



ASSEMBLY — 42ND SESSION

EXECUTIVE COMMITTEE

Agenda Item 20: Innovation in Aviation

PROMOTING REGULATORY SANDBOXES AS A TOOL FOR EVIDENCE-BASED INNOVATION IN CIVIL AVIATION

(Presented by Brazil and supported by 18 Latin American Civil Aviation Commission (LACAC) Member States¹)

EXECUTIVE SUMMARY

This paper advocates for the adoption of regulatory sandboxes as an effective mechanism to enhance regulatory agility, resilience, and evidence-based decision-making in civil aviation. It highlights the experience of the Brazilian National Civil Aviation Agency (ANAC) in implementing regulatory sandboxes to foster innovation safely, focusing on two pioneering projects: the implementation of photovoltaic-powered runway lighting systems and the development of vertiport infrastructure for eVTOL operations.

Building upon prior discussions in A41-WP/233, HLCC 2021-WP/210, and HLCC 2021-WP/11, the paper proposes the integration of sandbox methodologies into existing ICAO guidance materials and explores the future possibility of dedicated guidance development. Recognizing the diversity of legal frameworks among Member States, the paper also presents foundational principles that enable the safe adoption of regulatory sandboxes regardless of specific legislative structures.

Action: The Assembly is invited to:

- acknowledge the prior discussions held under A41-WP/233, HLCC 2021-WP/210, and HLCC 2021-WP/11 on modernizing regulatory practices and enhancing regulatory capacity;
- recognize the role of regulatory sandboxes as a valuable tool to foster evidence-based regulatory innovation, build resilience, and support agile regulatory responses to emerging technologies in civil aviation;
- request the Council to initiate the integration of regulatory sandbox methodologies into existing ICAO guidance materials related to regulatory capacity-building and innovation, and to consider, subject to further demand, the future development of dedicated guidance material and a compendium of best practices on the design, implementation, and evaluation of regulatory sandboxes;
- encourage Member States to adopt sandbox approaches as part of their regulatory toolkits, in alignment with ICAO's Strategic Objectives and the principles established under Article 44 of the Chicago Convention.

Strategic Goals:

This working paper relates to *Every Flight is Safe and Secure*.

Financial implications:

N/A

¹ Argentina, Belize, Bolivia (Plurinational State of), Chile, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela (Bolivarian Republic of)

<i>References:</i>	Doc 7300, <i>Convention on International Civil Aviation</i> A41-WP/233, <i>Promoting modern regulatory principles in the development of SARPs</i> HLCC 2021-WP/11, <i>Strengthening regulatory capacity</i> HLCC 2021-WP/210, <i>Illustration of new regulatory approaches in oversight</i>
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1. INTRODUCTION

1.1 Innovation and technological disruption are increasingly shaping the future of civil aviation. To ensure that regulatory frameworks remain robust yet adaptable, new methodologies are needed to manage risk, promote safe adoption of innovation, and maintain alignment with ICAO's Strategic Objectives and the principles of the *Convention on International Civil Aviation* (Doc 7300, Chicago Convention).

1.2 Regulatory sandboxes, offering controlled environments for experimentation, have emerged globally as valuable tools for enabling innovation without compromising safety or operational integrity. This paper presents the National Civil Aviation Agency's (ANAC) practical experience with regulatory sandboxes and proposes steps for ICAO to encourage their broader use.

1.3 Moreover, experimentation has historically been at the core of aviation development. Aircraft, technologies, and operational concepts have always relied on structured experimental frameworks to drive technological advancement and certification standards. The concept of "experimental" aircraft and prototypes, widely accepted and internationally recognized, illustrates the essential role that controlled experimentation plays in safely fostering innovation.

1.4 However, while experimentation is well established in areas such as product development and aircraft certification, it remains relatively incipient in the regulatory domain. Regulatory sandboxes represent a natural extension of this proven approach, offering a structured and supervised environment for the safe experimentation of regulatory frameworks, ensuring that innovation continues to advance aviation safety, efficiency, and resilience.

