Participated in the inspection process, verifying that manufactured parts met stringent aerospace standards.

Week Two:

- **Days 7-8: *Utilities and Maintenance (Boilers and Compressors Section)***
 - Studied the operation and maintenance of industrial boilers and compressors, essential for the facility's infrastructure.
 - Assisted in routine maintenance tasks, ensuring the continuous and efficient operation of these systems.
- **Days 9-12: *Assembly Line***
 - Observed the integration of various aircraft components, gaining insights into the assembly process of the JF-17 Thunder and MFI-17 Mushshak.
 - Engaged with engineers and assembly workers, discussing challenges and solutions in aircraft manufacturing.

This structured schedule provided a comprehensive overview of the AMF's operations, allowing me to apply theoretical knowledge in practical settings and develop a deeper understanding of the aerospace manufacturing process.

3. Learning Experience:

8.Learning Experience

a. Knowledge Acquired

During my two-week internship at the Aircraft Manufacturing Factory (AMF) of the Pakistan Aeronautical Complex (PAC), I acquired extensive knowledge about aerospace manufacturing processes. I developed an in-depth understanding of advanced CNC machining, the operation and calibration of Coordinate Measuring Machines (CMM), and the intricate assembly of critical aircraft components. This practical exposure not only reinforced the theoretical principles learned in courses

such as Manufacturing Systems, Industrial Quality Control, and Operations Management but also provided a clear demonstration of how lean manufacturing techniques and process optimization strategies are applied in an industrial setting.

b. Skills Learned

Throughout my internship, I cultivated a diverse set of skills that bridged both technical expertise and interpersonal communication. I enhanced my technical proficiency by gaining hands-on experience with sophisticated CNC machines and performing precise assembly tasks. My analytical abilities were sharpened as I examined production workflows and identified inefficiencies, skills that were directly supported by the analytical methods taught in my industrial engineering courses. Additionally, collaborating closely with engineers, technicians, and quality inspectors improved my teamwork and communication skills, while managing a strict internship schedule allowed me to refine my time management and organizational capabilities.

c. Observed Attitudes and Gained Values

The professional environment at PAC imparted essential work ethics and core values that are critical for success in the industrial sector. I observed firsthand the importance of hard work, dedication, and dependability, as every team member's role significantly impacted the overall efficiency of the manufacturing process. The commitment to safety, precision, and quality instilled in me a sense of discipline and meticulousness, emphasizing the necessity of these values in industrial operations. Moreover, the culture of innovation and adaptability demonstrated at PAC reinforced the importance of continuous learning and a proactive mindset when confronting evolving technological challenges.

d. The Most Challenging Task Performed

One of the most challenging tasks during my internship was assisting with the calibration and troubleshooting of the CMM in the Quality Assurance department. Initially, interpreting the complex measurement data and understanding the detailed calibration procedures were daunting tasks. However, by engaging actively with experienced technicians and applying the theoretical knowledge I had acquired, I was able to systematically break down the process into manageable steps. This approach not only enabled me to resolve the issues effectively but also deepened my technical competence. The experience underscored the significance of persistence, collaboration, and analytical thinking in overcoming the challenges faced in a high-precision industrial environment.

9. Strength, Weakness, Opportunities, Threats (SWOT) Analysis

The Aircraft Manufacturing Factory (AMF) at Pakistan Aeronautical Complex (PAC) exhibits several noteworthy strengths. As a government-backed organization, it benefits from sustained funding and strategic support from the Pakistan Air Force, which ensures the availability of advanced machinery, skilled labor, and a robust production process for indigenous aircraft like the JF-17 Thunder. This strong institutional framework and specialized expertise provide AMF with a competitive edge in producing quality aerospace components. However, the organization faces certain weaknesses, including bureaucratic constraints that can slow decision-making and innovation, and a partial reliance on imported components and technology, which sometimes hinders full self-sufficiency. In terms of opportunities, the evolving global aerospace industry and increasing emphasis on indigenous manufacturing create a favorable environment for expansion and technological advancement at AMF. There is significant potential for forming international partnerships, investing in research and development, and exploring new export markets, all of which could elevate the factory's capabilities and market position. On the other hand, AMF also encounters threats such as intense competition from established international aerospace manufacturers, potential budgetary constraints, and the impacts of geopolitical uncertainties on technology transfer and export agreements. These external pressures, coupled with fluctuating market demands, could challenge the organization's ability to maintain a steady production flow and innovate effectively.

