



International Civil Aviation Organization

MIDANPIRG Communication, Navigation and Surveillance Sub-Group

Thirteenth Meeting (CNS SG/13)

(Jeddah, Saudi Arabia, 20 – 23 October 2024)

Agenda Item 5: CNS Planning and Implementation Framework in the MID Region

**BENEFITS OF ARTIFICIAL INTELLIGENCE (AI) APPLICATION
IN AIR TRAFFIC MANAGEMENT & INNOVATION**

(Presented by Saudia Arabia)

SUMMARY

This paper describes the potential benefits of applying Artificial Intelligence (AI) techniques to enhance air traffic management (ATM) systems. AI has high potential in areas such as conflict detection and resolution, trajectory prediction, and decision support for air traffic controllers. The paper also discusses the challenges and considerations in developing AI-enabled ATM applications and services.

Action by the meeting is in paragraph 4 of this WP.

REFERENCE(S)

- ICAO Annex 11
- ICAO Doc 9750, Global Air Navigation Plan (GANP)

1. INTRODUCTION

1.1 The rapid advancement of digital technologies, including Artificial Intelligence (AI), provides significant opportunities to enhance the global air traffic management (ATM) system. AI techniques can be leveraged to support air traffic controllers, increase airspace capacity, and optimize traffic flows.

1.2 This paper highlights the potential benefits of AI in ATM and outlines some key considerations in preparing for the integration of AI-enabled tools.

2. DISCUSSION

Potential Benefits of Artificial Intelligence in ATM

2.1 AI systems have high potential in ATM, specifically in areas which involve decision making under uncertainty (e.g. conflict detection and resolution) and prediction with limited information (e.g. trajectory prediction). These approaches can support human operators in exploitation of timely and dynamic information on atmospheric hazards, traffic fluctuations, and airspace utilization and management.

2.2 In addition to developing solutions to support ATM operations, AI can be applied in the following applications:

- a) **Conflict Detection and Resolution:** AI systems can analyze real-time data to identify potential conflicts between flights. By leveraging machine learning algorithms, these systems can provide Air Traffic Controllers with timely alerts and suggest optimal resolutions, thereby enhancing safety.
- b) **Speech recognition to act as an additional safety net to detect read-back errors:** Integrating AI-driven speech recognition technology can enhance communication between pilots and Air Traffic Controllers. By automatically detecting read-back errors and misunderstandings, AI can serve as an additional safety layer in air-ground communications.
- c) **Trajectory Prediction:** AI can improve trajectory prediction by analyzing historical flight data and real-time environmental factors. This capability allows for more accurate forecasting of flight paths, enabling Air Traffic Controllers to manage air traffic more effectively and reduce delays.
- d) **Predicting the most optimal runway configuration for a given arrival sequence and departure schedule.**

2.3 AI can analyze various factors, including weather conditions and traffic patterns, to recommend optimal runway configurations. This application can significantly enhance runway throughput and reduce delays during peak operational periods. With the development of these AI-powered tools, it is envisioned that ATM operations will evolve into a highly automated environment capable of supporting high intensity and more complex operations.

Preparing for AI-enabled ATM

2.4 Embracing AI-enabled ATM requires addressing several challenges, including the lack of relevant competencies to understand and implement AI in aviation.

2.5 Collaboration between ICAO, States, and industry partners will be crucial in developing the necessary standards, guidance material, and training to support the safe and effective integration of AI in ATM.

2.6 Consideration should be given to the ethical implications of AI decision-making, ensuring transparency, accountability, and human oversight in the ATM system.

3. CONCLUSION

3.1 Artificial intelligence has significant potential to enhance air traffic management by supporting air traffic controllers, increasing airspace capacity, and optimizing traffic flows.

3.2 AI and digitalization present great opportunities for the future of aviation, enabling increased safety, efficiency, and capacity in ATC. To fully harness the potential of these technologies, ICAO, States, and industry must work together to update existing frameworks and develop new standards to support the integration of AI in ATM.

3.3 Preparing for AI-enabled ATM will require a collaborative effort between ICAO, States, and industry stakeholders should develop a roadmap for the integration of AI in ATM, including the necessary updates to existing Standards and Recommended Practices (SARPs) and the creation of new standards where needed.

3.4 The integration of AI in ATM should be approached thoughtfully, considering the ethical implications and ensuring the continued safety and efficiency of the global air navigation system.

4. ACTIONS BY THE MEETING

4.1 The meeting is invited to:

- a) note the potential benefits of applying artificial intelligence techniques to enhance air traffic management systems;
- b) consider the AI applications in the CNS SG work program to develop the necessary standards, guidance material, and training to support the safe and effective integration of AI in ATM systems and services; and
- c) collect and share information on potential AI applications considering the upcoming edition of the GANP and on-going development of AI in other ICAO regions.

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