



ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

**UPDATE ON THE WORK OF THE ASIA-PACIFIC (APAC) UNMANNED AIRCRAFT
CERTIFICATION WORKING GROUP (UCWG)**

(Presented by the United States and Singapore, APAC UCWG Co-Chairs,
with support from UCWG Member States¹)

EXECUTIVE SUMMARY

This paper provides an update of the work done by the APAC UCWG to examine a risk-based approach to unmanned aircraft systems (UAS) design and airworthiness certification. Interested States are invited to engage with the UCWG to incorporate a risk-based safety continuum into their UAS design and airworthiness certification processes.

<i>Strategic Objectives:</i>	This information paper relates to the Safety Strategic Objective.
<i>Financial implications:</i>	This information paper has no significant financial implications.
<i>References:</i>	<ul style="list-style-type: none">• A39-WP/202 presented by the United States• Joint Authorities for Rulemaking on Unmanned Systems – Specific Operations Risk Assessment

1. INTRODUCTION

1.1 In recent years, technological advances and significant investments made in the unmanned aircraft systems (UAS) sector have resulted in innovative uses of new unmanned technologies and capabilities across many industries. As a result of industry investments, a growing customer base, and, in some cases, less familiarity among new entrants regarding existing aviation safety processes applied to manned aviation, State regulators have been challenged to find appropriate ways to approve UAS design, airworthiness, and operations. In some cases, regulators may have developed unique, non-traditional methods to approve domestic operations that would not necessarily be appropriate for international operations.

¹ Australia, China, India, Indonesia, Japan, New Zealand and the Republic of Korea.

1.2 The mission of UCWG is to promote a common understanding of risk-based principles for UAS design and airworthiness certification, harmonizing certification approaches across civil aviation authorities (CAAs), and ensuring a seamless exchange and integration of UAS design and airworthiness concepts similar to manned aviation. To achieve this, the UCWG will identify design and production requirements, develop airworthiness certification processes, identify operational integration challenges, and study other aspects of UAS certification. The UCWG is not addressing specific operational approvals nor operational integration into the air traffic management system(s), since these vary greatly among individual States.

2. DISCUSSION

2.1 Taking from past work done to promote risk-based certification of manned aircraft ([A39-WP/202](#) refers), and the work done by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) Work Group 6 to identify and mitigate design and operational risk for UAS, the UCWG identified a broad risk-based framework relating aircraft size, weight, performance, proposed mission, and area of operation (concept of operations) to the level of rigor required by the responsible authority for design and airworthiness certification. This framework recognizes that it is impractical to apply a single set of requirements, certification processes, and safety expectations for all UAS.

2.2 The UCWG framework considers two main risk components for UAS: (1) the UAS kinetic energy (KE) derived from size and performance instead of take-off weight of the aircraft, to determine certification classes; and (2) operational risk to the airspace posed by the UAS. These components are combined to determine the overall level of risk and the corresponding certification rigor necessary for design and airworthiness approval, and to facilitate safe integration.

2.3 Figure 1 shows the current UCWG risk framework, applying the safety continuum principles from manned aviation, and with the intent to move towards performance-based design and airworthiness requirements for UAS. KE, which is performance based, is shown on the left vertical axis, with increasing airspace risk on the top horizontal axis. KE is calculated using $\frac{1}{2} * \text{mass} * \text{cruise velocity}^2$. Airspace risk is based on the four Airspace Encounter Category risk levels in the JARUS Specific Operations Risk Assessment.²

2.4 The framework in Figure 1 creates a two dimensional space with varying zones of low (Zone A), medium (Zone B), and high risk (Zone C). The hashed portions of Zone C indicate areas where participating CAAs had differing opinions regarding the level of rigor (medium or high) needed for certification. The framework does not specifically address operational integration, nor quantify the risk of a particular operation, but simply acknowledges that the rigor of design and airworthiness certification must account for the aircraft and the airspace in which it operates.

² The JARUS Specific Operations Risk Assessment work can be found here: <http://jarus-rpas.org/content/jar-doc-06-sora-package>

Figure 1 – Rigor of Certification Oversight Against Associated Risk

Air Risk Risk Class – KE	No Air Risk	Low Air Risk	Med Air Risk	High Air Risk
≥ 50,000,000 ft lb and above				
≥ 6,000,000 to ≤ 49,999,999 ft lb			Zone C	
≥ 800,000 to ≤ 5,999,999 ft lb				
≥ 25,000 to ≤ 799,999 ft lb		Zone B		
≥ 530 to ≤ 24,999 ft lb	Zone A			
51 to ≤ 529 ft lb				

- Note: 1) Unmanned aerial taxi for passenger carrying purposes will be managed under Zone C.
 2) Classification of Air Risk is determined by individual State.
 3) The placement of Zones A, B, C are notional for the purpose of this paper.

2.5 The UCWG developed this risk-based framework to support efficient transfer of UAS between States, with consideration for design and airworthiness certification expectations, oversight of the certification and production organization(s), expectations for providing continued airworthiness and maintenance, and applicable pilot licensing requirements. The UCWG framework encourages States to consider applying a risk-based continuum to the certification of small and medium UAS.

2.6 Going forward, the UCWG intends to use the framework to help identify suitable design and airworthiness requirements for Zones A and B. This will include leveraging industry standards and industry-based compliance processes as much as practicable for medium risk UAS use cases (Zone B). The UCWG acknowledges significant challenges exist for UAS in Zone B because of the current diversity among States to define operational requirements, provide airworthiness approval, and address risk to the public. Zone A will rely primarily on the operational mitigations.

3. CONCLUSION

3.1 The UCWG seeks to initiate discussions with interested States and other international working groups regarding design and airworthiness certification of low and medium risk UAS. The intent is to start this discussion within the existing risk-based framework for manned aircraft, and show how it relates to the development of the UCWG approach for UAS.

3.2 The goals of these discussions are to:

- a) recognize that a single set of requirements cannot effectively accommodate design and airworthiness for the entire spectrum of UAS, in the same way that a single set of design and airworthiness requirements does not work for manned aviation;
- b) apply a risk-based continuum to UAS design and airworthiness certification, taking into account the impact operational integration may have on the rigor of these design and airworthiness processes; and
- c) encourage States and industry to consider using the risk-based framework in Figure 1 as a basis for developing harmonized UAS design and airworthiness certification requirements and processes.

3.3 The Assembly is invited to note the work done by the Asia-Pacific Unmanned Aircraft Certification Working Group, and encourage States to engage with the UCWG about the risk-based safety continuum as applied to UAS design and airworthiness certification processes and consider using the UCWG framework.

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