



ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

RECONNECTING **THE** WORLD



ICAO

ENVIRONMENT



2

ICAO Annex 16: Volumes I-III

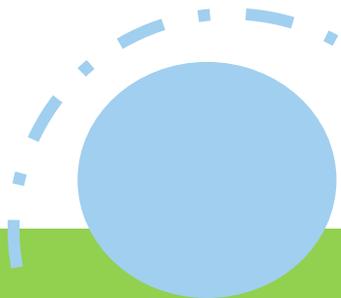
ICAO/SASO ENV Workshop

Mbabane, Eswatini (24-27 Oct 2023)

Ms. Chinga Mazhetese

Regional Officer: Environment/ Meteorology

ICAO ESAF Office



Outline

- Annex 16 Vol I- Aircraft Noise
- Annex 16 Vol II- Aircraft Engine Emissions
- Annex 16 Vol III- Aeroplane CO₂ Emissions





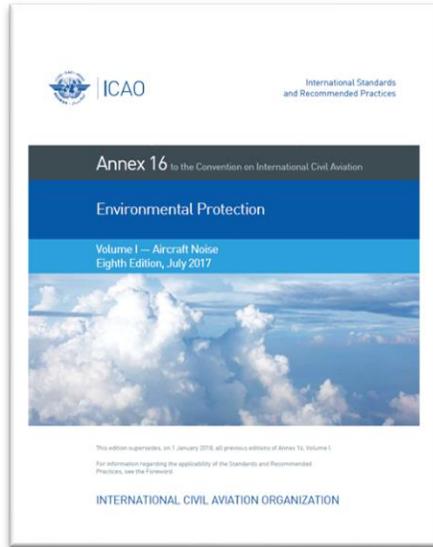
Part I. DEFINITIONS, NOMENCLATURE: SYMBOLS AND UNITS

Part II. AIRCRAFT NOISE CERTIFICATION

Part III. **NOISE MEASUREMENT FOR MONITORING PURPOSES**

Part IV. **ASSESSMENT OF AIRPORT NOISE**

Part IV. **BALANCED APPROACH TO NOISE MANAGEMENT**



APPENDICES

APPENDICES 1-5 : Evaluation methods for noise certification

APPENDIX 5. Monitoring aircraft noise on and in the vicinity of aerodromes

APPENDIX 6. Verification Evaluation method for noise certification

Purpose of Volume I

- ensure that the latest available noise reduction technology is incorporated into aircraft design
 - demonstrated by procedures that are relevant to day-to-day operations

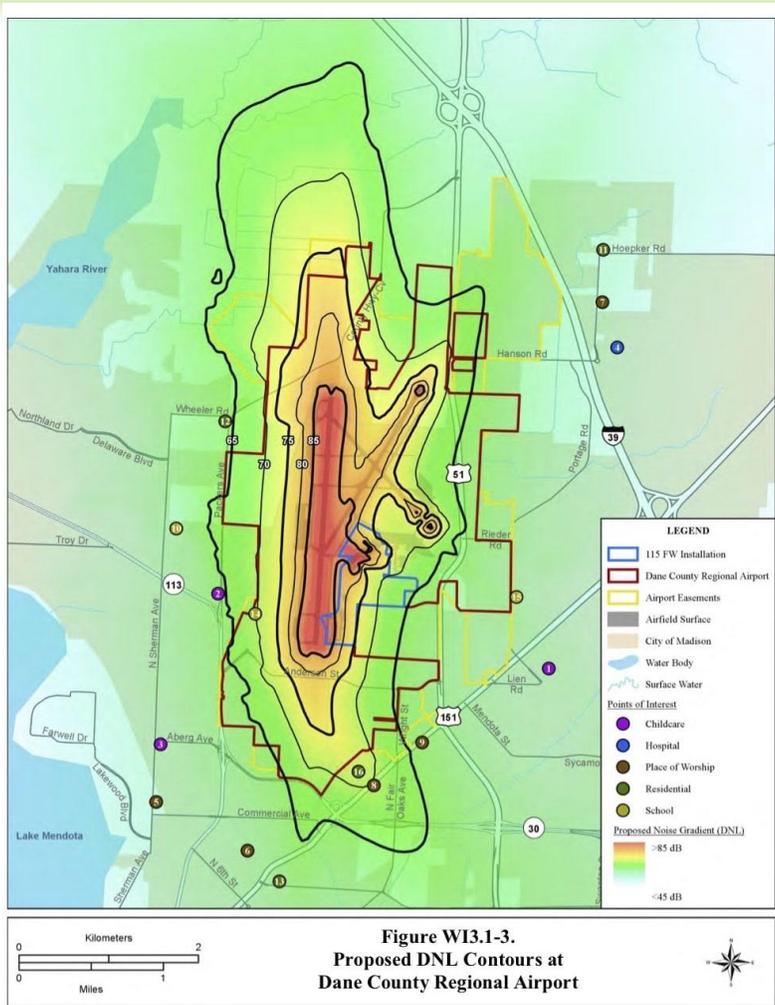
noise reductions offered by technology are reflected in reductions around airports



