ICAO actions and initiatives on climate change

Accra, Ghana
23 August 2008

Jane Hupe, Chief Environmental Unit
ICAO - International Civil Aviation Organization
Contents

- ICAO’s environmental activities
- Aviation data
- Scientific background
- Measures to address aviation GHG emissions
  - Technology
  - Operational
  - Market-based measures
- Group on International Aviation and Climate Change (GIACC)
- The way forward
Air transport key figures

- 2.2 billion passengers transported by air annually
- Total scheduled passenger traffic worldwide forecast to increase at an average annual rate of 4.6% (2005–2025)
- International traffic: 60% scheduled passenger traffic; 83% of freight air traffic
ICAO

- Established by the “Chicago Convention”
- UN specialized agency
- 190 Contracting States
- 86 International Organizations
- Safety is paramount
- Environmental Policies and Standards since early 70’s
- Special circumstances of developing Countries
Environmental Protection

- **Key Strategic Objective**: minimize the adverse effect of global civil aviation on the environment

- **ICAO GHG goal**: to limit or reduce the impact of aviation GHG emissions on global climate

- **Standards**: Annex 16 - *Environmental Protection, Volume II — Aircraft Engine Emissions*

- **ICAO Env. Policy**: Assembly Res. A36-22 - *Consolidated statement of continuing policies and practices related to environmental protection*
ICAQ Policies and Standards

Assembly Resolutions in Force
(as of September 2007)

Published by authority of the Secretary General

International Civil Aviation Organization

Doc 9902
A36-22: Consolidated statement of continuing ICAO policies and practices related to environmental protection
Main scientific reports

- 1999 IPCC Special Report on Aviation and the Global Atmosphere
- IPCC Fourth Assessment Report – Climate Change 2007
- IPCC 2006 Guidelines for National Greenhouse Gas Inventories
- Transport sector accounts for 23% of global GHG
- Aviation accounts for 2% of worldwide CO₂ emissions from fossil fuel use
- Could reach 3% by 2050
- International Aviation CO₂ < 2%
Aviation emissions
Kyoto Protocol

- Domestic aviation - within States territory - included as part of the national totals
- International aviation – beyond States boundaries – not included in national totals, just reported
International aviation emissions
- Kyoto Protocol art 2.2

“Pursue limitation or reduction of emissions of greenhouse gases from aviation bunker fuels, working through ICAO”
COOPERATION WITH UNFCCC/IPCC

- Methodological issues
- Data Quality
- Split Domestic/international
- SBSTA – no progress since SBSTA22
ICAO fuel consumption estimates

- ICAO develops fuel consumption estimates by:
  - City-pair
  - Traffic flow
  - Country of departure, arrival
  - Country of airline registration
  - International / domestic

- Estimates based on airline schedules:
  - Non-scheduled (charter) flights are not accounted for
  - Flight cancellations are not accounted for
  - Flights additions are not accounted for
Fuel consumption - top 10 countries by category of service (by country of departure)

<table>
<thead>
<tr>
<th>Cargo Services</th>
<th>Fuel*</th>
<th>International+</th>
<th>Fuel*</th>
<th>Domestic</th>
<th>Fuel*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. United States</td>
<td>7 750</td>
<td>1. United States</td>
<td>20 220</td>
<td>1. United States</td>
<td>46 613</td>
</tr>
<tr>
<td>2. China</td>
<td>2 956</td>
<td>2. United Kingdom</td>
<td>10 611</td>
<td>2. China</td>
<td>6 979</td>
</tr>
<tr>
<td>4. Korea</td>
<td>1 111</td>
<td>4. Germany</td>
<td>7 088</td>
<td>4. Russia</td>
<td>3 006</td>
</tr>
<tr>
<td>5. Japan</td>
<td>994</td>
<td>5. Japan</td>
<td>6 774</td>
<td>5. Australia</td>
<td>1 930</td>
</tr>
<tr>
<td>7. Netherlands</td>
<td>725</td>
<td>7. Spain</td>
<td>3 693</td>
<td>7. Brazil</td>
<td>1 672</td>
</tr>
<tr>
<td>8. France</td>
<td>605</td>
<td>8. Singapore</td>
<td>3 531</td>
<td>8. Indonesia</td>
<td>1 257</td>
</tr>
<tr>
<td>10 Luxemburg</td>
<td>457</td>
<td>10 Netherlands</td>
<td>3 249</td>
<td>10 Spain</td>
<td>1 209</td>
</tr>
</tbody>
</table>

