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CAEP/9 Agreed Certification Requirement for the Aeroplane CO₂ Emissions Standard

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CAEP/9 AGREED CERTIFICATION REQUIREMENT FOR THE AEROPLANE CO₂ EMISSIONS STANDARD

1. INTRODUCTION

1.1 The International Civil Aviation Organization (ICAO) promotes the safe and orderly development of international civil aviation throughout the world. ICAO sets global Standards for aviation safety, security, and environmental protection. The ICAO Council's Committee on Aviation Environmental Protection (CAEP) conducts most of ICAO's environmental technical work and has developed a range of Standards to address aircraft noise and local air quality. The Ninth Meeting of the Committee on Aviation Environmental Protection (CAEP/9) was held at ICAO Headquarters in Montréal from 4 to 15 February 2013. This meeting marked the culmination of three years of intensive activity by CAEP working groups in aircraft noise, operations and emissions, and involved more than 400 experts from different States and organizations around the world.

1.2 The CAEP/9 meeting agreed on a comprehensive set of 18 recommendations that will help ICAO fulfil its mandate on aviation environmental protection. Most of these recommendations consolidate the work undertaken by the technical experts in CAEP over the past three years, including: an agreement on a new aircraft noise Standard; an updated set of technology goals for aircraft noise; a set of aspirational operational goals for fuel-burn reduction; issues regarding progress in the development of a new ICAO non-volatile particulate matter (nvPM) engine Emissions Standard; and issues regarding progress in the development of the new ICAO Aeroplane CO₂ Emissions Standard.

1.3 CAEP is currently focused on developing an Aeroplane CO₂ Emissions Standard, which was a recommendation from the ICAO Programme of Action on International Aviation and Climate Change, as part of a set of measures to reduce greenhouse gas emissions from the air transport system. Subsequently, in October 2010, the 37th Assembly (Resolution A37-19¹) requested the development of an ICAO CO₂ Emissions Standard. The development of the ICAO CO₂ Standard will result in a new Annex 16, Volume III to the Chicago Convention.

1.4 The work on the CO₂ Standard is divided into two phases. At the time of writing this ICAO circular, Phase 1 work was completed and approved at the CAEP/9 meeting in February 2013, and Phase 2 work was just beginning. Phase 1 resulted in the delivery of a CO₂ Metric System and the development of a mature Annex 16, Volume III CO₂ Standard certification requirement which is contained in this circular. The ongoing work of Phase 2 will address the Standard setting process, which consists of developing the regulatory limit and applicability date required to complete the CO₂ Standard.

1.5 Since 2010, the complexity of the CO₂ Standard work has been significant both from a technical and political perspective. The commercial sensitivity associated with this topic, and the technical challenges encountered, resulted in a delay in delivering the CO₂ Standard, originally aimed for 2013. To move forward and to build on the significant progress made, CAEP reviewed a comprehensive CO₂ Standard-setting work plan and agreed on a late-2015 deliverable date, in time for approval by CAEP/10 in early 2016.

1. A37-19: Consolidated statement of continuing ICAO policies and practices related to environmental protection — Climate change: (24e) The Assembly requests the Council to develop a global CO₂ Standard for aircraft, aiming for 2013.

2. PURPOSE OF THIS CIRCULAR

2.1 This circular gives an overview of the CO₂ Standard development up to and including the CAEP/9 meeting, and provides ICAO Member States with the details of the CAEP/9 approved Annex 16, Volume III CO₂ Standard certification requirement. The material contained in this circular allows stakeholders to become familiar with the CAEP/9 agreed certification requirement. This material is published for information purposes only and will remain as an ICAO circular until the internationally agreed ICAO Standards and Recommended Practices (SARPs) for the CO₂ Standard have been fully developed (i.e. as Annex 16, Volume III). **The material is not intended to be used for CO₂ emissions certification purposes prior to Annex 16, Volume III being finalized by CAEP and adopted by the ICAO Council. This Circular does not require States to take any action whatsoever at this time, and States should not base any requirements, reporting or otherwise, on this material, as the material is currently incomplete as per the details in 3.7.**

2.2 The material contained in this circular is based on a document that is a work in progress, and CAEP has identified future CAEP/10 work where further discussions, analyses, and decisions would help reinforce the Annex 16, Volume III CO₂ Standard certification requirement and facilitate its subsequent implementation. As a result, additional amendments are expected over the next three years to the Annex 16, Volume III CO₂ Standard certification requirement text contained within this circular.