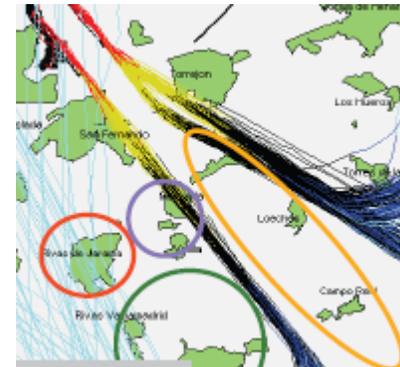
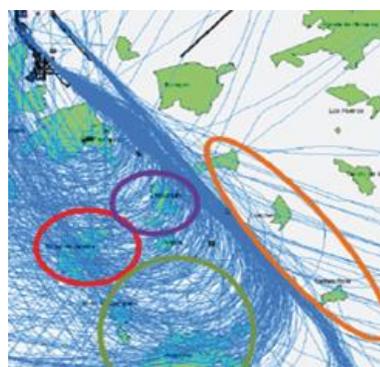


For illustration purposes

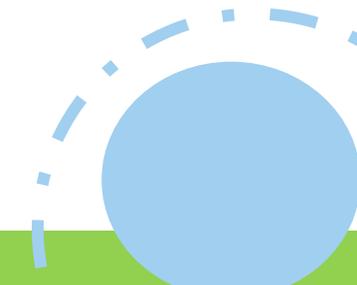
- Noise contour is the area influenced by the same noise level



