



WORKING PAPER

ASSEMBLY — 42ND SESSION

TECHNICAL COMMISSION

Agenda Item 24: Aviation Safety and Air Navigation Priority Initiatives

ESTABLISHMENT OF A STUDY GROUP ON THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN AVIATION

(Presented by Brazil)

EXECUTIVE SUMMARY

The increasing use of Artificial Intelligence (AI) in aviation—particularly in unmanned systems, urban air mobility, and high-density airspace operations—demands urgent international attention. This paper proposes the establishment of a Study Group under the Air Navigation Commission to assess AI's implications for safety, certification, airspace integration, and system validation.

Action: The Assembly is invited to:

- a) Recognize the need for ICAO to lead global coordination on AI in aviation; and
- b) Support the establishment of a Study Group on AI under the Air Navigation Commission (ANC).

<i>Strategic Goals:</i>	This working paper relates to <i>Every Flight is Safe and Secure</i> and <i>Aviation Delivers Seamless, Accessible, and Reliable Mobility for All</i> .
<i>Financial implications:</i>	Activities will be conducted within existing ICAO resources, supported by Member State contributions
<i>References:</i>	ICAO Environmental Report 2025 ICAO States adopt net-zero 2050 global aspirational goal for international flight operations ICAO Strategic Plan 2026–2050. International Civil Aviation Organization ICAO The Transformative Impact of AI in Aviation ICAO UAS Toolkit. International Civil Aviation Organization

1. INTRODUCTION

1.1 Artificial Intelligence (AI), and Machine Learning in particular, are increasingly recognized as critical enablers for the future of civil aviation. From air traffic management and aircraft systems to maintenance, training, and operational safety, AI has the potential to transform aviation by enhancing performance, safety, and efficiency while addressing the growing complexity and volume of air operations.

1.2 Global aviation is undergoing a significant transformation with the emergence of technologies such as advanced air mobility (AAM), unmanned aircraft systems (UAS), and vertical take-off and landing (VTOL) aircraft. These developments, as highlighted in the Federal Aviation Administration's (FAA) Advanced Air Mobility Implementation Plan (FAA, 2023) and the European Plan for Aviation Safety (EPAS) 2025 Volume III (EASA, 2025), introduce novel airspace users and operational paradigms that require dynamic, data-driven decision-making capabilities beyond what traditional human-centric systems can support.

1.3 Simultaneously, the FAA Roadmap for AI Safety Assurance emphasizes the urgency of developing robust frameworks to certify, validate, and integrate AI-enabled functions in safety-critical systems. However, without international coordination and guidance, Member States may adopt fragmented approaches, which could compromise global interoperability, safety, and regulatory alignment.

1.4 This working paper proposes the establishment of a dedicated Study Group under the Air Navigation Commission (ANC), as it is the principal technical body operating under the authority of the ICAO Council. The Study Group would be tasked with evaluating the application of AI in civil aviation and developing technical, regulatory, and operational guidance to support the safe and harmonized integration of AI across the industry.

2. DISCUSSION

2.1 Systemic challenges of AAM and AI Interaction

2.1.1 The aviation sector is facing a paradigm shift with the rise of AAM, UAS and VTOL operations. These emerging technologies are expanding access to airspace, particularly at low altitudes and in densely populated urban environments. However, their integration poses significant challenges to traditional air navigation systems, safety oversight structures, and regulatory frameworks.

2.1.2 According to the FAA Advanced Air Mobility Implementation Plan (FAA, 2023), the integration of AAM will require transformation across multiple operational domains—including air traffic management, airworthiness certification, communication infrastructure, and community integration. New aircraft types will operate beyond the visual line-of-sight (BVLOS), on-demand, and often autonomously or semi-autonomously. This dynamic operational model demands new levels of scalability, adaptability, and system intelligence, which cannot be managed solely through manual or legacy processes.

2.1.3 AI is increasingly seen as a viable solution to address the growing complexity and data density associated with AAM operations. However, as the FAA Roadmap for AI Safety Assurance (Version I) underscores, current aviation safety assurance frameworks are not yet equipped to handle adaptive systems that operate in real-time and learn or evolve over time. This leads to critical gaps in

certification procedures, validation methodologies, and trust-building mechanisms for AI-based aviation systems.

