



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

FACILITATING NEW AND EVOLVING AVIATION TECHNOLOGIES AND CONCEPTS

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This paper recognizes the impact of new and evolving aviation technologies and concepts on the aviation system. Evolving concepts include using existing aviation technologies in new ways, such as passenger and cargo commercial air transport airships, while new technology such as electric propulsion continues to develop to the point where it will become commonplace in commercial aviation. At the same time, the application of safety risk management methodologies based on systems thinking would need to be considered to support evolving aviation technologies and concepts.

ICAO, States and regional safety oversight organizations (RSOOs) need to coordinate and collaborate with industry and other Stakeholders to promote a safe, consistent, globally harmonized introduction and integration of the new and evolving aviation technologies and concepts. Standards and Recommended Practices should only be changed to accommodate those aviation technologies that are sufficiently mature and have a global interest, while facilitating the introduction of innovative ideas and concepts.

Action: The Conference is invited to agree to Recommendation 2.2/x — Addressing safety risks related to evolving aviation technologies in paragraph 4.1.

<i>Strategic Objectives:</i>	This working paper relates to the Safety, Air Navigation Capacity and Efficiency and Environmental Protection Strategic Objectives.
<i>Financial implications:</i>	<i>Impact for the aviation community:</i> A global approach, which incorporates the experiences of all stakeholders will allow for a smooth transition to international operations for new technology, and a greater harmonization of safety risk assessments based on systems thinking. This will result in reduced costs for stakeholders in the certification process. <i>Impact for ICAO (relative to the current Regular Programme Budget resource levels):</i> The integration of new aviation technologies and concepts into existing ICAO SARPs as far as possible, would serve to reduce the workload of the Secretariat and the need for additional resources to cover current and future unfunded work. However, additional work would be needed at the evaluation stage to determine the extent of required changes.
<i>References:</i>	AN Min. 219-1 C-DEC 229/5 Annex 19 — <i>Safety Management</i> Doc 9750, <i>Global Air Navigation Plan</i> Doc 9859, <i>Safety Management Manual</i>

	Doc 10004, <i>Global Aviation Safety Plan</i> Doc 10115, <i>Thirteenth Air Navigation Conference. Montréal, 9 – 19 October 2018. Report</i> Doc 10136, <i>Assembly 40th Session. Montréal, 24 September – 4 October 2019. Executive Committee. Reports and Minutes</i> Doc 10183, <i>Assembly 41st Session. Montréal, 27 September - 7 October 2022. Executive Committee. Report</i> Doc 10184, <i>Assembly Resolutions in Force (as of 7 October 2022)</i>
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1. INTRODUCTION

1.1 With aviation technology and concepts evolving rapidly, the Standardization framework also needs to evolve so as to facilitate the safe and orderly introduction and integration of innovations that offer significant potential to improve aviation safety, capacity and efficiency globally. To encourage innovation within the aviation sector, the 40th Session of the ICAO Assembly adopted Assembly Resolution A40-27: *Innovation in Aviation* to lay out a pathway for ICAO and its Member States to address new aviation technologies and concepts. The resolution recognizes that innovations have significant potential to improve aviation safety, capacity and efficiency globally.

1.2 Discussions at the 13th Air Navigation Conference (AN-Conf/13) recognized that many of the new aviation technologies and concepts challenged today’s methods for identifying and managing risk, leading to Recommendation 6.2/1, which directed ICAO to “in collaboration with States, RSOOs and industry explore more powerful methods of identifying hazards and managing risk, suitable for complex socio-technical systems such as aviation and adaptable, regardless of the type of risk”. Since then, ICAO has been working on guidance¹ which summarizes various safety risk management methodologies and tools.

1.3 The Air Navigation (AN) World 2023 symposium, held in Montréal from 28 to 31 August 2023, further highlighted that safety risk management approaches based on systems thinking may present opportunities for the aviation community to better address the new challenges in managing aviation safety brought by the evolving complexity of the aviation system as these new concepts mature and gain global interest.

2. DISCUSSION

2.1 Aviation is a sector driven by innovation and will continue to evolve based on changing global needs. Recently many new developments have been proposed from innovators outside of the traditional aviation sectors. As States continue to work with these innovators, valuable lessons are learned relating to many areas, including airworthiness, certification and licensing with both the new entrants and the regulators gaining significant experience through this process.

2.2 ICAO is committed to supporting the implementation of new and evolving technologies and concepts. The Organization provides a unique forum for States and industry to come together and share this experience. This helps to ensure that solutions to challenges, which have already been addressed in one State can be shared to support implementation globally.

2.3 States should exploit the opportunities provided by the relevant expert groups of ICAO, to ensure that their experiences and information related to the introduction of new and evolving aviation

¹ [Safety Management Implementation Website \(www.icao.int/SMI\)](http://www.icao.int/SMI) Chapter 2: Safety Management Fundamentals

technologies and concepts are shared fully. This will enable a full picture of the emerging concepts to be developed and lead to a more harmonized approach to individual State activities.