10. Problem Identification and Solution

During my internship, I observed that one of the most significant challenges at AMF was the inefficiency in the inventory management system, which led to delays in component availability and subsequent production slowdowns. This problem, rooted in outdated manual tracking methods, not only disrupted the assembly schedule but also increased downtime during critical maintenance and production phases, ultimately affecting overall operational efficiency. To address this issue, I would recommend implementing a modern digital inventory management system that integrates automated real-time tracking with lean management principles. Such a system would minimize errors, ensure timely replenishment of essential parts, and streamline the entire supply chain process. By reducing delays and optimizing component flow, AMF could significantly improve its production efficiency.

and responsiveness, thereby enhancing its competitive edge in both domestic and international markets.

4. Conclusion

My internship experience at the Aircraft Manufacturing Factory (AMF) of Pakistan Aeronautical Complex (PAC) was both transformative and enriching. Over the course of two intensive weeks, I had the opportunity to immerse myself in the multifaceted world of aerospace manufacturing and maintenance, gaining invaluable insights into the industry's core operations. Working across various departments—from advanced CNC machining and quality assurance using CMM to the assembly line and utilities maintenance—allowed me to see firsthand how theoretical concepts from my Industrial Engineering coursework are implemented in a high-precision, real-world setting.

I was exposed to the rigorous production processes required to manufacture and maintain modern aircraft, and the challenges involved in ensuring every component meets stringent quality standards. This practical exposure not only reinforced my technical knowledge but also honed my analytical, problem-solving, and time management skills. Furthermore, the collaborative environment at PAC emphasized the importance of teamwork, discipline, and continuous learning—values that are indispensable in the aerospace sector.

Perhaps the most memorable aspect of my internship was the opportunity to tackle complex tasks, such as assisting with the calibration and troubleshooting of the CMM, which required both technical acumen and persistent effort. Overcoming such challenges deepened my understanding of quality control and underscored the critical nature of precision in aerospace manufacturing. Overall, this internship has significantly bolstered my confidence and preparedness for a future career in industrial engineering, leaving me inspired by the dynamic intersection of technology, innovation, and practical application.

12. References and Sources Used:

The following sources were utilized for data collection, analysis, and report preparation during my internship at **Pakistan Aeronautical Complex (PAC), Kamra**:

Primary Sources

1. **Pakistan Aeronautical Complex (PAC) Documentation** – Internal manuals, technical guidelines, and standard operating procedures obtained during my training at the Aircraft Manufacturing Factory (AMF).
2. **Discussions with PAC Staff** – Insights gained from interactions with **engineers, technicians, supervisors, and foremen** in the CNC Machining Department, Quality Assurance Section, Assembly Line, and Maintenance Department.
3. **Personal Observations and Hands-on Experience** – Practical exposure to CNC machining, coordinate measuring machine (CMM) operations, and aircraft assembly tasks.
4. **Internship Training Schedule and Attendance Records** – Official documents outlining my assigned duties, department rotations, and weekly tasks.

Secondary Sources

5. **Pakistan Aeronautical Complex Official Website** (www.pac.org.pk) – General information about PAC's structure, facilities, and manufacturing capabilities.
6. **Wikipedia - Pakistan Aeronautical Complex** (en.wikipedia.org) – Background information on PAC, its history, and its role in aerospace manufacturing.
7. **News Articles on Aerospace Industry in Pakistan** – Information from news sources such as **Reuters, The Friday Times, and Dawn News** for insights into PAC's developments, exports, and collaborations.

13. Appendices

If necessary, students may provide any additional information that is relevant to their report and reference should be made to it in the report. However you must include the following:

1. **Reference letter from EDC**

At my university, the process for securing an internship at Pakistan Aeronautical Complex (PAC), Kamra did not require obtaining a reference letter from the Executive Development Center (EDC). Instead, we followed a different application method, where the university directly facilitated the internship opportunity through coordination with PAC. The application was processed through official university channels without the need for an individual reference letter.

Since this method was approved and accepted by PAC, I did not receive a formal reference letter from EDC. However, I can provide other supporting documents if needed.

2. Copy of Internship certificate (signed & stamped by supervisor)

PAKISTAN AERONAUTICAL COMPLEX KAMRA

INTERSHIP TRAINING
CERTIFICATE

It is certified that

Mr/Miss KHAYAM ULLAH Son/Daughter of MUJAHID SHAH
of UET PESHAWAR Bearing Reg. No. 21PWIND0682
has completed 02 weeks/months internship training held at
AIRCRAFT MANUFACTURING FACTORY PAC KAMRA
From 19 AUGUST, 2024 To 30 AUGUST, 2024

Director (Technical)
PAC Board Kamra

Member (Technical)
PAC Board Kamra

Date 30 AUG 2024