**Qatar University**

**College of Engineering**

**Department of Computer Science and Engineering**

# Internship Report
# At Turkish Aerospace Industry

## Practical Training Final Report

Marim Elhanafy
201803468

**Mentor**: Mr. Serder Kacka and Mr. Sanberk Daver

**2022**

This project report is submitted to the Department of Computer Science and Engineering of Qatar University in partial fulfillment of the requirements of the Practical Training course.

# Abstract

I am doing my summer training in Turkish Aerospace Inc. (TAI). This was an incredibly unique opportunity provided by Qatar University in collaboration with TAI. Working as an intern in a fast-growing company that is currently the biggest aerospace company in Turkey is a great honor and a great opportunity for a senior-year engineering student. I am working as a software engineer for the Software Engineering Department, who's scope of work is ARINC-429 which is the most widely used data bus standard in aviation, the encoding, decoding, and testing functions will be implemented. I have learned about the C language using a coding standard for FCC (Flight Control Computer). Also, I have learned the best practices in coding with applying what I learned in university courses, as learning is much more effective when being able to apply the knowledge in actual engineering problems under guidance of experienced mentors.

# Acknowledgment

# Table of Contents

# 1. Background of the organization

Turkish Aerospace Inc (TAI) is the biggest aerospace company in Turkey, established in 1973. It is responsible for design, development, manufacture, and integration of aerospace systems. It is primarily owned by Turkish Armed Forces foundation (54.49%) and the defense industry agency (45.45%), which is government institution that manages the Turkish defense industry.

TAI is undertaking both military and civil projects in collaboration with international, well-established aerospace firms. The modern aircraft facility located in Kahramankazan, Ankara, Turkey is equipped with state-of-the-art manufacturing capabilities ranging from singular part manufacture to complete aircraft assembly, flight testing and delivery.

Due to the nature of the defense industry and high security in the facility, most ongoing projects are classified for interns, and only those who are working on it directly are able to see the projects. Furthermore, image and video capture are prohibited within the facility.

The department I was assigned to is known as 'Software Department.' The department works in making the software for other department such as the avionics department. This department consists of electrical engineers, computer engineers, system engineers and computer science engineers. In general, standards and codes followed, different engineering disciplines involved, their roles, and their integrations and interactions with one another.

# 2. Internship learning objectives

1. Study ARINC 429 message characteristics of Digital Information Transfer System.
2. Each ARINC 429 message has a unique bit layout. Therefore, we have to implement encoding and decoding functions for each message (Learn how to develop encoding and decoding functions for ARINC 429 messages using the C programming language)
3. Learn how to develop unit tests for encode and decode functions.

# 3. Internship accomplishments

Mark 33 digital information transfer system part 1: functional description electrical interface, label, assignments, and word formats is the book I read to learn about ARINC 429.

Starting with the message related elements: direction of information flow, information elements, information identifier, source/destination identifier, sign/status matrix (BCD numeric, BNR numeric data words and discrete data words), and data standard.
The second part is called electrically related elements such as voltage levels and impedance levels. Regarding the radio system management of the application notes, I read the word format, the digital language, the update rate, the frequency ranges, the switching functions, and the sign/status matrix. Finally, I read some general word formats and aviation word examples.



ARINC 429 32 bit Word Format

Also, I briefly read DO-254 and DO-178C standards. Moreover, I saw the lab, played on the simulator and the encode/decode tester equipment.

Regarding the C language, I learned about pointers, structure and union, memory operations, and user defined data types.

For the last week, I will do the test function for the encode and decode function for the TCAS intruder range word.

## 4. Reflections on experience and learning outcomes

Overall, this has been an amazing experience so far and a great introduction to the aerospace and defense industries. TAI has been very generous accepting international students as interns in their company to learn and help contribute to the rapid growth of the Turkish defense industry. I have also explored a new country with a different culture, and everyone in Turkey is very welcoming and very friendly. The work environment is very casual, despite it being a defense company, with many social events being held. This helps improve teamwork, loyalty, and work efficiency.

Working in the software department has allowed me to gain much-needed practical knowledge, as I enjoy writing code. Working around experienced mentors has also allowed me to learn a lot from them, as most of them have decades of experience, and without them, learning and applying would just be 'imagination' and would be useless. The field of aircraft structures and their repair is very wide, and as the aviation industry continues to grow, has high demand, and is a great field for fresh graduates. The software department is less practical, but involves lots of communication, logistics and coordination between different departments. You get to meet lots of people and since you work all departments, you get to witness the aircraft from design stage to production stage, and all the evolution of different aircraft components as the product lifecycle evolves.

Overall, I am glad I was assigned to the software engineering department, as I get to work with all other departments in the organization, and many types of engineers, and being able to learn a little bit of what they do every time you meet gives you a very wide understanding of different engineering disciplines and aspects that you will not find in any other industry. I am hoping to leverage the knowledge gained so far in a future career, as well as applying it to the QU courses I will take in the future.