Before noise abatement After noise measures

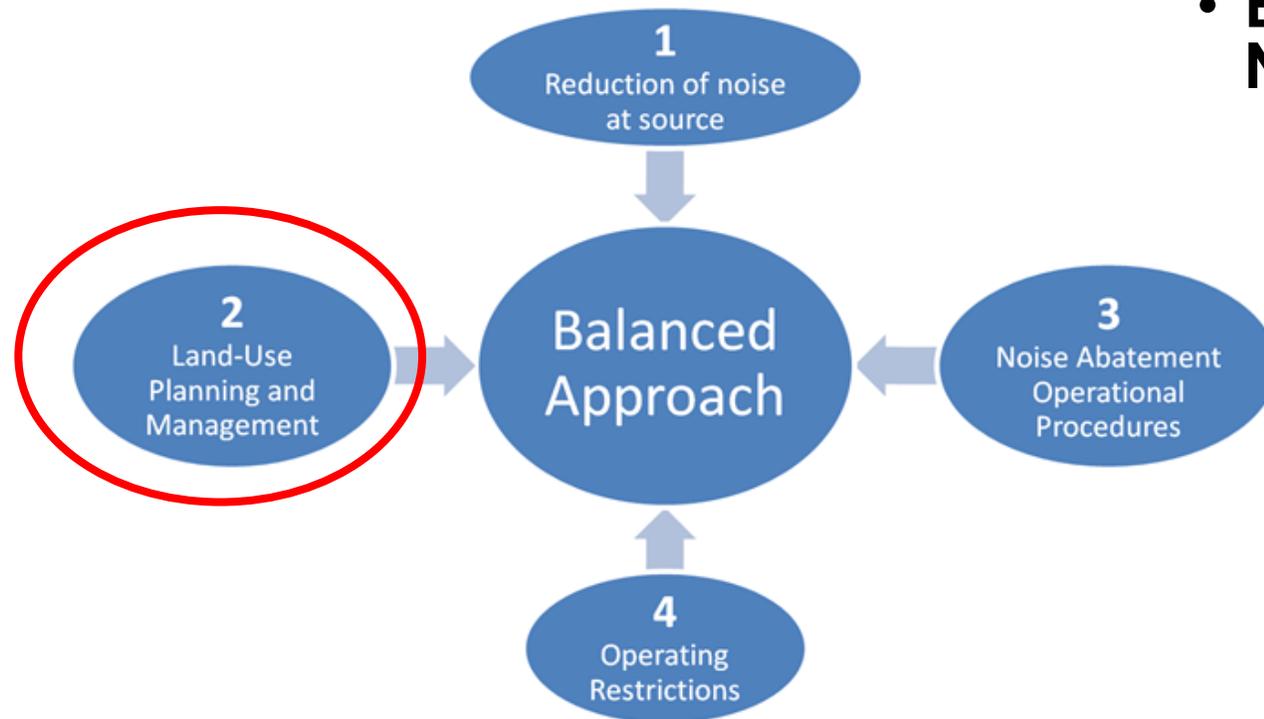


Longer trajectories =
More fuel burn



Aircraft noise

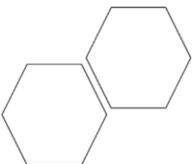
- the most significant cause of adverse community reaction related to the operation and expansion of airports.



• **Balanced Approach to Aircraft Noise Management**

- main overarching ICAO policy on aircraft noise;
- adopted by the ICAO Assembly in its 33rd Session (2011) and reaffirmed in all the subsequent Assembly Sessions;
- ICAO Doc 9829- *Guidance on the balanced approach to aircraft noise management*

Four principal elements of the Balanced Approach to Aircraft Noise Management



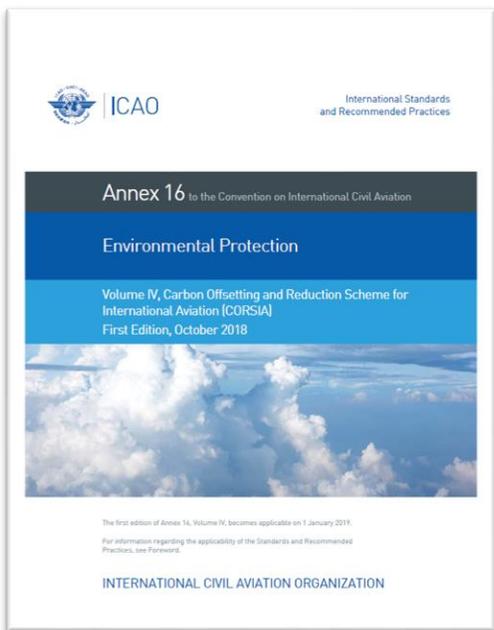
!!! To the extent that safety and operational considerations permit



- The compatibility of an airport with its environs:
 - achieved by proper planning of the airport, management of pollution-generating sources, and land-use planning of the area surrounding the airport
 - “**Land-use planning**” or “planning for compatible land uses takes into account the needs of airport development”
 - more adequately describes the **process of achieving an optimum relationship between an airport and its environs**

Annex 16, Vol II

Purpose of Volume II



– **Burning of hydrocarbons in aircraft engines emits gaseous and Particulate Matter (PM);**

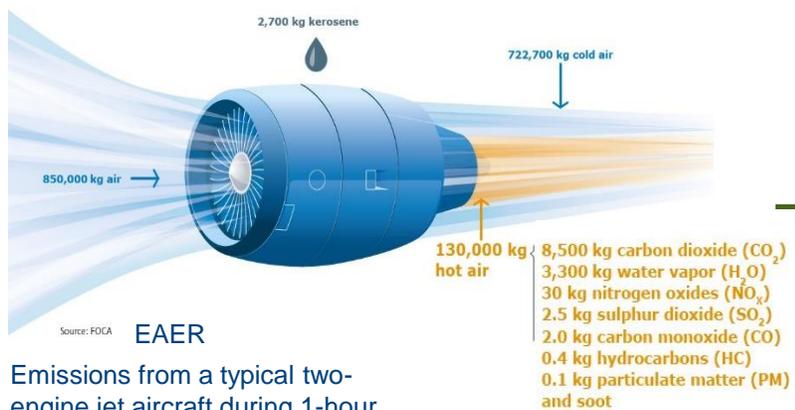
- PM- small particles of solid or liquid suspended in the air that do not sink to the ground directly but stay in the atmosphere for a while;
- Non-volatile PM (nvPM)- Emitted particles that exist at a gas turbine engine exhaust nozzle exit plane that do not volatilize when heated to a temperature of 350°C