*Fuel consumption expressed in millions liters

Source: ICAO based on OAG timetable +Including Domestic legs of International Services
## Fuel consumption - top 20 countries of departure

<table>
<thead>
<tr>
<th>Country of departure</th>
<th>Fuel*</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>74,584</td>
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<tr>
<td>China</td>
<td>18,282</td>
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<tr>
<td>United Kingdom</td>
<td>11,804</td>
</tr>
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<td>Japan</td>
<td>11,678</td>
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<tr>
<td>Germany</td>
<td>8,611</td>
</tr>
<tr>
<td>France</td>
<td>6,715</td>
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<tr>
<td>Australia</td>
<td>5,354</td>
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<tr>
<td>Canada</td>
<td>5,121</td>
</tr>
<tr>
<td>Spain</td>
<td>4,953</td>
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<td>Russia</td>
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<td>Korea</td>
<td>4,037</td>
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<td>Netherlands</td>
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<td>Italy</td>
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<td>Thailand</td>
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<td>Brazil</td>
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<td>India</td>
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<td>Mexico</td>
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<td>Malaysia</td>
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</table>

*Fuel consumption expressed in millions liters

Source: ICAO, based on OAG timetable
# Fuel consumption by top 10 airlines

<table>
<thead>
<tr>
<th>AIRLINE</th>
<th>Fuel*</th>
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<tbody>
<tr>
<td>1. American Airlines</td>
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<tr>
<td>2. United Airlines</td>
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<tr>
<td>3. Delta Airlines</td>
<td>8 465</td>
</tr>
<tr>
<td>4. British Airways</td>
<td>7 172</td>
</tr>
<tr>
<td>5. Northwest Airline</td>
<td>6 731</td>
</tr>
<tr>
<td>6. Lufthansa</td>
<td>6 565</td>
</tr>
<tr>
<td>7. Air France</td>
<td>6 167</td>
</tr>
<tr>
<td>8. Southwest</td>
<td>5 412</td>
</tr>
<tr>
<td>9. Singapore Airlines</td>
<td>5 386</td>
</tr>
<tr>
<td>10. Continental</td>
<td>5 263</td>
</tr>
</tbody>
</table>

*Source: ICAO based on OAG timetable*

*Fuel consumption expressed in millions liters*
Annex 1 emissions

- Annex 1 International aviation emissions of CO2

Source: UNFCCC (data excludes the Russian Federation)
ICAO work on the environment

- CAEP – Committee on Aviation Environmental Protection
- Measures to address emissions
- GIACC
CAEP

1970 CAN (Noise)

1977 CAEE (Emissions)

1983 CAEP

- Technical feasibility
- Environmental effectiveness
- Economic reasonableness
- Interdependencies of measures
## CAEP 22 Members and Observers

<table>
<thead>
<tr>
<th>Argentina</th>
<th>Germany</th>
<th>Singapore</th>
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<tbody>
<tr>
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# CAEP Members and 13 Observers

<table>
<thead>
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<th>Country</th>
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<td>IBAC</td>
<td>WMO</td>
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<tr>
<td>CANSO</td>
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</tbody>
</table>
ICAO policy options to reduce emissions

- Technology and Standards
- Operational Measures
- Market-based Measures:
  - Voluntary measures
  - Emissions charges
  - Emissions trading
Technology and Standards

- Emissions database available from ICAO website
- Emissions standards: NO\textsubscript{x}, HC, CO and smoke
- Mid and long term goals (10 and 20 years)

Annex 16
Vol. II

Doc 9646

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO ENGINE
EXHAUST EMISSIONS
DATA BANK

FIRST EDITION — 1996

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO Aircraft Engine Emissions Database

This Database contains information on exhaust emissions of only those aircraft engines that have entered production. The information was provided by engine manufacturers, who are solely responsible for its accuracy. It was collected in the course of the work carried out by the ICAO Committee on Aviation Environmental Protection (CAEP) but has not been independently verified unless indicated. The ICAO is hosting this Database on behalf of CAEP and is not responsible for the contents.

