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STRENGTHENING CLIMATE CHANGE ADAPTATION IN GLOBAL AVIATION: BUILDING RESILIENCE TO THE RISKS THROUGH UNIFIED GUIDANCE, INTEGRATED IMPLEMENTATION APPROACHES AND EMBEDDED PROVISIONS IN EXISTING ICAO ANNEXES AND SARPS

(Presented by Saudi Arabia)

EXECUTIVE SUMMARY

This working paper presents Saudi Arabia's views on the urgent need to strengthen climate change adaptation in international aviation. It underscores the importance of the International Civil Aviation Organization (ICAO) guidance for risk assessments, adaptation planning, and identifying key vulnerabilities, as rising temperatures, changing precipitation, and more frequent severe storms are already disrupting operations and creating significant safety and financial risks. The working paper highlights challenges in ensuring consistent implementation and calls for expanding ICAO guidance and embedding adaptation provisions within existing Annexes and Standards and Recommended Practices (SARPs) to enable a unified, integrated approach without requiring separate frameworks.

Action: The Assembly is invited to:

- recognize the need for strengthening integrated climate change adaptation measures in aviation;
- request the Council with the technical contribution from the ANC and CAEP to assess the appropriateness and potential impact of embedding adaptation guidance provisions within existing ICAO Annexes and SARPs, and to reflect the outcomes accordingly; and
- encourage Member States to incorporate climate resilience into national regulatory frameworks and operations.

<i>Strategic Goals:</i>	This working paper relates to the Strategic Goal – <i>Aviation is Environmentally Sustainable</i>
<i>Financial implications:</i>	N/A
<i>References:</i>	ICAO Assembly Resolution A41-21 2018 ICAO Climate Adaptation Synthesis Report Annex 14 – <i>Aerodromes</i> Annex 6 – <i>Operation of Aircraft</i> Annex 19 – <i>Safety Management</i> Annex 9 – <i>Facilitation</i> Doc 9137, Airport Services Manual (Part 7)

1. INTRODUCTION

1.1 Despite significant advancements in science and technology to reduce greenhouse gas emissions, certain impacts of climate change remain unavoidable. Figure 1 illustrates a key finding from an International Civil Aviation Organization (ICAO)¹ survey: 65 out of 88 respondents (74%) reported that they are already experiencing climate related impacts. Figure 2 shows that among nine potential impact categories, most respondents indicated they are currently affected or expect to be affected in the future by higher average and extreme temperatures (91%), changing precipitation patterns (89%), and increased storm intensity (86%).

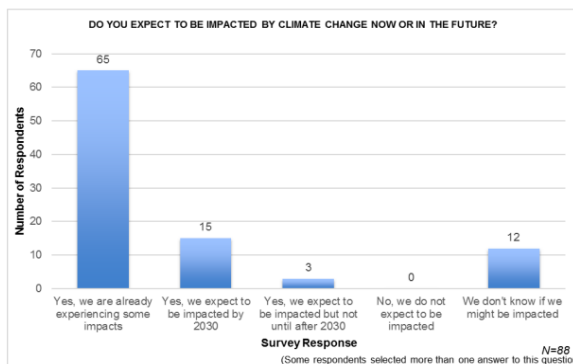


Figure 1: Timescales in which Respondents Expect to be Impacted by Climate Change (Reference: Key Findings of Survey Results¹)

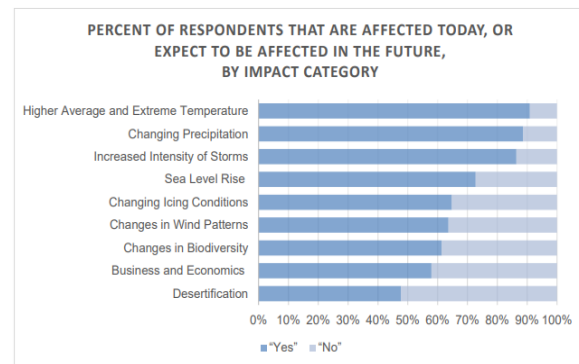


Figure 2: Percent of Respondents that are Affected by Impact Category (Reference: Key Findings of Survey Results¹)

1.2 Since the 41st Session of the ICAO Assembly adopted Resolution A41-21, recent extreme weather events affecting airport operations, particularly in the Middle East Region, demonstrate that the aviation community is not immune to these impacts, as evidenced by scientific assessments.

1.3 Over the past years, the ICAO Committee on Aviation Environmental Protection (CAEP) has worked to address these challenges. During the CAEP/12 (2019-2022) and CAEP/13 (2022-2025) cycles, Working Group (WG) 2 developed guidance materials on climate change risk assessment, vulnerability identification, and adaptation measures. Guidance, first issued in 2022, builds on the 2018 ICAO Climate Adaptation Synthesis¹ and has been updated to reflect the latest scientific information.

1.4 ICAO's guidance documents support Member States in conducting climate change risk assessments, developing and implementing adaptation plans, identifying key vulnerabilities, and selecting appropriate adaptation measures. These resources provide a foundation for integrating climate resilience into aviation strategies and offer a menu of potential adaptation options to reduce associated risks.

1.5 The aviation industry has already experienced significant impacts from extreme weather events, including airport closures, flight cancellations, operational delays, and substantial financial losses. These events highlight the need for consistent, proactive measures within current regulatory ecosystems to ensure the continuity and safety of air transport services.

