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ICAO: UNITING AVIATION ON CLIMATE CHANGE

# ICAO Colloquium on Aviation and Climate Change

## Development of an Aircraft Carbon Dioxide (CO<sub>2</sub>) Emissions Standard

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# Overview

- Current Status
- Highlights of the Scoping Analysis
- Conclusions



## Current Status

- ✓ Scoping analysis conducted during the CAEP/8 cycle
- ✓ Presentation to the CAEP/8 meeting
- ✓ Agreement on future work content and priority within the potential high-level schedule for CAEP/9 analyses



# Future Work Agreed at CAEP/8

E.08.01	CO <sub>2</sub> - Emission Standard (aircraft)	Conduct broad analysis to develop metric and methodology for a certification requirement pertaining to an aircraft CO <sub>2</sub> emissions standard.	CAEP/9 SG2011	Certification requirement	ACI, Brazil, Canada, China, EC, Egypt, Germany, IATA, ICCAIA, ICSA, Italy, Japan, Netherlands, Singapore, Spain, Sweden, UK, USA, Secretariat
E.08.02	CO <sub>2</sub> - Emission Standard (aircraft)	Develop stringency proposals, including technology responses, regulatory levels and applicability and dates for evaluation of cost effectiveness and market impacts by FESG and MDG	CAEP9	Inputs for Cost effectiveness analysis	ACI, Brazil, Canada, China, EC, Egypt, Germany, IATA, ICCAIA, ICSA, Italy, Japan, Netherlands, Singapore, Spain, Sweden, UK, USA, Secretariat
E.08.03	CO <sub>2</sub> - Emission Standard (aircraft)	Recommend an aircraft CO <sub>2</sub> emissions standard including applicability	Aiming for 2013, adjusting programme plans as necessary to ensure quality and effectiveness	Aircraft CO <sub>2</sub> emissions standard	ACI, Brazil, Canada, China, EC, Egypt, Germany, IATA, ICCAIA, ICSA, Italy, Japan, Netherlands, Singapore, Spain, Sweden, UK, USA, Secretariat



# CAEP/8 Scoping Analysis

- New work item arising in response to the GIACC
- WG3 offered to carry out additional work to define the scope of work, in order to inform discussion at CAEP/8 on this issue
- Approved by SG2009
- Reported in WP/20 & IP/21 to CAEP/8



## “CO<sub>2</sub>” or “Fuel Efficiency”

Agreed to continue to refer to it as a “CO<sub>2</sub> standard” based on “fuel efficiency” concepts within the certification requirement metric

Ensures transparency and public understanding that is essential to demonstrate this work is contributing to efforts to reduce aviation’s impact on climate change



## Alternative Fuels

Agreed that any mitigation of CO<sub>2</sub> emissions through the production and use of alternative fuels should be considered via a full life cycle analysis, and this is outside the scope of this work item

If future alternative fuels are developed with significant differences to kerosene, then this would need to be addressed although this is not foreseen in the near future



## Aspects Addressed

Specific aspects addressed by the CO<sub>2</sub> ad-hoc group during this scoping analysis were:

- **Historic CAEP work in this area**
- **Terminology and high level objectives**
- **Scope of requirements / priority**
- **Metric requirements / characteristics**
- **Certification procedure options**
- **Applicability**
- **Certification instrumentation and measurement methodology**
- **Regulatory level**
- **Manufacturer compliance**
- **Future timescale / resources**





## Historic CAEP Work

Past work within ICAO CAEP related to this issue should be considered in order to benefit from critical lessons learnt and to avoid repeating previous discussions and work. This includes:

- **Creation of the original Annex 16, Volume II emissions requirements (AEESG/CAEE: 1973 -1980)**
- **CO<sub>2</sub> Certification Standard Review (CAEP/5: 1998-2001)**
- **Aircraft Fuel Efficiency Parameter (CAEP/6: 2001-2004)**
- **EC NEPAIR (EC FP5: 2000-2003)**
- **Alternative NO<sub>x</sub> Emissions Methodology (CAEP/5, 6 and 7: 1998-2007)**



# Terminology

Terminology agreed as a working basis to structure future discussions:

- **Parameter** – a measured or calculated quantity that describes a characteristic of an aircraft (e.g. Foo, MTOW, Optimum Cruise Speed)
- **Metric** – a certification unit consisting of one or more parameters (e.g. Dp/Foo)
- **Procedures** – specific certification procedures, including applicability requirements (e.g. Annex 16 Vol II, Chapter 2)
- **Instrumentation and measurement methodology** – technical measurement procedures (e.g. Annex 16 Vol II, Appendix 3)



# Terminology

- **Certified level** – approved for a specific product by a certification authority to demonstrate compliance with a regulatory level, as determined by the certification requirement
- **Regulatory level** – a limit which a certified level must meet (e.g. CAEP/6 NO<sub>x</sub>)
- **Certification requirement** – the combination of metric, procedures, instrumentation and measurement methodology, and compliance requirements
- **Standard** – combination of a certification requirement and a regulatory level



## High Level Objectives

High level objectives were identified in order to assess future proposals against and, as far as practicable, identify an optimum way forward:

- Provide an additional incentive to improve aircraft fuel efficiency and thus global fleet fuel burn performance
- Measure fuel burn performance and relevant capabilities (e.g. range, size, speed) across different aircraft types
- Ensure it is technically robust (now and future) with an acceptable level of accuracy
- Represent key aircraft design characteristics and environmental performance with respect to individual design philosophies



## High Level Objectives

- Equity across products and manufacturers
- Permit flexibility in aircraft design to comply
- Minimise counterproductive incentives
- Minimise adverse interdependencies
- Base on existing certified data (parameters)
- Account for proprietary data protection concerns
- Not require inappropriate level of resources on part of National Airworthiness Authorities and industry to implement
- Simple, transparent and easily understood by all
- Develop a standard as soon as reasonably practicable to ensure that ICAO maintains its leadership in addressing aviation emissions issues



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## Scope

Prioritize coverage of aircraft and categories in the initial CO<sub>2</sub> standard in order to improve the probability of agreement by CAEP/9



## Metric

Critical aspect to future CO<sub>2</sub> standard which should meet key criteria:

- Reflect fuel efficiency of an aircraft at design and operational level
- Include parameters which characterise aircraft output (e.g. measure of distance travelled, what is transported and speed)
- Based on measurable certified parameters
- Minimise unintended consequences and interdependencies with other standards
- Equitable across stakeholders



## **Certification Procedures**

Incorporate aspects of relevant aircraft design and performance characteristics (e.g. cruise conditions, operating range, weight, reference missions / operating mode)

Kerosene-type fuel specification (e.g. Annex 16 Volume II Appendix 4) should be part of the certification requirement in order to remove any fuel burn performance variations resulting from variation in fuel properties





## Applicability

Agreed that a standard could be applied in a variety of ways and that all of these options should remain open for assessment at this point:

- **“New aircraft types”**
- **“New production aircraft”**
- **“In-service aircraft”**

In defining applicability requirements, including the treatment of modified products, any associated standard and its effective date should be taken into account



## **Instrumentation & Measurement Methodology**

Highly dependent on selection of the certification metric and definition of the procedures

Should be borne in mind at all times to ensure that proposals are technically feasible, and do not create an unreasonable regulatory burden

Possible need to consult with expert technical groups outside of the CAEP domain (e.g. SAE E-31)



## Regulatory Level

Current CAEP terms of reference and standard/goal setting approach may provide sufficient flexibility to be used to assess and agree on CO<sub>2</sub> standards

Any different perspective may need to be considered by CAEP while taking into account the broader implications

To the degree possible, work on assessing regulatory level options should be done in parallel to the development of the certification requirement

Should provide positive incentives for industry stakeholders to improve fuel efficiency



# Manufacturer Compliance

There are various potential approaches, including:

- **Type certification**
- **Type certification combined with corporate average targets**

Further work should consider the advantages and disadvantages of all available approaches to manufacturer compliance



## **Future Timescales / Resources**

**Timescales to develop a CO<sub>2</sub> standard will be dependent on maintaining a priority level and the provision of resources from Member States and Observer organizations**

**Establishing interim milestones with target completion dates are necessary in order to manage the development of an aircraft CO<sub>2</sub> standard**