Introduction
Background information for the ICAO Aircraft Engine Emissions Database.

Aircraft Engine Emissions Individual Datasheets
The information was obtained from engine manufacturers by the ICAO Committee on Aviation Environmental Protection (CAEP).

ICAO Aircraft Engine Emissions Database
Emailed this Datasheets.
Work in progress on technology and standards - 2010

- CO₂ / fuel efficiency metrics and parameters
- Fuel burn Technology Goals
- Environmental impact of alternate fuels
- New NOx Stringency (to be included in Annex 16)
- Review of NOx Technology Goals
- New Environmental Technical Manual for emissions
Summary of achievements on technology and Standards

- New aircraft obligatory certificated by ICAO Standards- resulting in more efficient, cleaner aircraft
- Passenger jet aircraft produced today are 70% more fuel efficient than those produced 40 years ago, and continued improvement is expected
- Increased stringency of NOx Standard by about 40%
Operational measures

- CO₂ emissions are directly proportional to fuel burn
  - 1 tonne of fuel is equivalent to 3.16 tonnes of CO₂

- Fuel saving opportunities come from improvements in air traffic management (ATM) e.g. more direct routings and the use of more efficient conditions such as optimum altitude and speed and other operational procedures.

- Optimize fuel consumption = reduced emissions
Global ATM Operational Concept

- **Vision Statement**

  - To achieve an interoperable global air traffic management system, for all users during all phases of flight, that meets agreed levels of safety, provides for optimum economic operations, is **environmentally sustainable** and meets national security requirements.
Next steps – ICAO role

- Support implementation of the ICAO Global Air Navigation Plan and its ATM global initiatives
- Facilitate the removal of major impediments to improving the global ATM system:
  - Encourage the organization and management of airspace based on operational requirements as opposed to national and political boundaries
  - Encourage militaries to cooperate with civil authorities so that airspace may be much more efficiently used
  - Encourage states to make funding available for local ATM improvements which should be based on clearly established performance requirements
Operational measures

- Operational Opportunities to Minimize Fuel Use and Reduce Emissions (ICAO Circular 303)
- ICAO Circular on noise and emissions effects from NADPs
Work in progress on operational measures - 2010

- Fuel burn operational goals
- New guidance on CDA – Continuous Descent Arrival
- Global plan and support to regional/state implementation of the operational concept
- Guidance on computing, assessing, and reporting on aviation emissions
- Environmental indicators
- Update of Circular 303
Market Based Measures (MBMs)

- **Voluntary Measures – ICAO Template**
  - government and other entity agree to take specified actions or meet specified goals

- **Emissions Charges**
  - a charge on the amount of emissions
  - revenues used to mitigate the environmental impact of engine emissions

- **Emissions Trading**
  - the total amount of emissions would be capped
  - allowances in the form of permits could be bought and sold to meet emission reduction objectives
  - open trading allows trading across sectors
ICAO Documents on MBMs

- Report on Voluntary Emissions Trading for Aviations (ICAO website)

- Emissions Trading Guidance (Doc 9885)

- Local Air Quality Emission Charges Guidance (Doc 9884)

- ICAO Policy on Charges for Airports and Air Navigation Services (Doc 9082)
Work in progress on market based measures - 2010

- 3 Scoping Studies
  - 1. Issues related to linking GHG emissions trading schemes including aviation
  - 2. Potential for emissions offset measures to mitigate effects of aviation on climate change
  - 3. Potential for using emissions trading and offsets to address local air quality

- Updated Report
  - 1. Report on Voluntary Emissions Trading
ICAO has developed a methodology to calculate the carbon dioxide emissions from air travel for use in offset programmes.

The ICAO Carbon Emissions Calculator allows passengers to estimate the emissions attributed to their air travel. It is simple to use and requires only a limited amount of information from the user.

The methodology applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried.

