

COMMITTEE ON AVIATION ENVIRONMENTAL PROTECTION (CAEP)

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The Committee on Aviation Environmental Protection (CAEP) is the only technical committee of the ICAO Council. Its mandate is to study and develop proposals to minimize aviation’s effects on the environment. It was established in 1983, superseding the Committee on Aircraft Noise and the Committee on Aircraft Engine Emissions.

CAEP is composed of 24 Members from all regions of the world, and 15 Observers (see **Table 1**). Over 600 internationally-renowned experts are involved in CAEP activities and working groups (see **Figure 1**). All of its proposals for example, measures to minimize noise and emissions, are assessed on the basis of four criteria: technical feasibility, environmental benefit, economic reasonableness, and interdependencies. The CAEP held three Steering Group meetings to guide the work programme during the three-year period leading up to the tenth meeting of CAEP in February 2016 (CAEP/10).

The ICAO Council reviews and adopts CAEP recommendations, including amendments to the Standards and Recommended Practices (SARPs) on aircraft noise (Annex 16, Volume I), engine emissions (Annex 16, Volume II), and the recently recommended Annex 16, Volume III on aeroplane CO₂ emissions. In turn, the Council reports to the ICAO Assembly (191 States plus international organizations) where the main policies on environmental protection are ultimately adopted and translated into Assembly Resolutions.

CAEP/10 Achievements

The Tenth meeting of the Committee on Aviation Environmental Protection (CAEP/10) was held at ICAO headquarters in Montréal, Canada in February 2016. The meeting was attended by approximately 200 participants. This meeting marked the culmination of three intense years of activity by the CAEP working groups looking into aircraft noise, operations, and emissions. It involved more than 600 experts from different States and organizations around the world.

Based on the work of the Committee’s technical experts, the CAEP/10 meeting agreed on a comprehensive set of 17 recommendations that will help ICAO fulfill its mandate on

aviation environmental protection. Key areas of progress and focus during CAEP/10 included:

- an agreement on a new aeroplane CO₂ emissions Standard;
- an agreement on a new non-volatile Particulate Matter (nvPM) engine emission Standard;
- review of the significant technical work completed so far on a Global Market Based Measure (GMBM);
- tabling of updated trends for CO₂, noise and engine emissions;
- recommendation of a new Circular on “Community Engagement on Aviation Environmental Management”; and
- establishing priorities and work programmes for the CAEP/11 work cycle (2016-2019).

