



WORKING PAPER

**SEVENTH WORLDWIDE AIR TRANSPORT CONFERENCE
(ATCONF/7)**

Montréal, HQ, 16 to 20 November 2026

- Agenda Item 4: Emerging technologies, new business models and other associated aspects**
4.3 Leveraging air transport data and the digital ecosystem for seamless, secure and resilient operations

**DIGITALIZATION AS AN ENABLER OF GLOBAL AIR TRANSPORT
CONNECTIVITY AND RESILIENCE**

(Presented by Brazil and the Civil Air Navigation Services Organisation
(CANSO), and supported by 20 LACAC Member States¹)

EXECUTIVE SUMMARY

Digitalization is a fundamental enabler of global air transport connectivity, efficiency and resilience. Interoperable information services, data-driven decision-making and emerging technologies can improve coordination, access to information, response to disruptions and sustainable growth. Brazil's experience integrates the digitalization of air navigation services, communications networks, operational applications and information services with interoperability, information security, governance and institutional capacity. Initiatives such as digital aeronautical networks, data-link communications, automation and System-wide Information Management (SWIM)-Brazil (BR) provide practical examples of how coordinated digital capabilities can contribute to a more connected, efficient and resilient aviation ecosystem. However, differences in digital maturity, interoperability, infrastructure and human resources, as well as cybersecurity risks and fragmented approaches, may limit the benefits of digitalization and widen the digital divide. This paper therefore highlights the need for a coordinated and inclusive approach based on interoperability, data governance, cybersecurity, digital trust, resilience and technology neutrality, supported by investment, capacity building and international cooperation. The Conference is invited to recognize digitalization, air transport data and interoperable digital ecosystems as strategic enablers of global air transport connectivity and resilience, and to support coordinated International Civil Aviation Organization (ICAO) policy guidance and implementation mechanisms for secure, trusted, interoperable and inclusive digital transformation.

Action: The Conference is invited to adopt the actions in Section 7.

<i>Strategic Goal:</i>	This working paper relates to Strategic Goals: <i>The Economic Development of Air Transport Assures the Delivery of Economic Prosperity and Societal Well-Being for All and Aviation Delivers Seamless, Accessible, and Reliable Mobility for All</i> .
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¹ Argentina, Belize, Bolivia (Plurinational State of), Chile, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela (Bolivarian Republic of).

<i>Financial implications:</i>	The recommendations may require resources for ICAO coordination, guidance, implementation support and capacity building. State investments should be phased and supported by transparent business cases as appropriate.
<i>References:</i>	ICAO Strategic Plan 2026-2050; Assembly Resolution A41-9 – <i>New Entrants</i> Doc 9750, <i>Global Air Navigation Plan</i> Aeronautics Directive for Brazilian Airspace Control (DCA 351-7, 2025)

1. INTRODUCTION

1.1 Air transport relies on the timely exchange of information among States, civil aviation authorities, air navigation service providers, airport operators, air carriers, meteorological organizations and other stakeholders. Digital platforms, interoperable information services, data analytics, automation and emerging technologies increasingly shape how these actors plan, coordinate and deliver services.

1.2 Digitalization is not merely the replacement of manual processes with electronic tools. It is an institutional transformation involving data, technology, people, processes, governance, cybersecurity and cooperation. When these elements evolve coherently, digitalization can improve situational awareness, predictability, infrastructure utilization and coordinated responses to disruptions. Air transport data are therefore a strategic asset and must be reliable, timely, protected, interoperable and available to authorized stakeholders under clearly established conditions.

2. AIR TRANSPORT DATA AND THE DIGITAL AVIATION ECOSYSTEM

2.1 The digital aviation ecosystem comprises the stakeholders, data, services, infrastructure, platforms, standards, processes and governance mechanisms that enable information to be exchanged and used across air transport. Its purpose is not unrestricted access to data, but the provision of the right information to the authorized stakeholder, at the required time and under agreed conditions.

