International Civil Aviation Organization

WORKING PAPER

ASSEMBLY — 42ND SESSION

EXECUTIVE COMMITTEE

Agenda Item 20: Innovation in Aviation

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE AVIATION SECTOR

(Presented by Colombia and supported by Latin American Civil Aviation Commission (LACAC) Member States[2]).

EXECUTIVE SUMMARY

Artificial intelligence (AI) is revolutionizing the aviation industry, optimizing processes and improving efficiency in key areas such as air traffic management (ATM), predictive maintenance and safety. Its ability to process large volumes of data, including weather information, flight plans and transfers, and to detect patterns, permits route optimization, congestion prediction and risk anticipation, improving safety and efficiency in the use of airspace.

AI also affects the development of new forms of air mobility, such as advanced air mobility (AAM) and urban air mobility (UAM), presenting new challenges for the integration of these operations and human-machine interaction in airspace.

It is crucial to understand the potential of AI if we are to meet the challenges posed by increasing automation, and to provide training to prevent over-reliance on systems; the possible effects on operators' perception of situations, the ethical dilemmas arising from assisted decision making and the challenges for training - all of which are factors in guaranteeing the ability to react in critical environments if necessary - should be a matter for analysis by the sector.

It is proposed that AI should be incorporated into ATM systems and a new concept, AI/CNS/ATM, should be developed with a view to the digital transformation of air navigation, incorporating the advances already made and encouraging further development for use in air navigation support services.

Action: The Assembly is invited to:

a) invite ICAO to promote discussions between regulatory authorities and system manufacturers in order to establish clear frameworks that address ethical and legal dilemmas, ensuring that artificial intelligence (AI) is implemented in a safe and transparent manner in aviation; and
b) direct ICAO to evaluate the incorporation of AI into Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM), applying the lessons learned from the incorporation of satellites into aviation.

[1] Spanish version provided by Colombia.
[2] Belize, Bolivia (Plurinational State of), Chile, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela (Bolivarian Republic of).

Strategic Goals:	This working paper relates to Strategic Goals *Every Flight is Safe and Secure*; and *Aviation Delivers Seamless, Accessible, and Reliable Mobility for All.*
Financial implications:	
References:	Annex 17 — *Aviation Security.* *https://www.icao.int/about-icao/Council/Pages/ES/Strategic-Objectives.aspx* https://www.iata.org/en/pressroom/2024-releases/2024-07-31-01/ https://www.mapfreglobalrisks.com/en/risks-insurance-management/article/artificial-intelligence-disruption-challenges-aviation/ *Artificial Intelligence and Aviation:* https://www.easa.europa.eu/en/light/topics/artificial-intelligence-and-aviation-0 *Microsoft Copilot. (2025) Assistance in drafting and analysing policies on artificial intelligence in civil aviation. AI tool based on OpenAI's GPT-4 model, integrated into Microsoft 365.* *EASA Artificial Intelligence Roadmap 2.0* *FAA Roadmap for AI Safety Assurance.*

1. INTRODUCTION

1.1 Digital change in aviation is revolutionizing the industry by improving efficiency, safety and passenger experience. Airlines and airports are adopting artificial intelligence (AI)-driven automation for predictive maintenance and customer service, while biometric identification such as facial recognition streamlines security and boarding procedures. Smart airports leverage advanced detection and control systems to enhance security. Cloud computing and big data analytics optimize flight scheduling, fuel consumption and personalization of customer interactions. In addition, airlines are modernizing their digital platforms, including mobile apps and payment systems, to offer a more seamless experience. This shift towards technological solutions is defining the future of air travel, making it smarter, safer and more convenient.

1.2 The aviation industry is in an unprecedented phase of change, driven by the rapid evolution of AI. This technology, with its ability to process large volumes of data and extract complex patterns, is optimizing key processes such as air traffic management (ATM), predictive maintenance and operational safety. From optimizing flight paths to predicting congestion and anticipating risk, AI is improving efficiency and safety in the use of airspace.

1.3 AI is also driving the development of new forms of air mobility, such as advanced air mobility (AAM) and urban air mobility (UAM), which present new challenges in integrating these operations and human-machine interaction in airspace. AI's ability to automate tasks and analyse data in real time is transforming the way aviation professionals interact with systems, opening up a range of opportunities to improve efficiency and safety.

1.4 However, the incorporation of AI into aviation also poses significant challenges. It is crucial to understand the implications of advanced automation for human-machine interaction, operators' situational awareness and decision making. In addition, there is a need to address the ethical dilemmas that arise from the implementation of AI and to ensure that it is used in a responsible and transparent manner. In this context, the training and education of the sector's technical, operational and general personnel must cover these key points in order to prepare aviation professionals for the challenges and opportunities presented by AI.

2. DISCUSSION

2.1 Aviation, as one of the most dynamic and technologically advanced sectors, is experiencing steady growth, as evidenced by the 9.1 per cent increase in passenger-kilometres reported by IATA in July 2024.[3] This growth requires airspace use to be optimized and safety to be guaranteed. Factors such as increased traffic density, the development of more accurate aircraft detection and tracking systems, coupled with new predictive traffic flow systems and greater availability of meteorological information, have transformed the way personnel interact with Communications, Navigation, Surveillance, Air Traffic Management and Meteorology (CNS-ATM-MET) systems. In this context, AI emerges as a key technology to increase operational efficiency and safety in aviation.