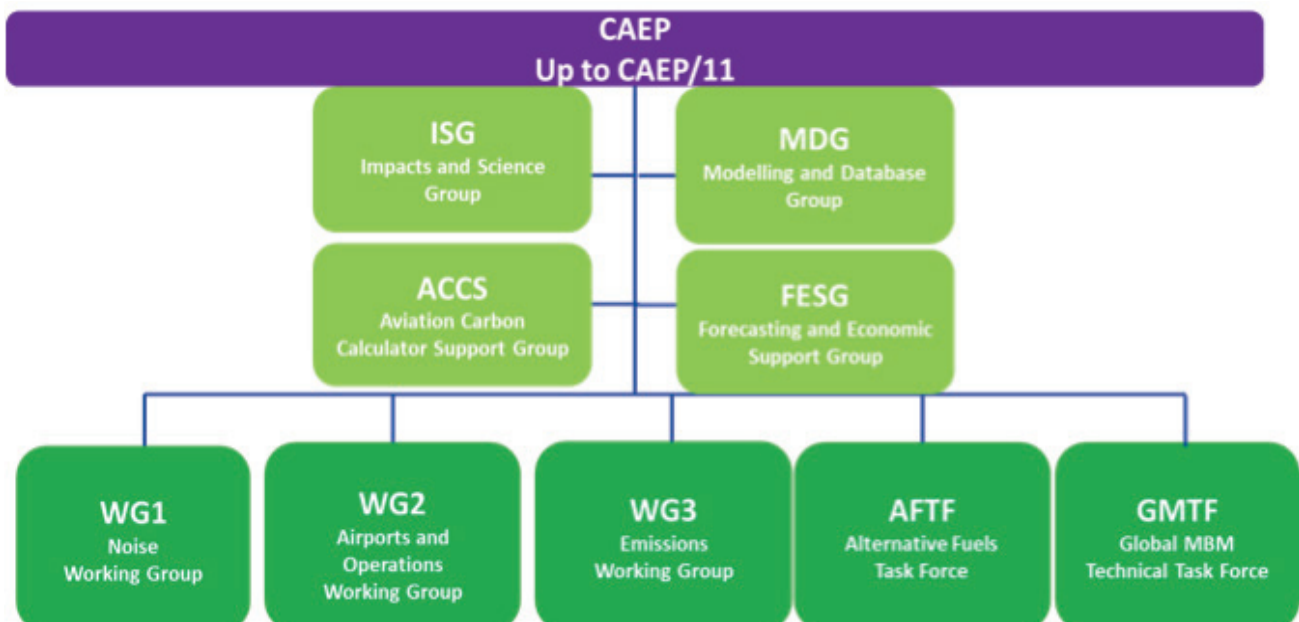


Figure 1. CAEP working groups and structure approved at CAEP/10 (2016)

Members (24 States)		
Argentina	Australia	Brazil
Canada	China	Egypt
France	Germany	India
Indonesia	Italy	Japan
Netherlands	Poland	Russian Federation
Singapore	South Africa	Spain
Sweden	Switzerland	Ukraine
United Arab Emirates	United Kingdom	United States

Observers (5 States and 10 Organizations)		
Greece	Norway	Peru
Saudi Arabia	Turkey	ACAC
ACI	CANSO	EU
IATA	IBAC	ICCAIA
ICSA	IFALPA	UNFCCC

Table 1. CAEP Member States and Observer States and Organizations.

New Standards on CO₂ emissions and nvPM

The results of the CAEP/10 meeting were unprecedented, because it was the first time CAEP had been able to recommend two completely new standards in one meeting, on Carbon Dioxide (CO₂) and non-volatile particulate matter (nvPM) emissions.

The recommended Aeroplane CO₂ Emissions Certification Standard is a technology standard with the aim of encouraging more fuel efficient technologies into aeroplane designs. This technology-based approach is similar to the current ICAO engine emissions standards for Local Air Quality (LAQ) and the aircraft noise standards. The recommended CO₂ standard has been developed at the aeroplane level, and therefore has considered all technologies associated with the aeroplane design (e.g. propulsion, aerodynamics and structures). This approach is similar to the current ICAO aircraft noise standards. The CO₂ standard will apply to subsonic jet and turboprop aeroplanes that are new type (NT) designs from 2020, as well as to those aeroplane type designs that are in-production (InP) in 2023 and undergo a change. Regarding the latter, if after 2023 any InP aeroplane type design that is changed to the extent that it triggers applicability, it would then need to be made compliant with the standard. In 2028, there is a production cut-off. This means that InP aeroplanes that do not meet the standard can no longer be produced from 2028, unless the designs are modified to comply with the standard. The recommendation on the CO₂ emissions standard was supported by a significant data driven process and the cost-benefit modelling analysis of

several different CO₂ stringency options. The new CO₂ emissions Standard is recommended as being included in an entirely new Volume to Annex 16 (Volume III).

The recommended new nvPM standard has been developed for the certification of aircraft engines emissions and is set at the engine level, in a similar way to the current ICAO engine emission standards. The recommended new nvPM standard will apply to engines manufactured from 1 January 2020, and is for the certification of aircraft engines with rated thrust greater than 26.7kN. The new nvPM standard is the first of its kind, and it includes a full standardized certification procedure for the measurement of nvPM, and the regulatory limit for the nvPM mass concentration set at the current ICAO smoke visibility limit. The new nvPM standard is recommended as a new Chapter to Annex 16, Volume II. The agreement on the new nvPM standard will set the basis for a more stringent nvPM standard during CAEP/11.

The aeroplane CO₂ and engine nvPM standards will be subject to final review and adoption by the ICAO Council during 2017. Further information on the nvPM and CO₂ standards can be found in Chapters 3 and 4 of this Environmental Report.

