



**WORKING PAPER**

**FOURTEENTH AIR NAVIGATION CONFERENCE**

**Montréal, Canada, 26 August to 6 September 2024**

- Agenda Item 2: Timely and safe use of new technologies**  
**2.2: Addressing safety risks related to evolving aviation technologies**

**ELECTRIC VERTICAL TAKE-OFF AND LANDING (eVTOL) AIRCRAFT PRODUCT  
CERTIFICATION AND OPERATIONAL ASPECTS**

(Presented by Brazil)

**EXECUTIVE SUMMARY**

This working paper presents the challenges of regulating the early stages of aviation's disruptive technologies, specially related to aircraft certification.

It suggests strategies to support the safe introduction of new aircraft technologies through exchange of information and enhanced transparency concerning the ongoing development of approaches, procedures, and certification frameworks for electric Vertical Take-Off and Landing (eVTOL) aircraft, as well as their operational aspects.

The current state of eVTOL technology is assessed in comparison to the regulatory expectations on ICAO and a prudent and balanced solution is proposed.

**Action:** The Conference is invited to agree on the recommendations in paragraph 3.1

**1. INTRODUCTION**

1.1 The certification of emerging eVTOL aircraft is causing significant disruption to traditional type certification procedures globally.

1.2 The present paper is related to Agenda Item 2.2 as it focuses on the potential risks for the safe development of the emerging technology. The current mandate of the Advanced Air Mobility Study Group (AAM SG), established at the 221st Session of the Air Navigation Commission, doesn't cover aspects of the eVTOL certification processes here explored. Indeed, there are some aspects related to eVTOL certification and harmonization that the Conference should address.

**2. DISCUSSION**

2.1 Defining the certification basis is one of the initial steps in certifying an aircraft. This process involves establishing the requirements that the design must meet in order to obtain type

certification. The procedure for developing the certification basis of a traditional aircraft is well established. It involves matching the aircraft with an appropriate category for which there is already a regulation defined.

2.2 However, under this regulation, certain requirements may not apply depending on the specific characteristics or innovations of the design. In such cases, exemptions are granted, and special conditions are imposed. It is important to note that the number of these exceptions is relatively low when compared to the overall number of requirements. This is primarily due to the fact that traditional aircraft designs adhere to a well-established and stable pattern, with most characteristics being common and few innovations or exceptions being present.

2.3 New eVTOL designs do not follow the same pattern. There is no set pattern yet, and there are a multitude of very different configurations. There is considerable number of new technologies enabling radical new design solutions. For example, electric motors enable distributed propulsion, which enables either VTOL capability or blown lift short take-off and landing (STOL) designs. Other relevant new technologies are batteries, high voltage, new composite materials, electronic data exchange, autonomy or new piloting command solutions, inter alia. The interaction among the new technologies poses innumerable challenges for the establishment of the certification basis. Moreover, eVTOL aircraft technologies are in the early stages of development, making it difficult to coalesce to a stable common design. There is little experience and few available data to properly regulate these designs. Additionally, there is a wide diversity of operations, with different aircraft configurations.

2.4 The Civil Aviation Authorities of Brazil, European Union, and the United States have implemented various strategies to address this challenge, that are essentially the development of tailored certification criteria for individual scenarios, in order to avoid the establishment of rigid regulations that apply universally. This approach naturally has its challenges; for example, defining appropriate safety objectives, international harmonization and international acceptance of the certified models.

2.5 In line with other States of Design, the first certification basis developed by Brazil was made available for public consultation from December 2023 to March 2024. This approach ensures a fair and equal platform for manufacturers globally, promoting the general understanding of the requirements under consideration thus addressing the main drawback of individualized regulations, which is the potential for inconsistent treatment.

2.6 Likewise, at this early stage of development, it would not be proper for ICAO to define Standards and Recommended Practices (SARPs), however, it is appropriate to promote the visibility of approaches, strategies, and ongoing activities of States of Design regarding eVTOL type or model certification, thus promoting regulatory harmonization and preparing, eventually, for the safe operation worldwide.

2.7 Despite the apparent expectation for ICAO to promptly establish guidelines and SARPs for new technologies, it is crucial that the organization, instead, prioritizes the dissemination of knowledge among all Member States. By adopting this approach, with a comprehensive understanding of the latest technologies, the development of guidelines or SARPs will occur organically. This is essential to promote safety, to prevent information asymmetry and unfair competitive advantages.

2.8 Exchanging their State of Design information about processes and certification bases under development for eVTOL aircraft and involving the international community is a best practice of change management pursuing the international harmonization and the understanding of the new technologies involved. In this manner, States of Design would contribute even more to the global benefit and to support the safe introduction of such new aircraft technologies.

2.9 In the same way, dissemination of operational aspects by the States of Design, aiming at better preparing States of the Operator, may be an important means to leverage the safe introduction of eVTOL aircraft operations.

2.10 Nevertheless, it is paramount the sharing of data and information obtained during the development and certification, including operation experiences, incidents and accidents details, thus providing such valuable information to other States of Design and future States of the Operator.

### 3. CONCLUSION

3.1 To effectively address the short-term challenges related to eVTOL certification and to support the safe introduction of new aircraft technologies, the Conference is invited to agree on the following:

**Recommendation 2.2/x — Air Navigation priorities for strategies to evolve existing frameworks to support the safe introduction of new aircraft technologies**

That the Conference:

- a) note the current early stage of development of electric Vertical Take-Off and Landing (eVTOL) aircraft and the challenges presented in this paper;
- b) encourage Member States to exchange information and promote visibility regarding approaches, procedures, and certification frameworks under development for eVTOL aircraft, for the global benefit of the safe introduction of this kind of aircraft;
- c) promote the dissemination of operational aspects by the State of Design, aiming at better preparing States of the Operator for the safe introduction of new eVTOL technologies; and
- d) recommend ICAO to monitor the progress and advancement of national regulations for eVTOL aircraft certification and to prioritize the dissemination of knowledge among all Member States, thus avoiding to define Standards and Recommended Practices (SARPs) or guidelines prematurely.

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