



WORKING PAPER

ASSEMBLY — 42ND SESSION

EXECUTIVE COMMITTEE

Agenda Item 20: Innovation in Aviation

RESPONSIBLE AND STRATEGIC INTEGRATION OF ARTIFICIAL INTELLIGENCE IN INTERNATIONAL CIVIL AVIATION

(Presented by Singapore, co-authored by Thailand and co-sponsored by Canada, China and Republic of Korea)

EXECUTIVE SUMMARY

Artificial intelligence (AI) is seeing rapid advancements and increasing adoption across many industries, including aviation, with applications ranging from predictive maintenance to safety oversight, air traffic management and operational decision support. These technologies offer transformative potential but also raise new challenges relating to oversight and accountability, ethics and equality of access, and consistent safety outcomes and automation dependency, particularly when AI operates on probabilistic or opaque logic.

This paper proposes that ICAO take a leading role in studying, standardising and adapting the safety applications of artificial intelligence in aviation.

Action: The Assembly is invited to request the ICAO Council to:

- a) establish a structured collaboration platform with UN bodies, standards organizations, industry, and academia to identify aviation-specific risks, use cases, and ethical concerns;
- b) conduct a global scoping study on current AI applications, oversight practices, and readiness gaps;
- c) task relevant ICAO panels to assess the implications of AI integration on their areas of expertise; and
- d) initiate the development of foundational ICAO guidance material (e.g., a circular or manual) on AI integration in safety-critical domains.

<i>Strategic Goals:</i>	This working paper relates to Strategic Goals: <i>Every Flight is Safe and Secure</i> <i>No Country Left Behind</i> <i>Aviation Delivers Seamless, Accessible, and Reliable Mobility for All</i> <i>The International Civil Aviation Convention and other Treaties, Laws and Regulations address all Challenges</i>
<i>Financial implications:</i>	Nil
<i>References:</i>	Nil

1. INTRODUCTION

1.1 Artificial intelligence (AI) refers to the simulation of human intelligence in machines, allowing them to perform tasks that would typically require human cognitive processes such as learning, problem-solving, understanding natural language, and even creative thinking. In its most primitive form, AI has demonstrated benefits in efficiency and automation by handling repetitive tasks quickly and accurately.

1.2 The emergence of AI technologies is transforming many areas in aviation — from predictive maintenance to airspace optimization, flight trajectory management, and security risk detection. AI technology will help drive innovation in the aviation field and help facilitate the achievement of envisioned outcomes in air navigation, safety and security, with the eventual possibility that it may reshape the rules, processes and standards. This introduces new forms of operational and regulatory complexity. It is therefore necessary to maintain global cooperation and harmonization to adapt to the rapid development of AI in aviation.

1.3 In the absence of globally harmonized data requirements, AI deployment in aviation may become fragmented, leading to interoperability challenges, unforeseen safety risks, and limitations on cross-border optimization of airspace. While existing ICAO frameworks such as the adoption of Aeronautical information exchange model (AIXM) Flight information exchange model (FIXM) and ICAO meteorological information exchange model (iWXXM) provide a foundational basis for digital data exchange, AI-readiness goes beyond data-readiness to include infrastructure-readiness, talent and skill provision, governance and regulatory frameworks, and integration plans, among others.

2. DISCUSSION

2.1 There are demonstrated practical benefits to AI in the aviation sector, which can improve efficiency when handling repetitive tasks quicker and more accurately including: error detection during the flight planning process. AI has also been used to optimise resource planning such as crew scheduling and gate allocation. For air navigation services providers (ANSPs) AI has been used to enhance air traffic flow management through demand forecasting and conflict detection and improve safety through anomaly detection and safety monitoring, thereby reducing safety incidents. There is also potential for AI assistants to be deployed for data-driven decision support and air traffic management.

2.2 The feasible application of AI in aviation is vast and has the potential to help aviation increase productivity, enhance efficiency and reduce safety risk, given the high level of automation envisioned and facilitated by the digitalisation of aeronautical, flight, and meteorological information. It is, therefore, timely to consider its integration into aviation and air traffic management.

2.3 The complexity of cross-border operations necessitates a consistent approach to AI and automation applications in the aviation. Without ICAO guidance, States may adopt divergent practices, undermining global air traffic management (ATM) principles and integration, potentially creating safety, regulatory acceptance and liability challenges. Hence, there is a need to develop a structured approach to the safe and effective adoption of AI-assisted automation.

2.4 First, ICAO could establish a global dialogue platform on AI in aviation to share current and potential use cases and emerging concerns specific to aviation. This can take place in the form of a structured collaboration mechanism with relevant UN bodies (e.g., International Telecommunication Union (ITU) United Nations Educational, Scientific and Cultural Organization (UNESCO) World

Intellectual Property Organization (WIPO) standards developers (e.g., ISO, IEEE), academia and research bodies, and industry stakeholders (original equipment manufacturer (OEMs), ANSPs, operators). This global dialogue could take reference from the UN – the Secretary-General has established a High-Level Advisory Body on AI, where the Body aims to align AI governance with human rights and the Sustainable Development Goals.

2.5 Second, ICAO could conduct an AI scoping study to provide a baseline for how AI is currently being applied and adopted across the aviation sector; how risks are identified, managed and if there are gaps in oversight or certification processes; and benchmark international best practices from other industries for adoption by aviation. This will provide an empirical foundation for prioritising ICAO's next steps and priorities including whether to pursue guidance, standards, or capacity-building.

2.6 Third, ICAO could conduct a Cross-Panel Scoping study to identify relevant panels and expert groups (e.g., Safety Management Panel, ATM Requirements and Performance Panel, Flight Operations Panel, Global Air Navigation Plan Study Group) to review and assess AI implications in their respective domains and identify key ICAO principles for the use of AI in ATM, safety and security domains. This work is essential to support the cross-cutting evolution of aviation and build technical awareness for further Standards and Recommended Practices (SARPs) if needed.

2.7 Fourth, with the above completed, ICAO Secretariat could then initiate the drafting of an ICAO Circular, Manual or Provisions on AI in aviation. This could include Ethical principles and governance considerations, approaches for consistent safety outcomes for AI-supported systems and limitations, where appropriate, on boundaries for the integration of AI. This will provide reference and guidance for States and industry that supports early harmonization without regulatory pressure.

2.8 While States remain responsible for oversight over the means and extent of AI implementation in accordance to their international obligations, ICAO guidance on the use of AI based on the scoping study will provide a baseline for global data requirements and governance principles in support of the AI adoption. Under the auspices of ICAO, this manual would promote trust, facilitate interoperability, enhance safety assurance delivery by AI-enabled systems.

2.9 ICAO already has relevant expert panels e.g. the Information Management Panel and Trust Framework Panel that are looking at different aspects of the data lifecycle and providing guidance for interoperability and trusted information exchanges for operational purposes. This new guidance should build on and align with emerging best practices in digital transformation, information security, and data ethics.