

My name is Aneil Maharaj and I am pursuing my MSc. Data Science at the University of Essex, my choice for the research topic is Artificial Intelligence in fixed wing aircraft development. My background is based in aviation as I work for an aviation company headquartered in Lafayette, Louisiana.

The significance to the discipline in this topic stemmed from various factors, including the initial design of the aircraft, maintenance of the aircraft and passenger satisfaction levels.

The research questions which were focused on are:

- 1) What benefits have been garnered from the implementation of Artificial Intelligence to date?
- 2) What lessons have been learnt from the implementation of Artificial Intelligence to date?
- 3) How can Artificial Intelligence implementation be improved on?

The aims and objectives were chosen to expand the knowledge base of the numerous positives that artificial intelligence can be used for in aviation, secondly informing of the negative outcomes which have occurred to ensure that there is not a one-sided presentation occurring for each individual to be aware of the outcomes; both positive and negative. It should be noted that the implementation of any new technology is not a cheap practice, in any industry and will require investment. Finally, the barrier to change lies most with the line employees who have utilized a tried and tested “pen and paper” method for tracking scheduled maintenance coming

due be either flight hours, or calendar time (Hobbs, 2021). Transitioning these employees will be a major objective to implementing artificial intelligence for aviation maintenance practices.

The primary method of creating efficiency during flight is before the first flight even occurs. Savings can be found during the development phase in calculating wind and drag resistance (Di Pasquale & Savill, 2022), to ensure that the aircraft fuselage and wings are not battling any unnecessary friction to reduce fuel burn. This is then followed by aircraft maintenance; specifically, preventive maintenance is the most important type of maintenance which occurs as it can reduce operating costs which may occur from enforced changes due to damaged parts. It has been observed that the minor downtime for preventive maintenance versus extended downtime for enforced maintenance can result in thousands of dollars, not only in parts but lost revenue from the inability to complete a flight (Kiyak, 2011).

The use of artificial intelligence would be ideal for the tracking, predicting and scheduling of the maintenance practices developed using the original equipment manufacturers airworthiness limitations which are a predefined and known values tracked by either flight time or calendar date for serviceability and health.

Maintenance has been found to be the largest expense for air operators, however it ensures that the aircraft, its staff, passengers and cargo are safe to continue to utilize the service (Hobbs, 2021). The type of inspections vary from a visual inspection, non-destructive testing and load testing for electrical components to list some examples. These inspections ensure that the aircraft are within the operating minimum and deemed legal by the regulating authority for the state.

The aviation industry has always been driven by innovation and efficiency, and this makes it a perfect industry to use A.I. to continue this trend of improvement and increasing efficiencies for airline operators not only from a financial standpoint, but from a safety perspective which is the most important when it comes to air travel.

The use of machine learning has been utilized and has resulted in large amounts of data being accumulated which are divided into reactive and proactive safety risk categories which are then used to predict outcomes from an accumulation of unsafe events. Strategies to mitigate these events, should they occur to prevent incidents, or worse accidents are formalized and emergency response drills are conducted to ensure that proper processes are followed and all parties are aware of their responsibilities during this time. (Haryanti & Komarudin, 2023). In addition to the use of data for predictions, the use of real time flight data for monitoring of aircraft health and tracking of aircraft flight path help to ensure that aircraft remain serviceable and are able to fly safely and preventing the possibility of midair collisions through the use of air traffic controllers (Bosman, 2021).

Additionally, the use of A.I. can be used for staff and passenger accommodations that arise from flight delays, through the use of travel algorithms to locate hotel availability and rates for preferred business partners along with alternative flight options to reach their final destinations (Sumitha, 2023). The improvement of A.I. bots can also assist with frequently asked questions and for tracking of aircraft on a route, tracking of baggage and cargo and potentially ticket prices as well (Sadou & Njoya, 2023).

The introduction of A.I. does not only have to benefit the airline operator, but all stake holders may benefit from this advancement in technology (Ratliff, 2023). Additionally, numerous countries which have curfews due to their airports being located near residential areas have a “no fly time” and the use of artificial intelligence can help airlines plan properly to avoid spending any wasted time on the ground in these countries. Furthermore, the benefits of implementing more artificial intelligence into aviation can increase traveler experience which is often rated as the worst aspect of vacations by expediting the check in and the baggage claiming exercise. Currently artificial intelligence is used to assist with this process, however it can be further enhanced by the utilization of new technology for sorting and classifying passengers based on the airline reward program and their final destination.

Unfortunately for the benefits listed prior, there are some disadvantages and due to this severely regulated industry, A.I. has not been able to be utilized on a full scale basis due to the lack of regulation governing its use (Lopes et al, 2024), and due to the dearth of datasets for algorithms to process this data, resulting in undertrained datasets which could result in catastrophic consequences affecting numerous countries, families and individuals (Verma, 2024).

The methodology of this research project consisted of a literature review with a connection between artificial intelligence and aviation, which included numerous conference papers, journal entries and articles which included statistical data collected from experiments conducted during aircraft development, and surveys conducted to analyze customer satisfaction levels, customer willingness to interact with A.I. and feedback from aircraft manufacturers. These are all classified as

secondary sources of data as it was all collected by another party. Unfortunately the Caribbean region is not blessed to have many aircraft manufacturers or aircraft operators, and for this reason, a global aviation overview was selected. This is due to the lack of options when selecting the most popular airlines and most popular aircraft manufacturers for travel.

The development of this topic has a direct result of the rise in A.I. in all industries, and unfortunately, it has resulted in a large group of individuals having a dislike of A.I. due to an antiquated thought process that they are at risk of losing their jobs, however in aviation, this is the furthest from the truth as aviation requires the human element in order for the right decision to be made not just from a thought process, but the human element is essential (Gao & Marvis, 2022). The continued development will however surely be aided by the education of staff who are reluctant to change, and with the increase in safety of paramount importance, that can be where the focus begins (Kirwan, 2024). Additionally, the collection and pooling of further datasets for continued experimentation and educating of algorithms to ensure that there is accurate machine learning parameters for future development would be ideal.

The research questions were narrowed down upon a review of the available literature available, and the reduction of the aviation industry to fixed wing aircraft and only passenger travel, as it allowed for a greater pool of information to be accessed inclusive of customer and manufacturer feedback, however there were ethical considerations due to the use of A.I. which is a hotly debated topic. The use of A.I. stems from where the datasets are acquired from, and how they are acquired,

however the datasets utilized were created from proprietary methods for the airline manufacturers and all individuals who completed surveys did so anonymously, and were aware of the purpose for the survey (Geske et al, 2024), it was also noted that there were no identifying characteristics in any of the survey data which was observed during the literature review. Furthermore, the proprietary data which was observed are all publicly available values which are presented for scientific observation and use.

The compilation of survey results by air passengers expressing their interest or disinterest in utilizing A.I. techniques to enhance their travel experience as well as feedback from major air operators on their opinions in investing in A.I. to improve on revenue are some examples of the secondary data sources which were found, however there were no artefacts directly created during this project

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