2.2 With its ability to analyse data from various sources and automate processes, AI is transforming aviation thanks to the range of applications it has in the industry. In ATM, AI-based systems permit the processing of large volumes of data in real time, identifying patterns and anticipating critical situations such as potential collisions or traffic congestion. This translates into optimized flight paths, better prediction and resolution of congestion and greater efficiency in managing air traffic flow when confronted by unexpected changes, for example in the weather.

2.3 AI is emerging as a force for change in aviation, especially in the autonomous generation of flight plans. Advanced artificial intelligence of this kind allows systems to sense, decide and act with minimal human intervention, optimizing flight paths, fuel efficiency and airspace management; data can be continuously monitored in real time, including weather conditions, air traffic congestion and operational constraints, enabling flight plans to be dynamically adjusted. By leveraging predictive analytics and reinforcement learning, it improves decision making, reduces delays and optimizes operational efficiency.

2.4 With respect to the growth of new technologies such as AAM and UAM, with their respective management systems (UTM), it is necessary to rethink human-machine interfaces, introducing new forms of interaction between technology and human beings. New challenges will arise with the incorporation of these operations into the aviation sector, since intelligent technologies will simplify simple tasks, under supervision from aviation professionals with new profiles. Human-machine interaction is evolving towards a supervisory relationship, with aviation professionals taking on roles with greater responsibility for strategic decision making, planning and conflict resolution.

2.5 The Federal Aviation Administration (FAA) has developed an AI safety roadmap with strategies for validating systems prior to their mass adoption in aviation and the European Union Aviation Safety Agency (EASA) is exploring its applications. In its 2020 report, EASA emphasized the need for reliable AI and a human-centred approach to its incorporation into aviation. Meanwhile, Boeing and Airbus are developing AI independently and in international collaboration, with the goal of improving operational efficiency and safety.

2.6 In predictive maintenance of aviation infrastructure, machine learning makes it possible to evaluate the condition of equipment and identify anomalies before they become critical failures, thereby increasing safety and reducing operating costs. On the flight deck, AI analyses real-time data to predict risk situations and provide recommendations for decision making, reducing pilot workload and improving situational awareness.

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[3] https://www.iata.org/en/pressroom/2024-releases/2024-07-31-01/

2.7 In ATM, AI-based systems process large volumes of data in real time, identifying patterns and anticipating critical situations such as collisions or congestion. This analytical capability enables flight routes to be optimized, adapting to changing conditions and minimizing delays. In addition, AI facilitates the inclusion of real-time weather information, predicting risk areas and adjusting routes to avoid them. It also permits the automation of processes, streamlining the loading of information and the interaction between different technologies. Pattern recognition on routes and in corridors can also help to automate actions through systems of decision support for the controller.

2.8 AI thus contributes to smoother and more efficient ATM, reducing delays, fuel consumption and pollutant emissions. Air traffic controllers benefit from decision support systems that, by integrating weather information, flight plans and surveillance data, enable them to generate accurate crossing and risk forecasts, giving them a comprehensive view of air traffic. This allows them to make more informed and efficient decisions.

2.9 The ability of AI to process multiple sources of information, coupled with the development of state-of-the-art satellite and ground-based weather sensors and data link systems with aircraft, promotes greater efficiency in air traffic flow and minimizes the impact of unexpected events and delays.

2.10 However, the incorporation of AI into aviation also brings challenges. Advanced automation can affect human-machine interaction and operators' situational awareness, creating risks such as over-reliance on systems and lack of attention in emergency situations. To mitigate these risks, it is crucial to implement training programmes that develop skills in human-machine interaction and ensure that operators understand the capabilities and limitations of AI.

2.11 Another fundamental aspect is ethics and accountability in AI-assisted decision making. There is a need to establish regulatory frameworks that define responsibilities in human-machine interaction, ensuring that AI is implemented in a safe and transparent manner. Education and training are crucial to ensure a successful transition to this new paradigm by incorporating content covering AI, the management of human-machine interaction and the development of critical thinking skills.

2.12 It is vital to address the implications of automation for human-machine interaction, operators' situational awareness and decision making. It is also essential to establish clear ethical and regulatory frameworks to ensure that AI is implemented in a responsible and transparent manner, under the concept of AI/CNS/ATM.

2.13 Training and continuing education are essential if aviation professionals are to take full advantage of the opportunities offered by AI, while mitigating potential risks. Ultimately, the successful incorporation of AI into aviation will depend on the industry's ability to adapt to technological change while maintaining a human-centred, safety-focused approach to the digital shift to AI/CNS/ATM.

2.14 CNS as a concept (Communications, Navigation and Surveillance) was introduced in 1983 to overcome the limitations of the air navigation systems of the time. Just as with satellite-based modernization, launched in 1991 at the Tenth Air Navigation Conference, today it is necessary to set up a special committee to define clear terms of reference for the incorporation of AI into aviation.

2.15 To sum up, artificial intelligence is rapidly transforming the aviation industry, optimizing processes and improving efficiency in key areas such as air traffic management, predictive maintenance and safety. However, the introduction of AI brings with it significant challenges that demand careful reflection: these include the certification of artificial intelligence (AI) in aviation given that its evolutionary nature makes it difficult to validate using traditional standards; the impact on aviation activities; and cybersecurity strategies. Investment in flight planning, simulation and training is permitting the gradual entry of AI into the aircraft cockpit, with expectations of significant adoption in the 2030s, but we must make progress in ATM if we are to ensure proper integration.

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