For additional information, please see the accompanying methodology to the ICAO Carbon Emissions Calculator.

You can find your carbon footprint by entering your city of origin and destination

**From:** MONTREAL (YUL)  **To:** TORONTO (YYZ)

**From:** TORONTO (YYZ)  **To:** SAO PAULO (GRU)

My ticket is:  
- Economy Class
- Premium Class (Economy Premium, Business, or First)

Number of passengers: 1

Click here to read the ICAO Methodology

www.icao.int
Future developments

- Public consultation
- Periodic updates (6 months basis)
- Consult with the IPCC on the use of multipliers
- Explore the use of carbon offsets
- Consult with UNFCCC on the link to adaptation fund
Mr. Yvo de Boer addressed the key issues related to aviation emissions and carbon markets.

A variety of approaches including emissions trading and carbon offset programmes were addressed, together with a broad discussion on other Kyoto flexible mechanisms and the opportunities for a global aviation carbon market.

Workshop also discussed the possible funding mechanisms for mitigation and adaptation.
GIACC - Group on action on International Aviation and Climate change - (Appendix K)

- New group established in 2007 to develop and recommend to ICAO an aggressive Programme of Action on International Aviation and Climate Change (GIACC)
- GIACC is composed of senior government officials representative of all ICAO regions, with the equitable participation of developing and developed States
GIACC/1 (Feb 08) reviewed aviation emissions-related activities within ICAO and internationally

- GHG on going activities in CAEP
- Cooperation with UN Bodies (UNFCCC/IPCC)
- Information on National/regional activities
- Information from Industry on possible actions to reduce aviation emissions (airlines; airports; air navigation services and business aviation);
- Discussion on elements of a framework for action;
- Aspirational goals
2nd GIACC meeting

- Held in July 2008
- UNFCCC participation
- Work progressed towards the establishment of aspirational goals
- 3 working groups were agreed upon:
  - Global aspirational goals
  - Measures to achieve reductions
  - Means to evaluate progress
- Next meeting – February 2009
**PARALLEL PROCESS**

<table>
<thead>
<tr>
<th>ICAO/GIACC PROCESS</th>
<th>UNFCCC PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIACC/1 – 25-27 Feb08</td>
<td>AWG5KP/LCA/1 – 31Mar-4Apr08</td>
</tr>
<tr>
<td>GIACC/2 – 14-16 Jul08</td>
<td>AWKPG5/LCA/2 – 2-13 Jun08</td>
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<tr>
<td>GIACC/3 – 16-18 Feb09</td>
<td>AWGKP6/LCA/3 – 21-27 Aug08</td>
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<td>GIACC/4 – 1-3 Jun09</td>
<td>AWGKP6/LCA/4 – 1-12 Dec08</td>
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<td>High Level Meeting in connection with COP/15 (date tbd)</td>
<td>AWGKP7/LCA/5 – Mar09</td>
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<td>CAEP/8-Feb10</td>
<td>AWGKP7/LCA/6 – 1-12Jun09</td>
</tr>
<tr>
<td>CAEP/8-LCA/8 – 30Nov/11Dec09 (COP/15)</td>
<td>WORKSHOPS / INFORMAL GROUPS</td>
</tr>
</tbody>
</table>
ICAO

- develops Standards, guidance and policies for use by States and the industry in addressing GHG emissions
- has the expertise, the fora and structure to address international aviation emissions
- is cooperating with the UNFCCC and developing an aggressive Programme of action on aviation and climate change to be considered in connection with COP/15 in 2009
Aviation & the Environment

Though its CO₂ and NOₓ impact is less than those of other industries and transport sectors, aviation continues to take bold steps toward aggressive targets as its global stakeholders confront the technological and leadership challenges of climate change.

In this issue:
- ICAO’s Environmental Leadership
- EU and US Climate Change Strategies
- What Science is Saying
- Olivier Boucher: Boeing and Airbus Initiatives
- Overview of Engine Advances and Planning
- CANSO Perspective
- Advances Through ICAO Implementation (TCB)
- IFALPA UAV Feature
- Message from UNFCCC Executive Secretary, Yvo de Boer
THANK YOU