2.1.4 Moreover, the lack of standards for AI systems, mostly due to fragmented national and international approaches to AI governance and certification risk undermining global interoperability and creating regulatory asymmetries between States. Inconsistent standards could hinder the scalability of AAM systems and jeopardize public confidence in AI-supported aviation services.

2.2 **Operational and regional challenges**

2.2.1 This challenge is further intensified by airspace saturation. As of 2023, U.S. commercial air traffic had returned to near pre-pandemic levels, with over 77.5 million passengers carried in a single month and a steady growth trajectory expected to continue in the coming years.

2.2.2 In parallel, as of December 2022, the United States had an estimated total fleet of approximately 2.42 million small UAS (sUAS), comprising 1.69 million recreational units and 727 000 commercial units. By 2027, the recreational fleet is projected to reach 1.82 million units, a 7.8 per cent increase from 2022, while the commercial fleet is expected to grow to 955 000 units, representing a 31.4 per cent increase over the same period. Overall, this implies an expected total sUAS fleet of 2.78 million units by 2027, marking a 14.9 per cent growth in just five years. This steady expansion underscores the increasing role of drones in both commercial and recreational domains and highlights the growing implications for airspace integration, regulatory frameworks, and infrastructure planning in the United States. Additionally, the FAA anticipates the production of up to 250 VTOL aircraft per year, signalling a significant step toward the operationalization of AAM systems and urban air transport.

2.2.3 In Brazil, Eve Air Mobility, a subsidiary of Embraer, is spearheading the development of eVTOL aircraft that promise to significantly impact urban mobility, particularly in congested cities such as São Paulo and Rio de Janeiro. Eve's holistic approach not only focuses on the aircraft but also on building a complete urban air mobility (UAM) ecosystem, including vertiports, urban air traffic management systems, and multimodal transport integration. The company has published Brazil's first Concept of Operations (CONOPS) for UAM, specifically scoped for operations in the city of Rio de Janeiro, developed in collaboration with ANAC, DECEA, and other key stakeholders. This initiative aims to ensure the safe and sustainable introduction of eVTOL services in urban environments, serving as a model for potential replication in other metropolitan areas.

2.2.4 Eve's partnership with Revo and Helicopters International SA (OHI) aims to introduce up to 50 eVTOLs into São Paulo's airspace by, transitioning current helicopter routes to fully electric, quieter, and more sustainable operations. This shift is expected to reduce travel times dramatically for commuters, alleviate road congestion, and lower carbon emissions, contributing to the city's environmental goals. However, this new eVTOL traffic will operate alongside over 400 registered helicopters, which currently perform nearly 2 200 daily take-offs and landings, creating a highly complex and congested low-altitude airspace that will require advanced traffic management solutions to ensure safety and efficiency.

2.2.5 The Brazilian Department of Airspace Control (DECEA) and the National Civil Aviation Agency (ANAC) are actively developing frameworks and systems to manage this growth, including transitioning from visual flight rules to digital flight rules for VTOLs and UAS. Key challenges include updating airspace classifications, enhancing communication and surveillance infrastructure, and adopting

AI-driven traffic management for real-time conflict detection and resolution. Without these advances, the safety and efficiency of Brazil's increasingly crowded airspace may be compromised.

2.2.6 These new aircraft will share already congested skies with general aviation, commercial flights, and a growing number of drones, creating a complex hybrid airspace environment. Managing this environment will require autonomous or AI-assisted coordination systems capable of real-time conflict resolution, traffic prioritization, and risk mitigation.

2.2.7 Therefore, human-centric traffic management systems, even with digital assistance, will not be able to safely or efficiently manage the increasing diversity, speed, and volume of operations. The FAA's AAM implementation strategy explicitly acknowledges this limitation by calling for new traffic management paradigms supported by advanced automation. Without the integration of AI-based decision support tools, the airspace system will be unable to scale to meet projected demand.