2.3 In order to promote the understanding of the future CO₂ Standard, the material contained in this circular has been written in the form of ICAO SARPs as they may appear in the future Annex 16, Volume III. This format does not constitute a rationale for the material's use for anything other than information.

3. DEVELOPING THE ICAO AEROPLANE CO₂ EMISSIONS STANDARD

Applicability of the CO₂ Standard

3.1 One of the first Phase 1 decisions made by CAEP came in November 2010 when it was agreed that the future CO₂ Standard will be applicable to subsonic jets and turboprops with weight threshold of Maximum Take-Off Mass (MTOM) > 5 700 kg (12 566 lb) for subsonic jet aeroplanes and MTOM > 8 618 kg (19 000 lb) for propeller-driven aeroplanes. This represented over 99 per cent global fuel burn, flight distance and operations. Agreements were also reached to include "new" aeroplane types, but not "out of production" within the scope of applicability, and that "in-production"² types should not be ruled out at this time. There is further work to be done on the applicability of the CO₂ Standard during Phase 2, and this work is outlined in 3.9 of this circular.

The CO₂ Metric System

3.2 An important Phase 1 milestone in the development of the CO₂ Standard was reached on 11 July 2012, when the CAEP Steering Group agreed unanimously on a CO₂ metric system to measure the aeroplane fuel burn performance and therefore the CO₂ emissions produced. The intent of this CO₂ metric system is to equitably reward advances in aeroplane technologies (i.e. structural, propulsion and aerodynamic) that contribute to reductions in aeroplane CO₂ emissions, and to differentiate between aeroplanes with different generations of these technologies. As well as accommodating the full range of technologies and designs which manufacturers can employ to reduce CO₂ emissions, the CO₂ metric system has been designed to be common across different aircraft categories, regardless of aircraft purpose or capability.

2. "In-production" aeroplane types are those aeroplane types which have already received a Type Certificate, and for which manufacturers either have existing undelivered sales orders or would be willing and able to accept new sales orders.

3.3 To establish the fuel efficiency of the aeroplane, the CO₂ metric system uses multiple test points to represent the fuel burn performance during cruise. There are three equally weighted points represented by aeroplane weights at high, middle and low percentages of MTOM³, and each of these represents an aeroplane cruise gross weight seen regularly in service. The objective of using three gross weight cruise points is to make the evaluation of fuel burn performance more relevant to day-to-day aeroplane operations. The fuel efficiency performance of an aeroplane is represented by 1/Specific Air Range (SAR), which represents the distance an aeroplane travels in the cruise flight phase per unit of fuel consumed. Further details on 1/SAR can be found in the certification requirement contained in this circular (future Annex 16, Vol. III, Appendix 1).

3.4 In some aeroplane designs, there are instances where changes in aeroplane size may not reflect changes in aeroplane weight such as when an aeroplane is a stretched version of an existing aeroplane design. To better account for such instances, not to mention the wide variety of aeroplane types and the technologies they employ, an adjustment factor was used to represent aeroplane size. This is defined as the Reference Geometric Factor (RGF) which is a measure of aeroplane cabin size based on a two-dimensional projection of the cabin. This improved the performance of the CO₂ metric system, making it fairer and better able to account for different aeroplane designs. The definition of RGF can be found in the certification requirement contained in this circular (future Annex 16, Vol. III, Appendix 2).

3.5 The overall design of the aircraft is represented in the CO₂ metric system by the certified MTOM. This accounts for the majority of aircraft design features which allow an aircraft type to meet market demand.

