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TECHNICAL COMMISSION

Agenda Item 24: Aviation Safety and Air Navigation Priority Initiatives

THE CERTIFICATION AND CONTINUING AIRWORTHINESS IN THE ERA OF HYPER-PERSONALIZED AND ON-DEMAND AVIATION

(Presented by Kazakhstan)

EXECUTIVE SUMMARY

The rapid emergence of hyper-personalized and on-demand aviation platforms such as electric vertical take-off and landing (eVTOLs), urban air mobility vehicles, and modular aircraft systems challenges the conventional framework of airworthiness oversight. These new operational models require a shift from static, type-based certification toward more dynamic, data-driven, and adaptive airworthiness methodologies. This paper proposes that ICAO develop new guidance and initiate discussions on evolving certification and continuing airworthiness principles to accommodate this emerging class of aircraft and business models.

Action: The Assembly is invited to:

a) recognize the limitations of existing airworthiness frameworks in addressing emerging on-demand and personalized aviation models;
b) acknowledge the need for ICAO to update or supplement existing guidance material (such as Doc 9760 – *Airworthiness Manual*);
c) recommend the establishment of an ICAO Study Group or Panel to explore adaptive airworthiness models for advanced air mobility (AAM), electric vertical take-off and landing (eVTOL), and digital fleet ecosystems; and
d) encourage collaboration between regulators, original equipment manufacturers (OEMs), operators, and digital service providers.

Strategic Goals:	This working paper relates to *Every Flight is Safe and Secure.*
Financial implications:	
References:	Annex 8 — *Airworthiness of Aircraft* Doc 9760 — *Airworthiness Manual*

1. INTRODUCTION

1.1 The aviation industry is undergoing a fundamental transformation with the rise of hyper-personalized and on-demand flight operations. Platforms such as electric vertical take-off and landing (eVTOL) vehicles, drone taxis, hybrid modular aircraft, and AI-driven flight customization are redefining how people and goods are transported.

1.2 These innovations pose new challenges to traditional airworthiness systems which are largely built around legacy, fleet-based, and standardized aircraft operations. The certification, continuing airworthiness, and regulatory compliance processes must evolve to match the complexity, flexibility, and scale of new aviation ecosystems.

1.3 ICAO, as the global aviation standard-setting body, must lead the evolution of airworthiness governance to ensure the safety, efficiency, and sustainability of emerging aviation technologies.

2. DISCUSSION

2.1 Gaps in existing frameworks

2.1.1 The current airworthiness framework, centered around ICAO Annex 8 — *Airworthiness of Aircraft* and Doc 9760 — *Airworthiness Manual*, emphasizes traditional manufacturing, maintenance, and certification lifecycles. However, these frameworks may not be agile enough to address technologies with frequent design iterations, software-centric architectures, and distributed manufacturing.

2.2 Hyper-personalized aviation introduces variable configurations, dynamic mission profiles, and AI-optimized performance parameters, all of which require real-time oversight models.

2.3 Key challenges

2.3.1 New aviation platforms often feature:

a) rapid prototyping and digital twin integration;

b) AI-based flight planning and operations;

c) cloud-based maintenance and diagnostics; and

d) custom configurations for individual users or missions.

2.4 Traditional airworthiness does not yet accommodate:

a) real-time certification updates or adaptive airworthiness approvals;

b) autonomous systems integrated with machine learning and neural networks; and

c) non-traditional ownership models, such as fractional ownership or on-demand service networks.

3. PATH FORWARD

3.1 ICAO is encouraged to consider the establishment of a dedicated Airworthiness Innovation Study Group, operating under the auspices of the Airworthiness Panel or in coordination with the Advanced Air Mobility Study Group (AAM SG). This group would be tasked with exploring and developing forward-looking regulatory concepts, including but not limited to:

a) dynamic and modular type certification systems tailored to flexible and reconfigurable aircraft architectures;

b) software assurance frameworks to validate artificial intelligence (AI), machine learning algorithms, and autonomous functionalities integrated into aircraft systems;

c) real-time, data-driven continuing airworthiness models, leveraging predictive maintenance, in-service analytics, and digital fleet management tools; and

d) the integration of digital twin technologies to enhance certification, inspection, and lifecycle oversight processes.

3.2 The success of such an initiative will require robust collaboration between key stakeholders, including:

a) national aviation authorities (NAAs) to provide regulatory insight and implementation pathways;

b) industry stakeholders, including original equipment manufacturers (OEMs), air mobility operators, and digital platform providers; and

c) academic institutions and AI research communities, to contribute expertise in automation, data science, and emerging technologies.

3.3 Collaboration is essential between:

a) national aviation authorities (NAAs);

b) industry stakeholders (OEMs, operators);

c) academia and AI researchers; and

d) international standards bodies (e.g., SAE, RTCA, ASTM).

4. CONCLUSION

4.1 Hyper-personalized and on-demand aviation platforms will be critical components of the next-generation air transport ecosystem. To ensure their safe and efficient integration, ICAO must proactively modernize its airworthiness frameworks.

4.2 This requires not only updating technical standards but also rethinking the entire regulatory approach to aircraft lifecycle oversight, in alignment with digital transformation and user-centric service models.

4.3 ICAO is well-positioned to lead this transformation and foster international consensus on safe, agile, and scalable airworthiness practices.

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