Global Market-Based Measure (MBM) Scheme

During the 38th session of the Assembly, the ICAO Council was requested to finalize the work on the technical aspects, environmental and economic impacts and modalities of the

possible options for a global MBM scheme, including on its feasibility and practicability, taking into account the need for development of international aviation, the proposal of the aviation industry and other international developments, as appropriate, and without prejudice to the negotiations under the UNFCCC.” The mandate included making “a recommendation on a global MBM scheme that appropriately addresses them and key design elements, including a means to take into account special circumstances and respective capabilities [...], and the mechanisms for the implementation of the scheme from 2020 as part of a basket of measures which also include technologies, operational improvements and sustainable alternative fuels to achieve ICAO’s global aspirational goals.” The Council’s first action following the 2013 Assembly was to establish the EAG, mandated to oversee all work related to the global MBM scheme and make recommendations to the Council. The EAG started with a “strawman” approach, a basic proposal with a view to generating discussion and analysis. As part of the assessment process, the EAG called on CAEP for a series of analyses, including:

- future CO₂ emissions volumes from international aviation and cost impacts to achieve carbon-neutral growth from 2020;
- approaches for distribution of offsetting requirements to individual aircraft operators;
- cost impacts using various combinations for operator and international aviation growth factors; and
- comparison of approaches to offsetting requirements

CAEP undertook additional work on technical aspects of the global MBM scheme, such as monitoring, reporting and verification (MRV), emissions unit criteria (EUC), and registries. The CAEP/10 meeting reviewed the significant technical work completed so far, and agreed on recommendations related to MRV, EUC, and registries. CAEP recommended that the technical reports submitted to the meeting be used as the basis for further work, pending future decisions by the Council and Assembly. The meeting also recognized the analytical work undertaken by CAEP on various approaches for a global MBM scheme to support the work of the Council and its Environment Advisory Group (EAG). The work continues leading up to the 39th Assembly and further information on MBMs can be found in Chapter 4 of this Environmental Report.

Sustainable Alternative Fuels

The use of sustainable alternative fuels is an important element of the basket of measures for reducing aviation’s impact on the global climate and also on air quality. CAEP has carried out a substantial amount of work related to developing a projection for the possible availability of sustainable alternative fuels in 2020 and 2050, along with their potential to reduce net CO₂ emissions. The analysis showed that in 2020, a reduction of 1.3 per cent of international aviation CO₂ emissions could be possible from the use of sustainable alternative fuels. By 2050, 100 per cent of international aviation jet fuel demand could be

met with alternative fuels. However, such a scenario is highly dependent on policy decisions that are taken. CAEP also carried out a considerable amount of work on the life-cycle analysis methodology for sustainable alternative fuels for use in a global MBM scheme. Further information on Alternative Fuels can be found in Chapter 4 of this Environmental Report.

New Air Cargo CO₂ Emissions Tool

The current ICAO Carbon Calculator for passenger air travel emissions is one of the most popular tools developed by ICAO. It allows passengers to estimate the emissions attributed to their air travel. It is simple to use and only requires a limited amount of information from the user. To complement the ICAO Carbon Calculator for passenger air travel emissions, during the CAEP/10 meeting, a methodology to quantify air cargo CO₂ emissions was recommended by CAEP. This new methodology will predict the CO₂ emissions from cargo shipped on board both passenger and dedicated cargo aircraft. This tool will only require information such as origin and destination. The ICAO Carbon Calculator is available for use on the ICAO website and on mobile applications (see <http://www.icao.int/environmental-protection/carbonoffset/pages/default.aspx> and Chapter 4 of this Environmental Report).

Environmental Trends

Every three years, CAEP develops an analysis of environmental trends in aviation to include: Aircraft Emissions that affect the Global Climate; Aircraft Noise; and Aircraft Emissions that affect Local Air Quality (LAQ). CAEP uses the latest input data and related assumptions to assess the present and future impact and trends of aircraft noise and aircraft engine emissions. During the CAEP/10 meeting, CAEP developed an updated set of trends and it was recommended that these be the basis for decision-making on matters related to the environment during the 39th ICAO Assembly. Further information on the Environmental Trends in Aviation to 2050 can be found in Chapter 1 of this Environmental Report.

