



WORKING PAPER

ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 33: Other issues to be considered by the Technical Commission

USING ARTIFICIAL INTELLIGENCE TO IMPROVE GLOBAL AVIATION SAFETY

(Presented by Iran (Islamic Republic of))

EXECUTIVE SUMMARY

The purpose of this working paper is to investigate artificial intelligence and help to introduce the challenges of artificial intelligence (AI) systems in aviation. It is also trying to introduce the potential of artificial intelligence in areas such as reducing human workload or increasing safety in aviation and cyber security.

Artificial intelligence has the potential to cause significant growth in aviation in the near future. In addition, the analysis and processing of raw data in aviation by artificial intelligence systems can be the key to access to safer global aviation.

Action: The Assembly is invited to:

- a) recognize the benefits of artificial intelligence to improve global aviation safety;
- b) instruct ICAO to establish a working group that will facilitate the establishment of a data science platform;
- c) instruct ICAO to build applications based on artificial intelligence that could provide safety assessment tools to States;
- d) instruct ICAO to present to the ICAO Council and the next Assembly, a report about the progress on such initiative; and
- e) instruct ICAO to adapt processes to new technologies, including artificial intelligence (AI).

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objectives to improve global aviation safety using artificial intelligence.
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<i>Financial implications:</i>	N/A
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<i>References:</i>	N/A
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1. INTRODUCTION

1.1 Artificial intelligence (AI) has the potential to be widely used in the aviation industry today. In the future, many areas of aviation industries will be affected by artificial intelligence technology. Today, air transportation in the world is associated with many challenges. These challenges include the increase in the volume of air travel, the formulation of stricter safety standards, the increasing complexity of air transportation systems, and the occurrence of numerous air accidents despite the advances made in the aviation industry, which artificial intelligence can provide opportunities to solve these problems.

1.2 In this working paper, some of the most important applications of artificial intelligence in aviation are introduced.

2. ARTIFICIAL INTELLIGENCE IN AVIATION SAFETY OVERSIGHT

2.1 Today, both technical advances and the development of strict regulations have helped to create safe systems and safety records. Sometimes the accumulation of safety data is so high that it is practically impossible to analyze and review it without using methods such as artificial intelligence. Also, many safety data may have relationships with each other that cannot be identified.

2.2 Safety data in aviation may be qualitative, quantitative, absolute, or relative, which should be supported by systematic data collection and analysis. These data can be obtained from various sources such as questionnaires, incident reports, technical reports (reliability, observation, and data collection systems such as flight data monitoring), operational performance monitoring systems, and monitoring activities and inspection, etc. Also, economic data such as the financial trends of a company can be among the important things in checking the safety of that operator.

2.3 Artificial intelligence systems can examine and process large amounts of safety data from a variety of sources faster than humans. To plan operators' safety monitoring programs, converting data into meaningful safety information helps provide a safety risk assessment by addressing the likelihood and severity of consequences.

2.4 AI-based decision-making can be a key aspect of any safety oversight system in the future and improve the overall quality of safety regulations. Instead of creating prescriptive regulations that tell operators what they can and cannot do, AI sets safety goals for desired outcomes and measures operator performance against them.

3. ARTIFICIAL INTELLIGENCE IN AIRCRAFT MAINTENANCE

3.1 According to studies conducted in recent years, it has been proven that artificial intelligence models can be used to predict the health of aircraft systems and plan maintenance processes. Artificial intelligence systems provide the ability to provide continuous monitoring systems for aircraft health. With the use of artificial intelligence, repairs are carried out exactly when necessary, which prevents financial resources from being wasted on late repairs of the aircraft.

3.2 AI is also able to design a highly complex maintenance planning process that is currently mostly done manually. The use of artificial intelligence can be one of the most important platforms to achieve predictive maintenance in the aviation industry. This action causes a significant reduction in maintenance costs and increases the safety factor in the aviation industry.

4. ARTIFICIAL INTELLIGENCE IN AVIATION TRAINING

4.1 Artificial intelligence can be used to improve training facilities in aviation. For example, it can be used to train pilots by providing a suitable simulation environment. Smart training in the future can be achieved by using simulators equipped with artificial intelligence in combination with virtual reality systems. These simulators will be capable of collecting and analyzing pilot training data to create personalized training data using biometrics to monitor and predict individual performance.

