



# **ICAO actions and initiatives on climate change**



**Accra, Ghana**

**23 August 2008**

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**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



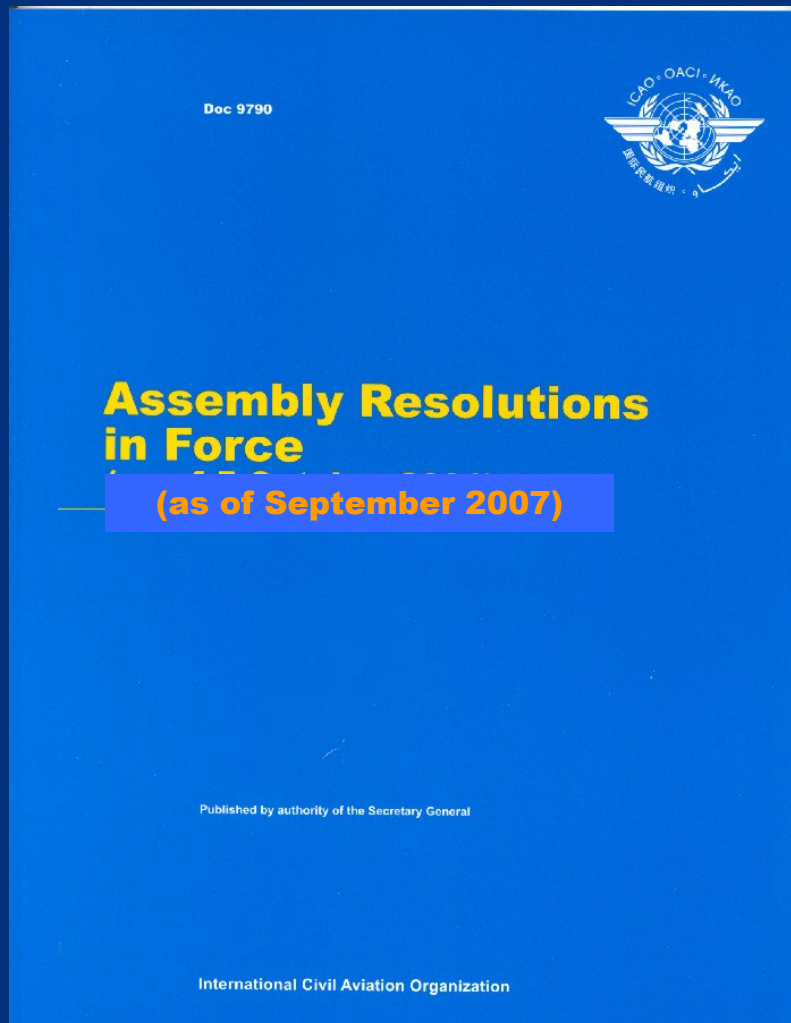
- Established by the “Chicago Convention”
- UN specialized agency
- 190 Contracting States
- 86 International Organizations
- Safety is paramount
- Environmental Policies and Standards since early 70's
- Special circumstances of developing Countries

# 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*

# ICAO Policies and Standards

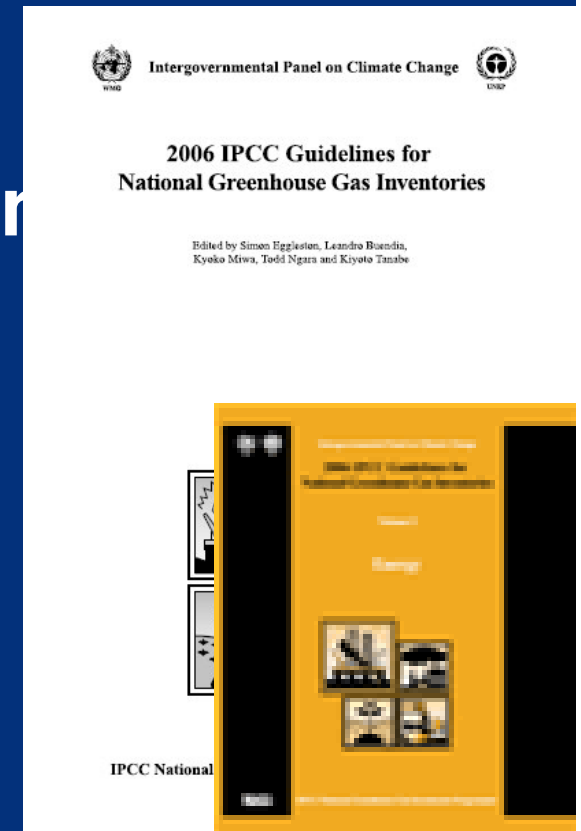
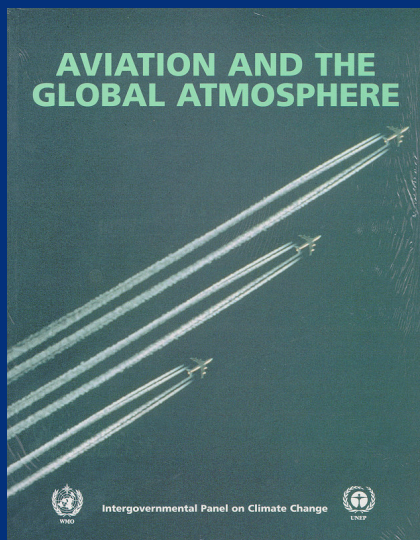