2.4 The need to accommodate new and evolving aviation technologies and concepts is clear, however there is a need to ensure any changes to the Standards and Recommended Practices (SARPs) represent mature concepts that have gained sufficient global interest. Further, there should be a starting assumption that, as far as practicable, existing SARPs should be considered to apply to new aviation technologies and concepts thereby ensuring a seamless safe integration with existing operations. Once a topic has matured, areas will be identified where additional requirements are needed – such as airworthiness and operational requirements for electric propulsion. These additions should be the minimum required to adapt the SARPs.

2.5 To support this work, additional input will be required from experts in the fields of these new concepts. Recognizing that some States are already facing difficulties with managing the pace of change, opportunities to leverage contacts with industry to help support this work should be considered. States should consider how their national industries can be used to provide this essential knowledge, and look for ways to support the work of ICAO and other standards-making bodies in developing necessary requirements for global harmonization.

2.6 New aviation technologies and concepts may require the application of different approaches to assess and manage risks. It is important to manage the safety risks related to new and evolving aviation technologies and concepts through the collection of relevant data to identify hazards and assess the associated risks. As noted in the 2023-2025 edition of the *Global Aviation Safety Plan* (GASP, Doc 10004), the management of risks related to emerging issues can also provide opportunities to foster innovations and encourage the development of new aviation technologies and concepts, including any associated procedures.

2.7 Annex 19 — *Safety Management* includes provisions related to safety risk management and the associated guidance is provided in the *Safety Management Manual* (Doc 9859). As the aviation system is continuously evolving and becoming more and more complex, it is increasingly challenging to identify and manage safety risks. As data-driven analyses are a challenge due to the limited availability of operational data related to new aviation technologies and concepts, complementing existing techniques with safety risk management methodologies based on systems thinking could be valuable.

2.8 Expanding the scope of data collection and analysis to include learning from all operations, instead of focusing on failures, would also help address this challenge and validate the effectiveness of risk controls related to new and evolving aviation technologies and concepts. To support harmonization, it would be beneficial for the aviation community to collaborate and explore a broad range of safety risk management methodologies and tools to determine their appropriate applications.

3. ICAO INITIATIVES

3.1 ICAO is committed to supporting innovation and development. A number of existing initiatives may also help address some of the challenges identified above. Such support includes enhancing the competencies of aviation personnel through workshops and training, the hosting of various symposia and conferences such as AN World (Montréal and Singapore, 2023) and the Advanced Air Mobility (AAM) Symposium (Montréal 2024), and collaborating closely with other industry standards-making bodies. Specific initiatives are also underway, which may be of use in the integration of new and evolving aviation technologies and concepts.

3.2 *Dedicated Expert Groups*

3.2.1 Through the establishment of specific expert groups of ICAO (such as the newly formed AAM Study Group) closer collaboration with industry is made possible. This ensures that new and evolving aviation technologies and concepts are closely reviewed in order to determine when it may be necessary to develop new SARPs. State support of such expert groups is vital to ensuring they have sufficient resource to conduct this work.

3.3 *Standardization roadmap*

3.3.1 Following Resolution A40-27 arising from the 40th Session of the Assembly, the Council invited the Air Navigation Commission to formalize a proposal for the conceptualization and deployment of a standardization roadmap to provide greater certainty and predictability to the industry regarding the timely development of SARPs, consistent with existing work concerning innovations.

3.3.2 The first iteration of the Standardization Roadmap was agreed to be dedicated to, *inter alia*, the aircraft and engine technologies identified in work associated with the long-term aspirational goal (LTAG). The methodology developed would then be applied to other ICAO Strategic Objectives.

3.4 *Direct Submissions*

3.4.1 In addition to the regular process to develop new SARPs, ICAO has developed the direct submission process to capitalize on existing material and experience from States and international organizations. This process can be used to leverage the knowledge of innovators where their solutions have been implemented, to develop SARPs specific to the new and evolving aviation technologies and concepts.

3.4.2 This will allow greater opportunity to utilize the expertise of those directly involved in the innovation, including non-traditional stakeholders, to support the development of the SARPs.

4. **CONCLUSION**

4.1 In light of the above, the Conference is invited to agree to the following recommendation:

Recommendation 2.2/x — Addressing safety risks related to new and evolving aviation technologies and concepts

That States:

- a) enhance the sharing and exchange of information in relevant ICAO expert groups, symposia and conferences regarding the safe introduction of new and evolving aviation technologies and concepts; and
- b) industry, recognizing the need to comply with the existing provisions to ensure the safety of international air navigation, identify and implement measures necessary to facilitate the safe and timely integration of new and evolving aviation technologies and concepts;

that ICAO:

- c) along with States and industry identify how to better engage with aviation innovators in order to benefit from a wider range of experience and expertise in addressing the safe introduction of new and evolving aviation technologies and concepts;
- d) support the safe integration of mature technologies and concepts with global interest by developing SARPs when necessary and with minimal required changes to the existing provisions to facilitate global integration; and
- e) consider how hazard identification and risk assessment methodologies and tools based on systems thinking may be used to further support safety risk management.

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