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International Civil Aviation Organization

**WORKING PAPER**

# ASSEMBLY — 41ST SESSION

## TECHNICAL COMMISSION

**Agenda Item 30: Aviation Safety and Air Navigation Policy**
**30.3 Relevant Outcomes of the High-level Conference on COVID-19, Safety Stream (HLCC 2021)**

## SAFETY ASSURANCE FRAMEWORK FOR FUTURE AVIATION SYSTEMS

(Presented by Canada and Japan)

**EXECUTIVE SUMMARY**

The emergence of new aviation technologies and use cases (e.g., RPAS*) is fundamentally changing the composition of the aviation transportation sector and is introducing new challenges, risks and opportunities in the process. One of the challenges of the rapid emergence of these use cases and technologies (e.g., Advanced Air Mobility) is the introduction of non-traditional technology into a highly regulated airspace. Establishing new approaches to traffic management provides an opportunity to preserve the efficiency of the existing aviation system, supports economic development, and ensures the safety of the public is maintained. This paper proposes a risk-based approach to the definition of Communication, Navigation, and Surveillance (CNS) technology deployment/approval that considers the level of risk associated with the specific operation. This approach would help realize these opportunities while aligning with ICAO safety management principles.

*Please note that in Canada, we use the gender-neutral terminology of RPAS to refer to drones at large and in place of Unmanned Aircraft Systems (UAS) or Unmanned Aerial Vehicles (UAV).

**Action:** The Assembly is invited to:

a) request that ICAO consider a risk-based approach to aid in the definition of future traffic management practices;
b) request that ICAO consider the application of appropriately scaled safety assurance processes for future CNS equipment; and
c) request that ICAO consider providing guidance on how to align safety assurance processes with a State’s risk evaluation for future CNS equipment requirements.

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| *Strategic Objectives:* | This working paper relates to Strategic Objectives of Safety and the Economic development of air transport. |
| *Financial implications:* | No financial implications. |
| *References:* | *Convention on International Civil Aviation (1944)*<br>Annex 19 – *Safety Management*<br>JARUS Doc 09 – *UAS Operational Categorization* |

## 1. INTRODUCTION

1.1 Recent advancements and innovations in technology have created an opportunity to expand the envelope of existing aviation operations and created new use cases for operations in the airspace. These opportunities (e.g., artificial intelligence, remotely piloted aircraft systems, near real-time satellite-based communications) have also created challenges in understanding how to effectively integrate these new technologies into the airspace while retaining the level of safety that the public has come to expect of aviation. Of particular note, is the stress these types of operations will put on the air traffic management systems, which have been deployed and maintained over the decades in order to provide services to traditional aviation operations. These new types of operations (e.g., high-altitude operations above FL600, urban air mobility, very-low-level operations below 400 ft.) have already shown the limitations of the traditional approach to delivering services.

1.2 In Canada, the Remotely Piloted Aircraft Systems (RPAS) industry has experienced rapid and unprecedented growth and since the implementation of required RPAS registration in Canada there have been 69,000 drones registered versus 37,000 traditional aircraft registered in Canada. To accommodate these numbers Canada had to adopt a digital drone registration portal, and work with NAV CANADA (Canada's Air Navigation Services Provider (ANSP)) to provide a mechanism for digital access to controlled airspace (NAVDrone).

1.3 These challenges are not unique to Canada. The United States is exploring new traffic management concepts such as 'Extensible Traffic Management[1]', which is based on cooperative operating practices amongst the operators rather than delivering, services via a traditional Air Traffic Service Unit. In Europe, expanding operating capacity at non-towered aerodromes resulted in a decision to support the development and deployment of 'remote towers[2]'.

1.4 While many States are developing innovative solutions to enable operations within their borders a common approach to describing operations, developing airspace management system requirements, and delivering information-centric air traffic services will enable equipment designers, aircraft operators, and ANSPs to scale their systems in a common global environment. The concept of "Safety Assurance" is introduced in this paper to support the planned and systematic actions necessary to provide adequate confidence and evidence that a product or process satisfies stated safety objectives and requirements. The application of the appropriate level of safety assurance for air traffic management systems is proposed as part of the solution to establishing an internationally harmonized approach to the development and deployment of technologies supporting airspace integration.