2.2 Interoperability extends beyond technical connectivity. It requires common understanding of data meaning and structure, agreed levels of quality and currency, clear responsibilities, conditions for access and use, information protection, participant identification and authentication, and expected levels of service availability and continuity. These conditions enable scalable information services that reduce duplication, support collaborative decision-making and allow information to accompany the operational process consistently across organizations and national boundaries.

2.3 Effective use of data can improve the utilization of existing infrastructure, increase predictability, support performance-based management and guide investment decisions. During severe weather, infrastructure failures, public health emergencies, supply-chain disruptions or cyber incidents, timely and trusted information also improves the ability to anticipate, absorb, respond to and recover from disruption.

2.4 A mature digital ecosystem enables information to be used consistently throughout the phases of flight. Flight-and-flow, aeronautical, meteorological, airport and airspace information can support planning, pre-departure coordination, tactical operations and post-operational performance analysis, providing a basis for trajectory-based operations, collaborative decision-making and the integration of new airspace users.

3. KEY CHALLENGES

3.1 States have different levels of digital maturity. Some operate integrated environments and advanced information services, while others depend on legacy systems, manual processes, limited infrastructure and scarce specialized personnel. Without appropriate implementation support, this disparity may widen the digital divide and restrict participation in the global ecosystem.

3.2 Fragmentation remains a major obstacle. Independently developed systems may use different data models, interfaces, authentication methods, security requirements and governance arrangements, limiting effective information exchange across domains and national boundaries. Data governance must therefore establish responsibilities for data production, quality, updating, classification, protection, provision, retention and use.

3.3 Cybersecurity and digital trust are equally essential. Participants must be able to verify identities and authorizations and rely on the authenticity, integrity, availability and origin of the data received. As greater interconnection may propagate failures and cyber threats, resilience, redundancy, continuity and recovery should be incorporated by design.

3.4 Digital transformation also depends on institutional and human capacity. Clear decision rights, coordination among operational, regulatory and technical authorities, sustainable service-management processes and qualified personnel are essential. Financing must likewise consider the total cost of ownership, interoperability, lifecycle renewal and risks associated with concentration in common technologies and supply chains. Technology-neutral, standards-based approaches can limit unnecessary dependence on particular suppliers or proprietary solutions.

4. BRAZILIAN EXPERIENCE

4.1 Brazil has a continental territory and an integrated civil-military airspace environment in which aviation is essential for national and regional integration. Against this background, the *Departamento de Controle do Espaço Aéreo*'s (DECEA) 2040 Operational Concept establishes a future Brazilian Airspace Control System (SISCEAB) that is more digital, integrated, resilient and globally interoperable.

4.2 DECEA treats digitalization as a transformation of the complete air navigation service environment, encompassing secure communications, navigation and surveillance infrastructure, Air Traffic Management (ATM), Air Traffic Flow Management (ATFM), aeronautical and meteorological services, civil-military coordination and the integration of Unmanned Aircraft Systems (UAS), Advanced Air Mobility (AAM) and Higher Airspace Operations (HAO) users. Information services provide the common digital thread across these layers.

4.3 The evolution of communications infrastructure includes the Aeronautical Telecommunication Network – Brazil (ATN-Br), data-link communications, digital voice and data services and resilient data centres. Operational digitalization includes real-time flight information, trajectory-based operations, automated and collaborative decision-making, predictive tools, digital surveillance and performance-based navigation, generating and consuming data for safer and more efficient operations.

4.4 This architecture is intended to support the gradual integration of Flight and Flow Information for a Collaborative Environment (FF-ICE), UAS Traffic Management (UTM), AAM, Remotely Piloted Aircraft System (RPAS) and HAO with conventional ATM. Within this transformation, SWIM-BR occupies a central position as the information-management and service-integration layer,

supporting the transition from dedicated point-to-point exchanges to discoverable, reusable and interoperable services.

4.5 SWIM-BR does not replace underlying aeronautical networks, operational systems or domain services; rather, it enables them to exchange information consistently and securely. The use of standardized models, including the Aeronautical Information Exchange Model (AIXM), the International Civil Aviation Organization (ICAO) Meteorological Exchange Model (IWXXM) and the Flight Information Exchange Model (FIXM), supports technical and semantic interoperability, common situational awareness, collaborative decision-making and performance-based management.