1.6 Considering the urgency and severity of these risks, it is essential to strengthen ICAO guidance and consider embedding relevant provisions within existing ICAO Annexes and SARPs, subject to further assessment by the Council, with the technical contribution of the ANC and CAEP, to evaluate

¹ <https://www.icao.int/environmental-protection/Climate-Adaptation>

appropriateness and potential impacts. This unified and integrated approach will support Member States in incorporating climate resilience into their regulatory frameworks and operational practices without requiring the development of separate standalone plans.

2. SIGNIFICANCE OF CLIMATE CHANGE ADAPTATION FOR AVIATION AND SAUDI ARABIA EXPERIENCE

2.1 Aviation is essential for the mobility of people and goods. Disruptions caused by climate change create ripple effects across the global economy. Because aviation also plays a critical role in disaster response and recovery, it is imperative that airports and air traffic control operations remain reliable even as extreme weather events become more frequent and severe. Aviation climate resilience refers to the ability of aircraft operations and infrastructure to withstand and recover from climate related disruptions. Implementing adaptation measures tailored specifically to aviation is therefore vital to safeguarding the sector's continuity and safety.

2.2 Saudi Arabia's National Aviation Strategy envisions substantial growth, targeting an increase in annual passenger traffic from 112.3 million in 2023 to 259.5 million by 2030. Air cargo volumes are expected to grow from 0.9 million tonnes in 2023 to 3.3 million tonnes by 2030, with the number of destinations expanding from 183 to 250 over the same period. In line with its aspiration to establish the Kingdom as the leading aviation sector in environmental sustainability in the Middle East and recognizing the significance of climate impacts Saudi Arabia has adopted climate change adaptation measures to build resilience across its domestic and international airports.

2.3 Saudi Arabia has embedded the provisions of Assembly Resolution A41-21 on climate change adaptation into its sectoral strategic objectives through the Civil Aviation Environmental Sustainability Program (CAESP). Under this strategy, climate adaptation is one of seven strategic pillars, with a key performance indicator targeting the development of adaptation plans for all 28 commercial civil airports by 2027.

2.4 To support this ambition, Saudi Arabia has established a regulatory framework, including the CAESP, local regulations (GACAR Part 156), and advisory guidance (AC-156/09 Guidance Material on Climate Change Risk Assessment and Adaptation) aligned with current scope of ICAO guidance. A quarterly regulatory oversight mechanism has been implemented to monitor progress and ensure accountability.

2.5 However, implementation has faced challenges, largely due to the absence of an integrated framework within the current regulatory ecosystem. Recognizing these gaps, Saudi Arabia emphasizes the urgency of strengthening climate change adaptation in global aviation by building resilience through unified guidance, integrated implementation approaches, and embedding relevant provisions within existing ICAO Annexes and SARPs (see in Table 1), which should be further assessed by the Council, with technical contributions from the ANC and CAEP, to determine feasibility and impacts.

Table 1: Provision of Climate Risk Assessment, Adaptation and Resilience within Existing ICAO Annexes and SARPs

#	Existing ICAO Annex	Provision of Climate Risk Assessment, Adaptation and Resilience
1	Annex 14 - Aerodromes	Provisions of <u>Adaptation Options</u> in Volume I i.e. infrastructure design and maintenance resilience, including drainage capacity, pavement strength, and operational robustness in adverse weather conditions. Provision of Climate Risk Assessment, Adaptation and Resilience Planning and urge to adopt with Doc 9137 Airport Services Manual (Part 7) which focuses on Airport Emergency Planning.
2	Annex 6 - Operation of Aircraft	Provisions on flight planning, weather data use, and contingency procedures to ensure resilient operations during extreme weather events.
3	Annex 19 - Safety Management	Provision to conduct risk assessment of climate change.
4	Annex 9 - Facilitation	Provisions to establish and implement a climate change adaptation plan under aerodrome emergency plans (Integration) and maintaining continuity of operations in disruption scenarios, including emergency preparedness and response including provision adaptation potation.

3. SCALING THE ADOPTION OF CLIMATE CHANGE ADAPTATION THROUGH UNIFIED GUIDANCE AND EMBEDDED PROVISIONS

3.1 Saudi Arabia acknowledges the valuable efforts of CAEP Working Group (WG) 2 in developing guidance materials on climate change risk assessment, adaptation planning, and resilience. However, experience has shown that without clear, unified frameworks and integration into existing regulatory structures, the adoption of adaptation measures remains fragmented and inconsistent.

3.2 To support effective and consistent implementation across the global aviation network, ICAO is urged to consolidate, update, and maintain its guidance in line with the latest scientific findings, including updates from forthcoming Intergovernmental Panel on Climate Change (IPCC) Assessment Reports. The 2018 ICAO Climate Adaptation Synthesis remains a key resource to support Member States and aviation organizations in developing and implementing adaptation plans.

3.3 Embedding clear and practical climate adaptation provisions, subject to detailed assessment by the Council with technical input from the ANC and CAEP, directly into existing ICAO Annexes and Standards and Recommended Practices (SARPs) will create a standardized and structured foundation for Member States to systematically incorporate climate resilience into their regulatory systems, operational procedures, and infrastructure planning. This unified and integrated approach will provide the clarity and consistency needed to enable all Member States to develop robust, practical adaptation strategies aligned with their national priorities.

4. KEY REFERENCE RESOURCE

4.1 The 2018 ICAO Climate Adaptation Synthesis remains a key resource to support Member States and aviation organizations in developing and implementing climate change adaptation plans. It is essential to keep this guidance current and aligned with the latest scientific findings, including updates from forthcoming Intergovernmental Panel on Climate Change (IPCC) Assessment Reports.