Aircraft Noise Technology and International Noise Standards

Dr. Neil Dickson, Environment Officer
Environment,
ICAO Air Transport Bureau
• The ICAO Noise Standards
• ICAO Noise Goals
• Overview and current work
A Balanced Approach to noise management

- Reduction of noise at source
- Land-use planning and management
- Operating restrictions
- Noise abatement operational procedures

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Established by the ICAO Council in 1983, superseding the Committee on Aircraft Noise (CAN) and the Committee on Aircraft Engine Emissions (CAEE)
• ICAO adopted its first noise Standard in 1972

- **Annex 16, Chapter 2**
  - ICAO adopts noise standard for new subsonic jet aeroplanes (1972)

- **Extraordinary session of ICAO Assembly**
  - Adopts phase-out of Chapter 2 aeroplanes (1990)

- **Annex 16, Volume I, Chapter 4**
  - ICAO adopts more stringent noise standard for new subsonic jet and heavy propeller-driven aeroplanes (2001)

- **Annex 16, Volume I, Chapter 14**
  - CAEP recommends an increase in stringency in the noise standard for new subsonic jet and heavy propeller-driven aeroplanes (2013).

- **Annex 16, Chapter 3**
  - ICAO adopts more stringent noise standard for new subsonic jet and propeller-driven aeroplanes (1977)

- **Phase-out of Chapter 2 aeroplanes**
  - Begins (1995)

- **ICAO 33rd Assembly**
  - Adopts the Balanced Approach to Noise Management (2001)
• Manufacturers’ new technologies have produced significant noise reductions.
• Noise certification is based on aircraft performance (airframe + engine).
• ICAO Annex 16, Volume I contains the aircraft noise Standards.
• Environmental Technical Manual (Doc 9501) contains the procedures for noise certification of aircraft.
Establishing Technology Standards
ICAO Noise Standards
Annex 16, Volume I
“The prime purpose of noise certification is to ensure that the latest available noise reduction technology is incorporated into aircraft design demonstrated by procedures which are relevant to day to day operations, to ensure that noise reduction offered by technology is reflected in reductions around airports.”

The seventh meeting of the Committee on Aviation Environment Protection (CAEP/7), 2007
Noise Certification Reference Points

Aeroplane acoustic certification involves measuring the noise level of an aircraft in Effective Perceived Noise Level (EPN) dB 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.

Cumulative levels are defined as the arithmetic sum of the certification levels at each of the three points.
### Aircraft Noise Certification

#### Applicable Year and Cum Margin (EPNdB)

<table>
<thead>
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<th>Chapter</th>
<th>Applicable Year</th>
<th>Cum Margin (EPNdB)</th>
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<tr>
<td>2</td>
<td>1972</td>
<td>Ch. 3 ~-16</td>
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<tr>
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<td>1978</td>
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<tr>
<td>4</td>
<td>2006</td>
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<tr>
<td>14</td>
<td>2017 &amp; 2020</td>
<td>Ch. 3 +17          (Ch. 4 +7)</td>
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• **Annex 16, Volume I** also contains:
  
  – Standards for Propeller Driven Aeroplanes, Helicopters and Tilt-rotors;
  
  – Details on: noise monitoring, airport noise assessment and the Balanced Approach to Noise Management;
  
  – Appendices on the evaluation methods for noise certification;
  
  – Guidance material on the calculation of noise limits, APU noise, noise documentation administration and land use planning.
ICAO Noise Goals

Independent Experts Review on Noise Technology
Summarised the status of new technological advances (novel aircraft and engine concepts):

- Looking at 2020 and 2030 time horizons (e.g. open rotor, geared turbofan, blended wing body, etc)

Silent Aircraft Initiative: SAX-40 concept

Front view and sketch of the reference Ducted Counter Rotating Fan (CRTF)

ICAO Noise Goals - Independent Experts Review on Noise Technology

NACRE Proactive Green Concept

| TRL 9 | System ready for full scale deployment |
| TRL 8 | System incorporated in commercial design |
| TRL 7 | Integrated pilot system demonstrated |
| TRL 6 | Prototype system verified |
| TRL 5 | Laboratory testing of integrated system |
| TRL 4 | Laboratory testing of prototype component or process |
| TRL 3 | Critical function: proof of concept established |
| TRL 2 | Technology concept and/or application formulated |
| TRL 1 | Basic principles observed and reported |

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Setting ICAO Noise Goals - Independent Experts Review on Noise Technology

Mid-Term (2020) Cumulative Noise Goals at TRL8 (including Large Turboprops).

- Chapter 4 Limit
- Mid-Term Goal for Turbofans
- Mid-term Upper Bound
- Mid-term Lower Bound
- Large Turboprop Goals

Cumulative Noise Level, EPNdB vs. Max. Takeoff Mass (Tonnes)
Second IE review on noise technology published as ICAO Doc 10017
ICAO current work on aircraft noise
2013-2016
CAEP continues to maintain and work towards updating Annex 16 during the CAEP/10 cycle.

Work on interdependencies related to noise and emissions standards.

Continue to work on noise certification standards for supersonic aircraft.

Develop a new certification scheme for future supersonic aircraft.
• Monitor research and report on various national and international research programmes.
Establishing Technology Standards
• ICAO’s role is to provide a global forum to develop a commonly-agreed solution among Member States:
  – Consists of a variety of measures
  – Harmonized and balanced manner.

• ICAO, through CAEP, will continue to update the Standards for noise in Annex 16, involving:
  – Monitoring research and technology developments;
  – Review of the latest technology developments;
  – Consideration of the interdependencies.
For more information on ICAO activities on Aircraft Noise…

ICAO Web Page

www.icao.int/

THANK YOU