– **emissions standards have an impact on the air quality around airports:**

- Goal b) to limit or reduce the impact of aviation emissions on local air quality (LAQ);

– **main gaseous exhaust emissions from jet engines:**

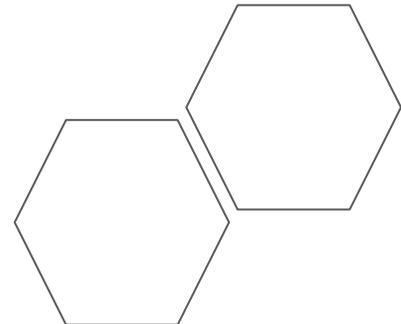
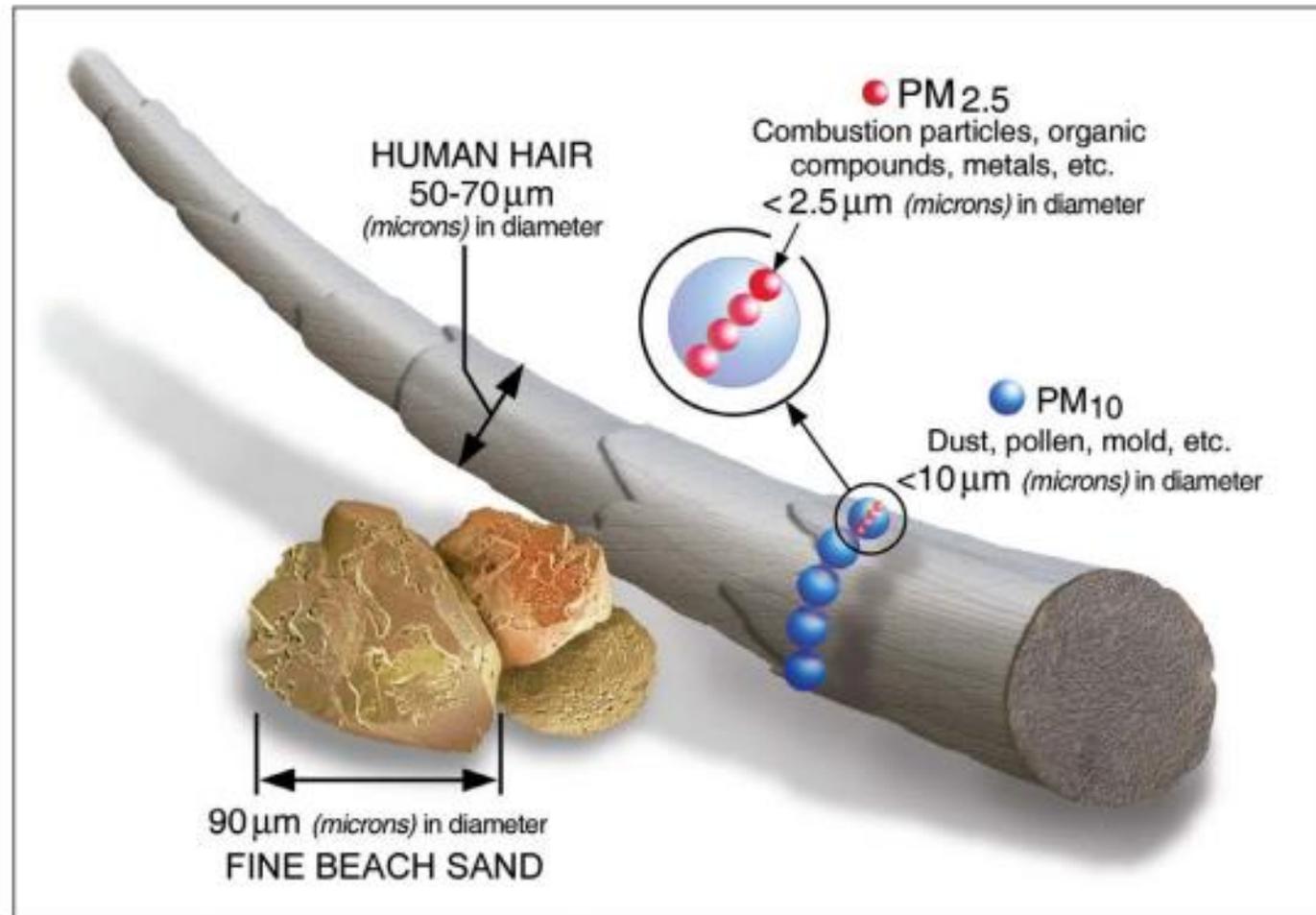
- hydrocarbons (HC), oxides of nitrogen (NO_x), carbon monoxide (CO)



