

REDUCING AIRCRAFT NOISE - OVERVIEW

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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. The main overarching ICAO policy on aircraft noise, which contains details on all the elements that can be employed to achieve noise reductions, is the **Balanced Approach to Aircraft Noise Management**. This can be found in the ICAO Doc 9829, *Guidance on the Balanced Approach to Aircraft Noise Management*.

An important pillar of the Balanced Approach to Aircraft Noise Management is the reduction of noise at source. Aircraft noise ("noise at source") has been controlled since the 1970s by the setting of noise limits for aircraft in the form Standards and Recommended Practices (SARPs) contained in Annex 16 to the Convention on International Civil Aviation (the "*Chicago Convention*")¹. This continues to be the case today. Noise provisions appear in Volume I of Annex 16. The primary purpose of noise certification is to ensure that the latest available noise reduction technology is incorporated into aircraft design and demonstrated by procedures that are relevant to day-to-day operations, in order to ensure that noise reductions offered by technology are reflected in reductions around airports.

The first noise standard was developed by the ICAO Committee on Aircraft Noise (CAN, 1971), which aimed at ensuring that any new aircraft entering service would use the best available noise reduction technology. That standard became applicable in 1973, setting noise limits as a direct function of Maximum Take-off Mass (MTOM) in order to recognize that heavier aeroplanes, which were of greater transport capability, produce more noise than lighter aeroplane types. This is the Chapter 2 Noise Standard contained in Annex 16, Volume I. **Figure 1** shows a schematic of the noise certification test procedures.

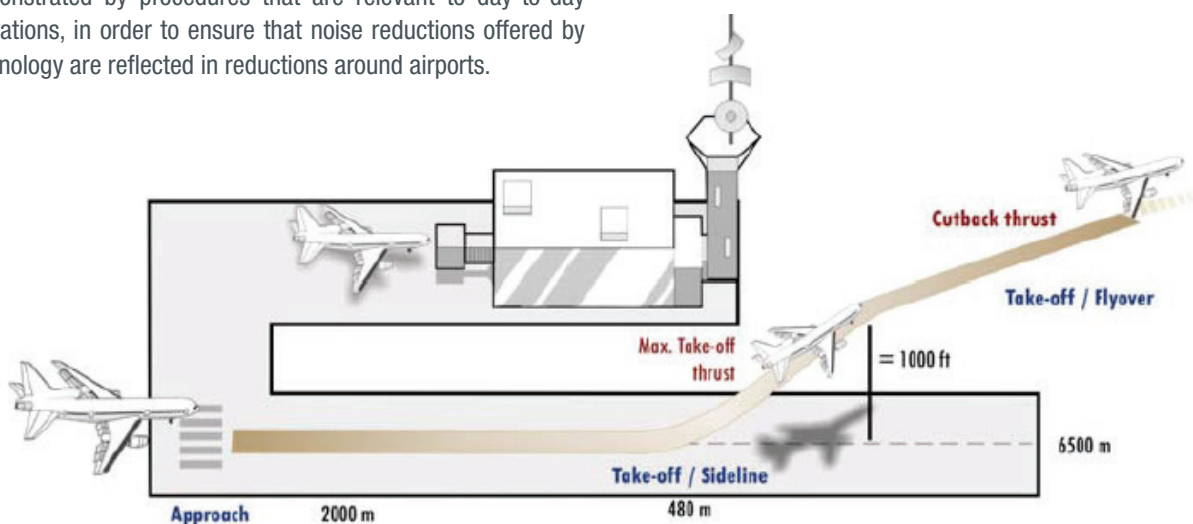


Figure 1. Aircraft noise certification reference points.

AEROPLANE CERTIFICATION PROCEDURES

Aeroplane acoustic certification involves measuring the noise level of an aircraft in Effective Perceived Noise Level (EPN) dB² at three reference points:

Fly-over: 6.5 km from the brake release point, under the take-off flight path;

Sideline: the highest noise measurement recorded at any point 450 m from the runway axis during take-off;

Approach: 2 km from the runway threshold, under the approach flight path.

ICAO NOISE POLICY

The Balanced Approach to Aircraft Noise Management consists of identifying the noise problem and analyzing various measures available to reduce noise at a specific airport through the exploration of four principal elements, namely:

1. reduction of noise at source;
2. land-use planning and management;
3. noise abatement operational procedures; and
4. operating restrictions.

The goal is to identify the noise-related measures that achieve maximum environmental benefit most cost-effectively using objective and measurable criteria.

Following the introduction of Chapter 2, much higher bypass ratio jet engines were introduced into service. Not only did this new technology deliver improved fuel efficiency, it also resulted in reductions in engine noise. This allowed for the ICAO noise standard to be made more stringent in 1977. This is the Chapter 3 Noise Standard contained in Annex 16, Volume I. In the following years, further noise reduction technologies were incorporated into engine and airframe designs which led to incremental improvements in aircraft noise performance and this resulted in further stringency increase of the noise standard which is contained in Annex 16, Volume I, Chapter 4.

In the 2013 ICAO Environmental Report it was reported that the CAEP/9 (in February 2013) meeting had recommended an amendment to Annex 16, Volume I involving an increase in stringency of 7 EPNdB (cumulative) relative to the current Chapter 4 levels. In 2014 the ICAO Council adopted the new Chapter 14 noise standard for jet and propeller-driven aeroplanes. This new, more stringent standard is shown in **Figure 2**, (along with the previous ICAO noise standards for reference) and will be the mainstay ICAO Standard for subsonic jet and propeller-driven aeroplane noise for the coming years. It is applicable to new aeroplane types submitted for certification on or after 31 December 2017, and on or after 31 December 2020 for aircraft less than 55 tonnes in mass.