2.2.8 In this context, ICAO leadership is essential to foster international coordination and develop harmonized guidance for the safe and effective integration of AI technologies. Without proactive engagement, the global aviation system may face operational inefficiencies, safety blind spots, and increased systemic risk as AI-enabled systems become more prevalent.

2.3 **Benefits and alignment with ICAO strategic objectives**

2.3.1 The establishment of a study group on AI in aviation directly supports all five strategic objectives of ICAO, as outlined in its official strategic framework and reinforced in the ICAO Strategic Plan 2026–2050.

2.3.2 First and foremost, this initiative addresses the objective to enhance global civil aviation safety. The integration of AI-based systems is seen as a promising capability to mitigate the safety risks posed by the growing presence of VTOLs and UAS in shared airspace. AI tools can help manage the high density and operational diversity introduced by these new aircraft types, offering real-time risk assessment, adaptive automation, and improved situational awareness for both human and autonomous operators.

2.3.3 The study group also contributes to increasing capacity and improving the efficiency of the global civil aviation system. As airspace becomes saturated with a wider range of users, especially in low-altitude urban corridors, traditional air traffic management systems will be unable to keep pace. AI-enabled services can provide critical support for scalable deconfliction, trajectory optimization, and seamless integration of manned and unmanned flights.

2.3.4 In the domain of civil aviation security and facilitation, AI systems can play a growing role in monitoring autonomous operations, detecting anomalies, and preventing unauthorized access or misuse of UAS. Harmonized global policies, interoperability, and oversight mechanisms will help ensure safe and secure operations, while enabling rapid innovation.

2.3.5 From an economic perspective, the creation of the Study Group will support the objective to foster the development of a sound and economically viable civil aviation system. Standardized AI frameworks can reduce certification costs, improve cross-border interoperability, and accelerate market readiness for new entrants such as UAM operators. This creates opportunities for equitable growth and supports ICAO's goal of inclusive and sustainable development.

2.3.6 Finally, although the primary drivers of AI integration are safety and efficiency, AI-enabled aircraft and airspace management can also help minimize the adverse environmental effects of civil aviation activities. VTOLs are expected to operate with reduced emissions and noise footprints, contributing to ICAO's long-term environmental goals, including the target of net-zero carbon emissions by 2050.

3. CONCLUSION

3.1 The increasing complexity of the global airspace system, driven by the simultaneous growth of traditional commercial aviation, the proliferation of UAS and the rapid emergence of VTOL aircraft, has created a transformative moment for civil aviation. This evolution is particularly evident in regions like Brazil, Europe, and the United States, where the operational, regulatory, and technological impacts of AAM are already being felt.

3.2 In Brazil, urban centres such as São Paulo and Rio de Janeiro are experiencing pressure from dense low-altitude operations. With over 400 helicopters already operating daily in São Paulo, and the planned deployment of eVTOL fleets by 2027, the complexity of airspace management is rapidly escalating. The collaborative publication of Brazil's first UAM CONOPS reflects the country's commitment to safe and sustainable integration of these technologies—but also underscores the urgency of adopting AI-based traffic management systems to handle increasing demand.

3.3 In the United States, the FAA reports a strong recovery in commercial air traffic and anticipates continued growth in UAS and AAM. Its plans highlight the need to adapt certification and oversight to AI and autonomous systems. In Europe, EASA's EPAS 2025 – Volume III also prioritizes AI, digital resilience, and UAS integration, noting that cross-border airspace complexity and fast-paced innovation challenge existing regulatory frameworks.

3.4 Critically, human-centric air traffic control and safety oversight models will soon no longer be sufficient to manage the speed, volume, and diversity of airspace users. As the aviation system evolves toward higher levels of autonomy, adaptive behaviour, and distributed decision-making, AI-enabled tools will become essential for ensuring safety, efficiency, and public confidence.

3.5 To address these challenges, this Working Paper proposes the establishment of a Study Group on the Application of Artificial Intelligence in Aviation under the authority of the ANC. The Study Group would provide a global forum to examine AI use cases, identify safety and regulatory gaps, and develop technical and operational guidance for integrating AI technologies across all domains of civil aviation.

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