Aircraft Noise

Aircraft noise is the most significant cause of adverse community reaction related to the operation and expansion of airports. This is expected to remain the case in most regions of the world for the foreseeable future. Limiting or reducing the number of people affected by significant aircraft noise is therefore one of ICAO’s main priorities and one of the Organization’s key environmental goals. CAEP continued its important work of ensuring that the ICAO noise standards are up to date and relevant. CAEP also continued the important work of monitoring noise technology and understanding the progress towards the use of these technologies on-board aircraft. This is part of the continued efforts to ensure that the latest available noise reduction technology is incorporated into aircraft designs.

Supersonic Noise Standard

CAEP also continued its work on the development of a new supersonic noise standard for future aircraft, and understanding

the current state of sonic boom knowledge, research and supersonic aeroplane projects. It is anticipated that the certification of a supersonic aeroplane could occur in the 2020-2025 timeframe.

It was also recognized that based on the CAEP trends work, for the first time, ICAO and its Member States may be able to consider the possibility that, under an advanced technology improvements scenario, an increase in aircraft operations may no longer result in an increase in noise contour area after 2030. This demonstrates how ICAO Standards for aircraft noise are working, and of the possibility of decoupling of air traffic growth and noise growth.

Further information on Aircraft Noise can be found in Chapter 2 of this Environmental Report.

Airports and Operations

The ICAO Global Air Navigation Plan (GANP) offers the potential to deliver fuel and CO₂ emissions reductions. Recognizing this, an analysis of environmental benefits from the implementation of the Aviation System Block Upgrade (ASBU) Block 0 was conducted by CAEP. The analysis showed that the full implementation of the aviation system block upgrade (ASBU) Block 0 could achieve 0.7 to 1.4 per cent fuel saving in 2018 compared to 2013.

CAEP continued its work on assisting states with developing guidance material on airport planning. The CAEP/10 meeting recommended an update to the Airport Planning Manual, Part 2, to include climate change considerations and to meet the direct needs for guidance of States facing environmental challenges at and around airports. CAEP also recommended a new Circular on “Community Engagement on Aviation Environmental Management”, which identifies key principles for stakeholders communication.

State of the Science

During the CAEP/10 meeting a set of White Papers were presented which provided the summary of a scientific literature review on a number of areas associated with aviation and environment. This summary was developed during an ICAO

CAEP Aviation Environmental Impacts Seminar, which involved designated internationally-recognized experts to inform the process of writing the White Papers. The following three White Papers are published as articles within this Environmental Report, and these report the State of Science on:

- **Aviation Noise Impacts:** This article summarizes the state of knowledge on noise measurement and prediction and the relationship between aviation noise and community annoyance, children’s learning, sleep disturbance and health impacts. Further information can be found in Chapter 2 of this Environmental Report.
- **Aviation Impacts on Air Quality:** This article includes an update to the aircraft Particulate Matter (PM) emissions State of the Science, with a particular focus on PM caused by aircraft and their impacts on surface air quality. Information is also presented on measuring and modelling emissions, PM emissions from alternative fuel combustion, modelling emissions dispersion and concentrations, and cruise emissions impacts on air quality. Further information can be found in Chapter 3 of this Environmental Report.
- **Aviation and Climate:** This article provides a summary of recent progress on the state of the science since 2012, especially related to contrails and induced cloudiness, aerosol and NO_x effects, and emissions from alternative aviation fuels. Further information can be found in Chapter 4 of this Environmental Report.

Future Work and Meetings

The meeting developed the future work programme for CAEP/11, and the three top priorities are the collection of data and further consideration of stringency levels for the nvPM Standard, completion of remaining technical work related to a global MBM scheme, and support for the implementation of the CO₂ emissions Standard. In addition, a number of emerging issues were highlighted, namely:

- 1) synthesis report on adaptation to climate change;
- 2) report on aircraft recycling; and
- 3) placing international aviation into context with a 1.5°C/2.0°C temperature increase scenario. These new areas are addressed further within this Environmental Report.



Figure 2. The CAEP/10 meeting, ICAO Headquarters, Montreal, Canada, 1 to 12 February 2016