## 2. DISCUSSION

2.1 Existing Aircraft Traffic Management (ATM) systems deployed to support traditional aviation activities have been designed, tested, installed, and operated following processes analogous to aircraft certification processes (e.g., Annex 8). These processes are not scaled to support the broad range of new and emerging aviation operations in a manner suitable to the risk posed by the operation. Addressing the entirety of emerging operations across all classes of airspace requires the concepts related to the approval of traffic management infrastructure equipment be expanded to assure the safety of aircraft and people in the sky as well as on the ground.

[1] Extensible Traffic Management: https://www.faa.gov/sites/faa.gov/files/2022-03/508.05Spring2022REDACNASOps_XTM.pdf
[2] Explanatory Note to Decision 2019/004/R: https://www.easa.europa.eu/downloads/71514/en

2.2 Risk-based approaches to managing safety are core to the ICAO framework for managing safety in an increasingly complex airspace. Annex 19 – *Safety Management*, Section 3.1 recognizes that the "State Safety Programme (SSP) must be commensurate with the size and complexity of the State's civil aviation system" and incorporation of emerging operations into an SSP requires a careful understanding and balancing of States limited resources in understanding aviation hazards, and successfully mitigating risks to meet target levels of safety. Annex 19 Section 3.4 identifies the goals of State Safety Assurance as it relates to an SSP, namely the establishment of the acceptable level of safety achieved and the surveillance obligations by States to monitor the safety performance of equipment developers, operators, and service providers.

2.3 While the concept of safety assurance in Annex 19 implies the need for states to holistically evaluate the risks to safety in their aviation systems, a common approach on assessing and classifying the risk regimes would help in a harmonized approach to the development and implementation of SSPs. For example, in RPAS operations the application of a risk-based approval mechanism has been internationally recognized by many individual states, civil aviation authorities and expert groups. The risk-based approach has three broad categories of operational risk identified[3]: Category A (lower risk), Category B (medium risk), and Category C (higher risk). This classification identifies traditional aviation primarily as Category C. The expectation is that the lower risk categories must still maintain aviation safety but would have less rigour associated with their approval and oversight.

2.4 Meeting the challenge of managing air traffic in these new operational environments means developing and deploying new communication, navigation, and surveillance (CNS) equipment solutions outside of traditional airspaces. Developing this kind of infrastructure is a long and arduous process with many examples of the challenges in recent infrastructure deployments to draw from. While these processes are well suited to the highest risk operations, they lack the flexibility required to support the large numbers of aircraft, which will be operating in lower risk environments. At the aircraft approval level, different processes have been introduced by States to support the development of equipment appropriate to the risk posed by the equipment itself (e.g., Technical Standard Order declaration processes for aircraft equipment, light-sport and ultra-light aircraft self-declaration systems). While these systems have their challenges, they have shown the potential for how a different approach to safety assurance methodologies can support the proliferation of equipment and the expansion of operations.

2.5 The general processes that have been utilized by States to manage the safety assurance of equipment can be broadly described as: self-declaration for lower risk, third party review of designs or organizations for medium risk, and design certification for higher risk. The declaration process identifies the expected level of safety and requirements the particular equipment or service must comply with in order to be considered safe for low-risk operations and requires only a declaration from the equipment provider that the equipment meets the requirements. The third party review process combines both declaration processes (for individual equipment and services) as well as a review by an independent qualified team to evaluate the design/manufacturing/operational organization itself. Finally, the design certification process follows the existing traditional certification processes codified by States for traditional aviation.

[3] JARUS Doc 09: http://jarus-rpas.org/sites/jarus-rpas.org/files/jar_doc_09_uas_operational_categorization.pdf

## 3. CONCLUSION

3.1 The recognition of the need for more flexibility in the processes used to develop and deliver future ATM systems and services will assist States in understanding how to develop regulatory frameworks, which make the best use of emerging technologies while providing for a harmonized approval environment to support international operations.

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