Source: FOCA EAER

Emissions from a typical two-engine jet aircraft during 1-hour flight with 150 passengers

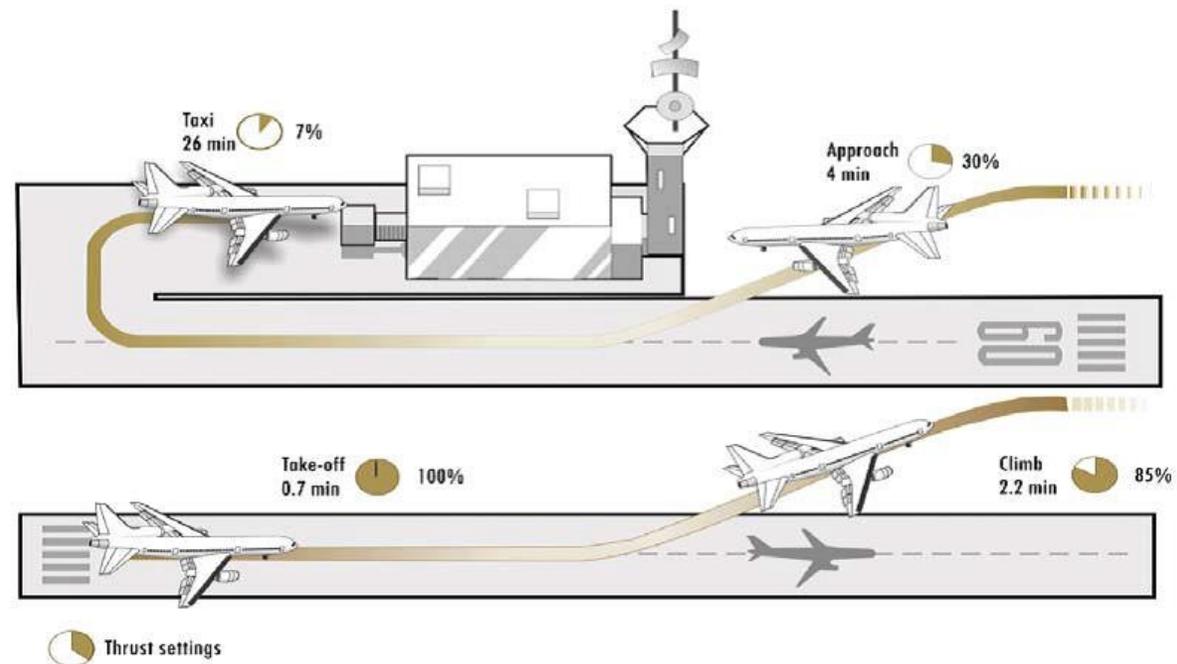
Comparison of particle sizes from different sources (from US EPA)



Local Air Quality (LAQ)

Focus on the effects of aircraft engine emissions released below 3 000 ft.
Landing and Take Off Cycle (LTO) (around airports)