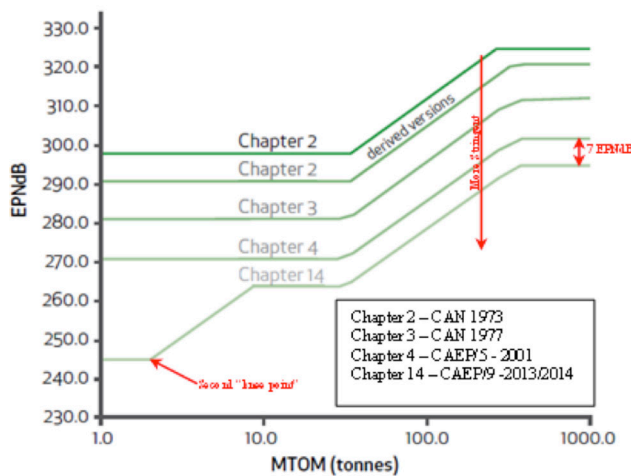


Figure 2. The progression of the ICAO Noise Standard.

Over the past three years (2013-2016), work has been conducted by ICAO to ensure the currency of the technical basis underpinning the ICAO Standards, guidance and policies associated with reducing aircraft noise. This work has included, among several topics, investigations into emerging subsonic aeroplane noise reduction technologies, studies into the status of aeroplane and helicopter noise reduction technology and the continuing development of SARPs for future supersonic aeroplanes. ICAO has also worked on the environmental aspects of airport land-use planning, and airport community engagement good practices. This chapter of the Environmental Report provides more details on the aforementioned topics.

As a result of the new Chapter 14 noise Standard, it is expected that the number of people affected by significant aircraft noise will be reduced, and that more than one million people could be removed from “Day Night average sound Level (DNL) of 55 dB affected areas” between 2020 and 2036.

Noise Reduction Technology

In order to set a new noise Standard in future, an understanding of current research and technology development is imperative. Technological progress continues to push the aviation community to delivering on the ICAO goal of limiting or reducing the number of people affected by significant aircraft noise. ICAO continually monitors research and development in noise reduction technology, and this complements the Standard-setting process. As reported in the 2013 Environmental Report, CAEP conducted an independent expert review to evaluate expected commercial aircraft noise levels by 2020 and 2030. The review focused on new novel aircraft and advanced engine concepts. More information on the IE review can be found in ICAO Doc 10017. While a full independent expert review was not conducted during the past three years, CAEP has continued to undertake a comprehensive overview of ongoing worldwide aircraft noise reduction efforts and associated goals (see article page 38).

As part of the technical monitoring effort, CAEP conducted a status review of the noise technology advancements of helicopters between 2000 and 2015 to highlight the developments since the last helicopter noise assessment report conducted in 2001 (during CAEP/5). The review included examining both noise reduction technologies and the costs associated with those technologies. The results of the helicopter status review was published on the ICAO website in 2016. The report includes an overview of international noise technology programmes and research initiatives, key noise reduction technologies of modern helicopters, and the status of advanced noise reduction technologies currently being tested in research programmes. Constraints and challenges to incorporate both current noise reduction technologies and promising new technologies are also considered (see article page 42).

Community engagement for aviation environmental management

As part of proper land-use planning and management, community engagement by airport operators and other aviation stakeholders is the key link between environmental stewardship and mitigating environmental constraints to aviation operation and growth. Recognizing the importance of community engagement, CAEP undertook a task in 2013 to collect case studies of airport outreach programs around the world and developed an ICAO Circular in 2016 highlighting both lessons learned and good practices (See article page 63). The Circular was developed to assist and encourage States and the aviation industry, in

particular airports, airlines, and Air Navigation Service Providers, to engage local communities early in airport development projects to address environmental matters.

Supersonic Aircraft Noise Standards Development

ICAO continues its efforts towards developing a Standard for future supersonic aircraft, and discussions continue on the sonic boom measurement schemes and procedures for future supersonic aircraft. The goal of the procedures formulation effort is to establish technical flight test procedures for supersonic noise certification. These would be in addition to the certification requirements for the subsonic local airport conditions, where the maximum noise levels that would be applicable to subsonic jet aeroplanes would likely be used.

During the CAEP/11 cycle, progress has been made on identifying certification measurement locations for assessing sonic boom noise on the ground; selecting an appropriate noise metric for use in a Standard that assesses sonic boom noise and shows favorable correlation between outdoor measurement and indoor human response; and evaluating the benefits of using sonic boom predictions in supersonic noise certification in addition to physical measurements. Research Focal Points (RFPs) also continue to inform the work of CAEP with details on important research associated with supersonic flight and guide the selection of metrics and measurement locations (see article page 46).

Future ICAO work

ICAO continues to develop measures aimed at mitigating the impact of aircraft noise, and to support this ICAO continues to develop international standards, guidance material, and technical documentation as appropriate for the needs of the international community. This includes the maintenance of Annex 16, the

environmental technical manuals, and the ICAO noise databank. Over the next three years the work on noise will focus on:

- monitoring and reporting on the various national and international research programme goals and milestones;
- conducting an integrated aircraft-level technology assessment of aeroplanes that includes both noise and emissions;
- continuing to develop a certification Standard for possible future supersonic aircraft.

Making sure that the international Standards, guidance material, and technical documentation are all up-to-date and are appropriate for the needs of the international community, is crucial to the ICAO objective of reducing or limiting the number of people affected by aircraft noise.

Sustainable Development Goals