2. BACKGROUND

2.1 Recent working papers presented to ICAO - notably A41-WP/233 (Brazil and LACAC States), HLCC 2021-WP/210 (United Kingdom), and HLCC 2021-WP/11 (Secretariat) - have emphasized the need for modernizing regulatory approaches to better accommodate innovation and emerging technologies. The concept of regulatory sandboxes aligns directly with these discussions, offering a structured method to:

- a) test novel technologies and regulatory frameworks in a controlled, evidence-generating environment;
- b) foster stakeholder collaboration;
- c) mitigate risks associated with the premature or unvalidated adoption of new practices.

2.2 The Brazilian experience, as detailed below, demonstrates how regulatory sandboxes can be practically applied to achieve these goals.

3. ANAC'S EXPERIENCE WITH REGULATORY SANDBOXES

3.1 Photovoltaic-powered runway lighting systems

3.1.1 In April 2023, ANAC initiated a regulatory sandbox to evaluate the use of photovoltaic-powered individual runway and taxiway lighting systems at airports in Tabatinga (SBTT) and Tefé (SBTF), Brazil. The innovative system utilizes LED lighting with solar-powered batteries, managed via a Wi-Fi mesh network.

3.1.2 Given that this system did not fully meet existing regulatory requirements for backup power under RBAC No. 154, its implementation was authorized experimentally within a controlled monitoring framework. The sandbox enables ANAC to assess system reliability, battery autonomy, light intensity, operational availability, and safety impacts, thus informing future regulatory adjustments.

3.2 Vertiport infrastructure for eVTOL operations

3.2.1 In June 2024, ANAC launched a regulatory sandbox focused on the development of vertiport infrastructure to accommodate eVTOL (electric vertical take-off and landing) aircraft operations. Following a public call for proposals, two projects were selected to develop operational and infrastructure models for vertiports in Brazil.

3.2.2 This sandbox, structured in two phases (virtual simulations and subsequent live testing), aims to generate critical data on layout standards, firefighting requirements, access control, operational safety, and noise and airflow impacts. Results from this initiative will directly inform the development of dedicated regulations for vertiport operations.

4. ANALYSIS

4.1 The ANAC initiatives illustrate the potential of regulatory sandboxes to:

- a) reduce uncertainty in regulatory decision-making by generating real-world evidence;
- b) enhance collaboration between regulators, industry stakeholders, and innovators;
- c) safeguard operational safety and security while enabling technological advancement;
- d) facilitate the timely updating of Standards and Recommended Practices (SARPs) and national regulations.

4.1.1 Integrating regulatory sandbox methodologies into ICAO's broader frameworks would support the Organization's strategic objectives of building regulatory resilience, fostering innovation, and maintaining the highest levels of aviation safety and efficiency.

4.2 Legal considerations and foundational principles for regulatory sandboxes

4.2.1 While the implementation of regulatory sandboxes in Brazil is supported by a dedicated legal framework (Law No. 182/2021, establishing the Startup Legal Framework), it is recognized that not all States may have specific legislation addressing experimental regulatory environments.

4.2.2 Nevertheless, regulatory sandboxes are compatible with diverse legal systems, provided that certain foundational principles are observed:

- a) *Voluntary participation*: Entities must voluntarily opt to participate, ensuring informed consent regarding the experimental nature of the environment.
- b) *Transparency and accountability*: Clear documentation of objectives, scope, duration, evaluation criteria, and rights and obligations of participants is essential.
- c) *Risk management*: Appropriate safeguards must be established to manage safety, security, and consumer protection risks during experimentation.
- d) *Supervision and oversight*: Regulatory authorities must maintain close oversight throughout the sandbox duration.
- e) *Reversibility*: Mechanisms must exist to promptly revert experimental measures if risks materialize or outcomes deviate from expectations.

4.2.3 These principles can guide States in adopting regulatory sandbox methodologies even in the absence of specific legislative instruments, thereby enabling safe, responsible innovation aligned with ICAO's strategic objectives.

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