The Certification Requirement

3.6 Based on the CO₂ metric system, CAEP developed procedures for the certification requirement including, *inter alia*, the flight test and measurement conditions; the measurement of SAR; corrections to reference conditions; and the definition of the RGF used in the CO₂ emissions metric. CAEP established and utilized a Certification Expert (CE) group to support the discussions on the certification requirement, and to facilitate oversight of commercially sensitive information. The CE group identified the manufacturers' existing practices in measuring aircraft fuel burn and high speed performance in order to understand how current practices could be used and built upon. Based on this information, the mature ICAO Annex 16, Volume III CO₂ Standard certification requirement was developed and this was approved by the CAEP/9 meeting in February 2013. The approved certification requirement text, which will be a core component of the Annex 16, Volume III CO₂ Standard, is contained in this circular.

3.7 Recognizing that the work on the certification procedures has progressed at a rapid pace with limited access to data, additional work items have been identified where further discussions would help reinforce Volume III and ensure a smooth implementation in Type Certification projects once adopted by ICAO and Member States. These include: stability criteria and confidence intervals; methodologies to correct test data to reference conditions; extrapolation of data; fuel used in SAR flight tests; verifying test aeroplane mass determination; demonstrating nominal operating values for power extraction; RGF for unpressurized aeroplanes; numerical model confidence intervals; correction of engine fuel efficiency performance; and alternatives to ground speed. With these current tasks in mind, it is important to realize that the CO₂ Standard certification requirement is a document that is work in progress and will be updated following the publication of this circular.

The next phase of the CO₂ Standard development

3.8 The work to finalize the CO₂ Standard continues into the Phase 2 Standard-setting process, and in order to complete the Annex 16, Volume III aeroplane CO₂ Standard leading up to late-2015, the following work items will be addressed:

3. MTOM can also be described as the Maximum Take-Off Weight (MTOW).

- a) definition of a no-change criteria to avoid having to recertify aeroplanes after minor modifications;
- b) applicability requirements in order to clearly define if, and when, the new CO₂ Standard is applicable to “new” aeroplane types and possibly new “in-production”; and
- c) pass/fail regulatory limit.

3.9 CAEP has decided that Phase 2 work will include the assessment of pass/fail stringency options for “new” aeroplane types, but not “out of production”, with applicability dates of 2020 and 2023. In addition, the proposed stringency options, applicability requirements, and applicability dates will also be assessed for in-production aircraft types. It has been agreed, in principle, that the CO₂ Standard should only be applied to the highest of all certificated MTOMs for the specific airframe/engine combination, and any other MTOM for which CO₂ emissions certification is requested by the applicant. This is on the basis that the highest mass variant will have the smallest margin to the regulatory limit and all lower mass variants would automatically comply. This will be verified during Phase 2 of the CO₂ Standard work leading up to late-2015.

3.10 In order to complete the Phase 2 Standard-setting work, including the development of the regulatory limit and applicability requirements, the decisions made during the CAEP/10 cycle will be underpinned by a thorough data-driven environmental and economic assessment.

4. SUMMARY

4.1 CAEP is currently focused on developing an Aeroplane CO₂ Emissions Standard which was requested by the 37th Assembly. The work conducted over the past three years has resulted in the CAEP/9 agreed CO₂ Standard certification requirement. This significant achievement is described in this circular which contains the agreed text on the certification requirement.

4.2 The complexity of the CO₂ Standard work has been significant both from a technical and political perspective, and along with the commercial sensitivity of the topic, this has resulted in a delay in delivering the CO₂ Standard. Going forward, to build on the significant progress made during the CAEP/9 cycle, the CAEP reviewed a comprehensive CO₂ Standard-setting work plan and agreed on a late-2015 deliverable date, in time for approval by CAEP/10 in 2016.

4.3 **The material in this circular is provided for information only.** It is not intended to be used for CO₂ emissions certification purposes prior to the Annex 16, Volume III being finalized by CAEP and adopted by the ICAO Council. This Circular does not require States to take any action whatsoever at this time and the States should not base any requirements, reporting or otherwise, on this material.

TEXT OF PROPOSED, FUTURE ANNEX 16, VOLUME III CO₂ CERTIFICATION REQUIREMENT

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