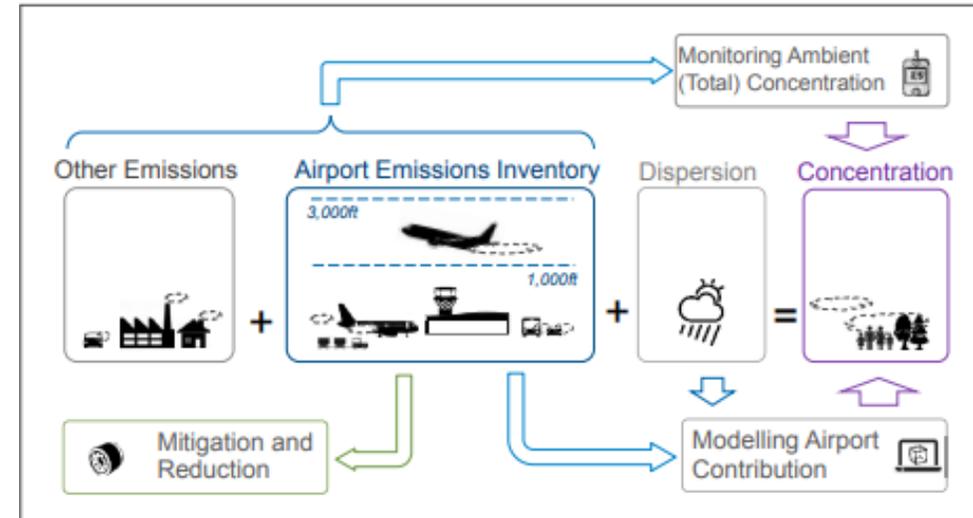
This LTO cycle representing pollutant emissions in the vicinity of airports consists of four operating modes, which involve a thrust setting and a time-in mode



ICAO emissions certification procedure representing the LTO cycle

Update of ICAO's Airport Air Quality Manual (Doc 9889)

Airport Air Quality Manual provides guidance and essential information for ICAO Member States to implement **best practices with respect to airport-related air quality**



Local air quality elements and their interactions (figure courtesy of E. Fleuti, Zurich Airport)

Other considered sources of airport **emissions include**

- ground service vehicles and airside ground transportation;
- de-icing and refueling operations, which produce evaporative emissions of non-volatile organic compounds



Airport Planning Manual, Part 2 (Doc 9184) that focuses on land use and environmental management on and around an airport

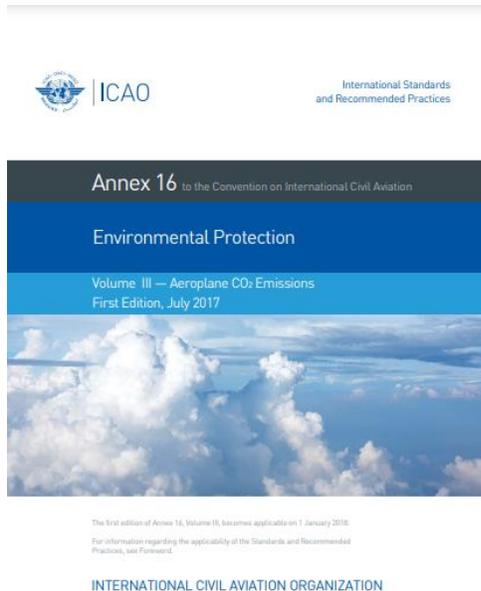
- Environmental Impacts Associated with Aviation Activities
- Environmental Management Measures and Considerations
- Infrastructure for Environmental Management
- Land Use
- Land-Use Planning
- Land-Use Administration
- Heritage Considerations
- Climate Change Resilience and Adaptation



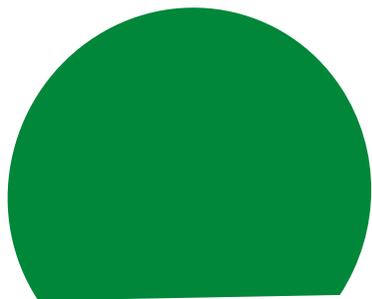
Annex 16, Vol III

Purpose of Volume III- certification standard for aeroplane CO₂ emissions based on the consumption of fuel

- Resolution A36-22:
- the establishment of a process which led to the development and recommendation to the Council a Programme of Action on International Aviation and Climate Change and
- a common strategy to limit or reduce greenhouse gas emissions attributable to international civil aviation.
- one of the recommended elements within the ICAO Programme of Action on International Aviation and Climate Change:
 - the development of an aeroplane CO₂ Standard as part of the range of measures for addressing greenhouse gas emissions from international aviation



Q&A





Thank You