**Prioritisation of this issue in the future work programme may lead to delays in other work items**



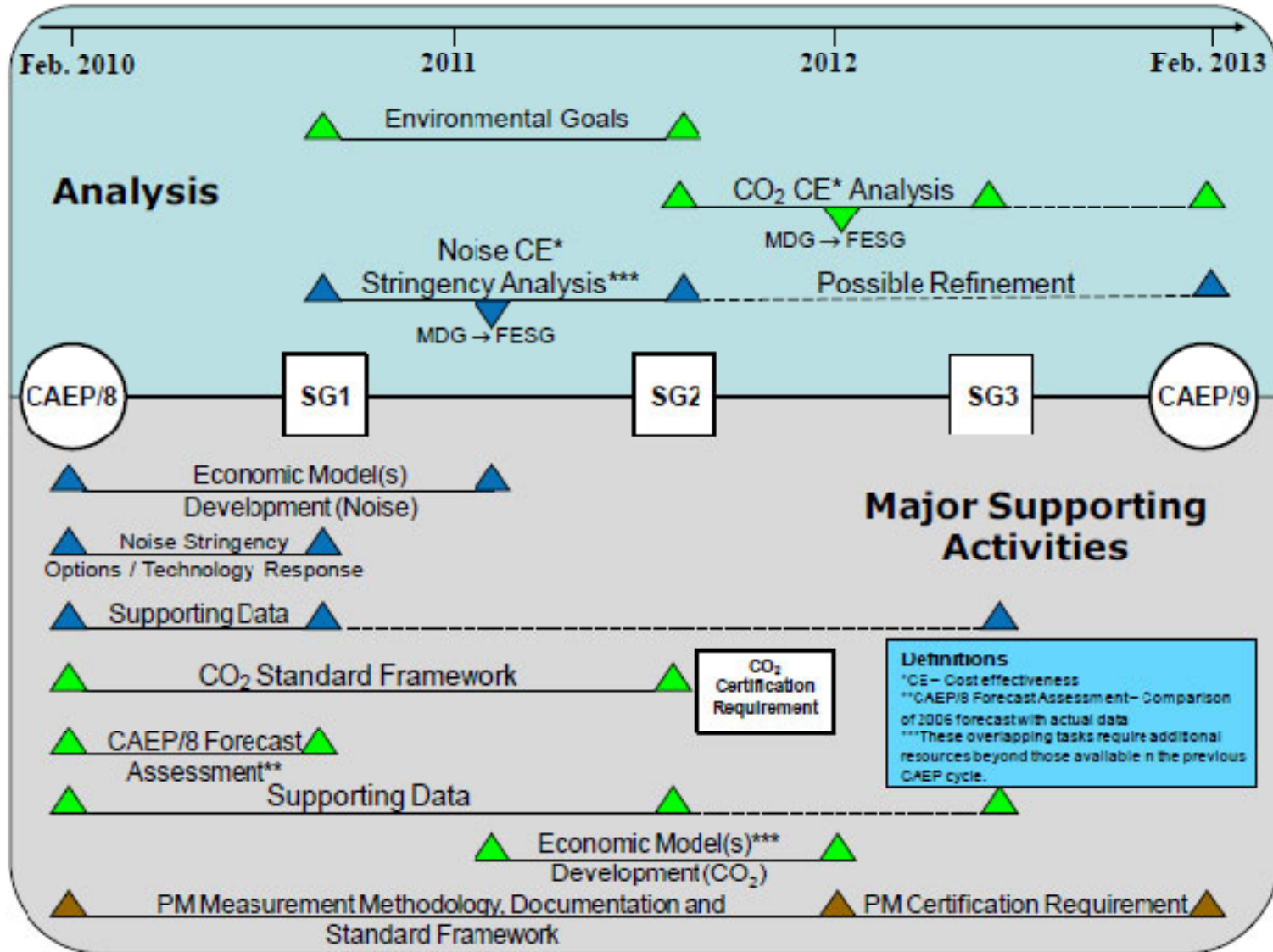
## **Future Resources / Timescales**

Resources required to implement the certification requirement will be highly dependent on how it is designed and the associated workload for regulatory authorities and manufacturers

A CO<sub>2</sub> standard must be considered the highest WG3 priority if it is to be potentially completed by CAEP/9



# Potential High-Level Schedule





# Conclusions

- In order to potentially deliver a robust standard in 2013, it is critical that this work item maintain the highest priority within the CAEP work programme
- In addition to being a high priority, it is critical that Member States and Observer organizations provide the technical working resources to support this remit
- The scoping analysis and CAEP/8 Summary of Discussions are being used to guide the CAEP/9 work on an aircraft CO<sub>2</sub> standard