4.6 The Brazilian experience therefore treats SWIM not merely as a platform, but as an institutional capability requiring governance, defined responsibilities, service lifecycle management, quality assurance, common standards, cybersecurity, digital trust and qualified personnel. Its phased implementation allows new service-oriented capabilities to evolve while legacy environments remain in operation.

4.7 DECEA's digital architecture is also linked to operational resilience through secure networks, alternative communication paths, distributed backups, redundant surveillance and navigation capabilities, minimum operational services and evolving cyber defences. These capabilities are intended to preserve critical operations during technical failures, natural disasters, electromagnetic interference or cyberattacks.

4.8 This coordinated digitalization is associated with measurable outcomes, including improved air navigation service productivity, more efficient use of SISCEAB infrastructure, better airport performance, more predictable flight trajectories, reduced environmental impacts, stronger regional connectivity and improved safety and security. Capacity-building and hybrid professional profiles complement these technological and organizational measures.

5. NEED FOR A COORDINATED GLOBAL APPROACH

5.1 Brazil's experience confirms that national initiatives alone cannot deliver global interoperability. States need common references that preserve national responsibilities while ensuring that investments, governance arrangements and information services can interact with the wider digital aviation ecosystem.

5.2 A coordinated approach should promote internationally recognized standards; effective data governance; cybersecurity, digital trust, continuity and resilience by design; technology neutrality; responsible use of emerging technologies; scalable implementation; institutional and human capacity development; and sustainable investment and cooperation.

5.3 ICAO is well positioned to maintain coherence among economic policy, air navigation, facilitation, security, cybersecurity, legal and capacity-development activities. Existing policies, standards and technical initiatives should be connected within an implementation perspective that avoids duplication and supports seamless, secure, resilient and inclusive operations.

5.4 Particular attention should be given to States with limited digital maturity. Capacity-building, training, technical cooperation, knowledge transfer and access to financing should accompany international expectations. Public-private partnerships can mobilize expertise and resources, provided that they preserve State oversight, sustainability, transparency and freedom from disproportionate long-term dependency.

5.5 Coordination should also address relationships between data providers, service providers and consumers across institutional and national boundaries. Common principles for authoritative sources, service descriptions, quality commitments, access conditions, incident notification and continuity arrangements can improve confidence without requiring every State to adopt the same architecture, product or implementation timetable.

5.6 Implementation should be evolutionary and measurable. States should establish priorities according to operational needs and maturity, while using common indicators to assess progress in interoperability, service availability, data quality, cybersecurity, workforce capability and contribution to connectivity and resilience. Digital transformation should also be incorporated into national aviation and infrastructure plans rather than treated as an isolated information-technology programme.

6. CONCLUSION

6.1 Air transport data and interoperable digital ecosystems can strengthen global connectivity, improve infrastructure utilization and increase the aviation system's ability to respond to disruption. The DECEA 2040 Operational Concept and SWIM-BR illustrate an integrated and phased approach in which standardized information services, data quality, semantic interoperability, trusted exchange, cyber resilience and qualified personnel evolve together. Digitalization should therefore be pursued as a means to achieve better air transport outcomes, with success measured by its contribution to seamless information flows, trusted collaboration, continuity of critical services, efficient use of resources and wider access to the social and economic benefits of global air connectivity.

7. ACTION BY THE CONFERENCE

7.1 The Conference is invited to:

- a) recognize digitalization as a strategic enabler of global air transport connectivity and resilience, and endorse an inclusive approach based on interoperability, data governance, cybersecurity, digital trust, technology neutrality and responsible use of emerging technologies;
- b) encourage States, international organizations and industry stakeholders to incorporate digital transformation into aviation policies and development plans; promote interoperable and trusted digital ecosystems; and strengthen investment, institutional capacity, qualified personnel and international cooperation, taking into account differing levels of digital maturity; and
- c) request ICAO to take into consideration the principles set out in Section 5 of this paper in developing coordinated policy guidance and implementation mechanisms for digital transformation in air transport.

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