4.2 Artificial intelligence can be used to design the training syllabus for pilots based on evidence-based training. By using this training system, it is possible to develop the best training syllabus for the pilots by focusing on their weaknesses.

5. ARTIFICIAL INTELLIGENCE IN AIRCRAFT HEALTH MONITORING

5.1 Considering that in recent years, most the airplanes are designed with composite structures, the diagnostic and prognostic capabilities of composite airplane structures are very important. Current manual inspection of composite aircraft structures is time-consuming, as the laminar and interlaminar beam, the damage is often not visible on the surface. Failure detection and prognosis systems have been created using artificial intelligence capable of detecting damage, damage location, damage type, and damage severity.

6. ARTIFICIAL INTELLIGENCE IN AIRCRAFT DESIGN

6.1 Aircraft design is a complex process that unites various controls to achieve a comprehensive approach. Today's airplanes are more expensive and the time spent to build them has increased significantly. The use of artificial intelligence can be of great help in planning design processes.

7. ARTIFICIAL INTELLIGENCE TO DECREASE CO2 EMISSION

7.1 Aerospace companies place great emphasis on reducing fuel consumption, and even a small reduction in aircraft fuel consumption can have a large impact on the company's greenhouse gas emissions. Artificial intelligence-based systems can significantly reduce fuel consumption.

7.2 For example, it designed a tool using artificial intelligence that can optimize a low-fuel climb profile for pilots before each flight. Since the climbing process consumes the most fuel, optimizing this phase leads to significant fuel savings.

8. ARTIFICIAL INTELLIGENCE FOR SMS

8.1 Analysing and understanding human factors in the aviation industry is a critical component in improving aviation systems and safety standards. Factors such as fatigue, workload, and distraction can cause dangerous accidents in aviation. Artificial intelligence can be widely used as a key factor for detecting new risks, classifying the severity of their occurrence, designing the risk portfolio, and prioritizing safety issues.

8.2 By identifying hidden correlations in different data, artificial intelligence can establish a logical relationship between them and help predict possible future risks.

8.3 Artificial intelligence uses innovative technology to improve the effectiveness of aviation safety management systems, which leads to increased safety in aviation and the characteristic ability to learn, improve and predict high-risk situations.

9. ARTIFICIAL INTELLIGENCE FOR AIRPORTS

9.1 Many airports around the world are using artificial intelligence to improve productivity. Artificial intelligence algorithms in airports can be fed with data such as passenger waiting time, queue length, foot traffic, and many other things.

9.2 Artificial intelligence can predict the occupancy of different sections of passengers at different times. This allows airport authorities to take effective measures to reduce passenger congestion. These techniques can greatly help to reduce the contact between passengers, which reduces the transmission of transmissible viruses in the airport area.

10. ARTIFICIAL INTELLIGENCE FOR AVIATION SECURITY

10.1 There is a clear understanding of the many opportunities that AI can create for aviation security equipment. Advanced systems relying on artificial intelligence technology can significantly improve aviation security.

10.2 Security systems are exploring methods that use artificial intelligence that can automatically detect prohibited items such as sharp objects and firearms. These systems are also working on self-screening pods, where visual processes guide passengers through screening without the need for human interaction.

11. CONCLUSION

11.1 In this study, some advantages of using artificial intelligence in aviation were examined. When looking at the big picture, anyone can understand that the importance of AI in aviation is undeniable.

11.2 The aviation industry has always been affected by different technologies. Some of those technologies, such as the jet engine, pushed aviation to historic speeds that no one imagined. It can be said that artificial intelligence is also capable of rapid development of aviation in the future.

11.3 By analyzing and processing safety data obtained from different sources, artificial intelligence can create a logical relationship between them and make safety oversight much more efficient by improving safety performance indicators.

11.4 Considering the importance of artificial intelligence in future aviation, ICAO can create different working groups, establish coordination between member states, and prepare related supportive documents.