**Doc 9902**  
**A36-22: Consolidated**  
**statement of**  
**continuing ICAO**  
**policies and practices**  
**related to**  
**environmental**  
**protection**

# 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

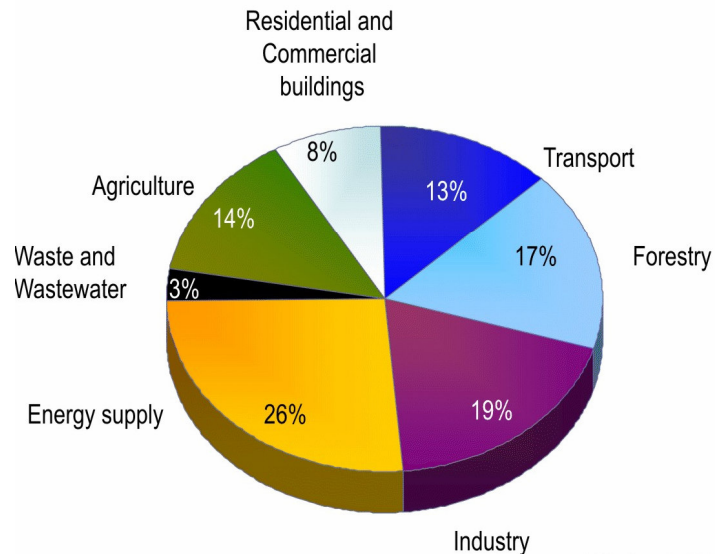




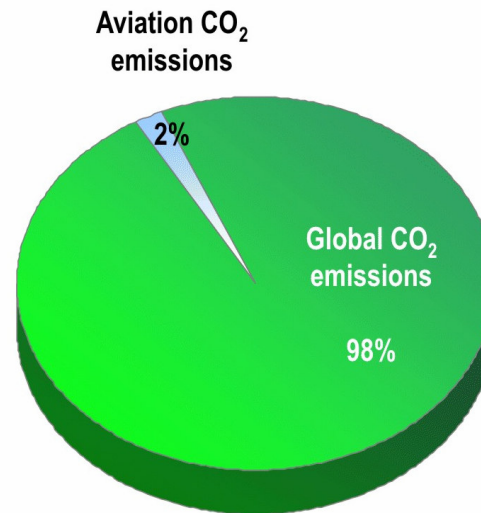
# Key data – IPCC



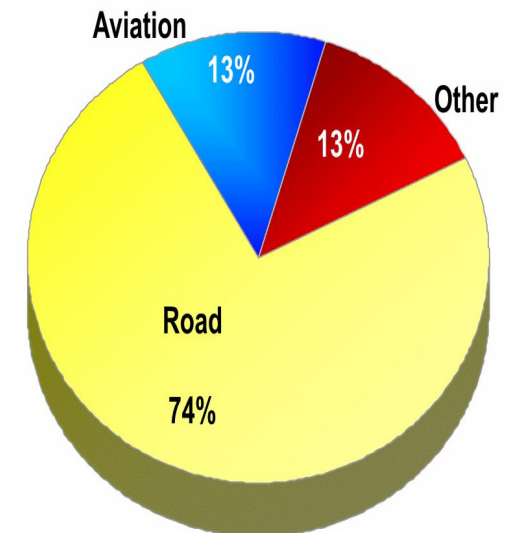
Global GHG by Section, 2004 (IPCC)



Part of Aviation Global CO<sub>2</sub> Emissions



Global CO<sub>2</sub> emissions per transport (%)



- Transport sector accounts for 23% of global GHG
- Aviation accounts for 2% of worldwide CO<sub>2</sub> emissions from fossil fuel use
- Could reach 3% by 2050
- International Aviation CO<sub>2</sub> < 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)

PASSENGER SERVICES					
Cargo Services		Fuel*	International+		Fuel*
Domestic		Fuel*			
1.	United States	7 750	1.	United States	20 220
2.	China	2 956	2.	United Kingdom	10 611
3.	United Arab Emirates	1 611	3.	China	8 346
4.	Korea	1 111	4.	Germany	7 088
5.	Japan	994	5.	Japan	6 774
6.	Germany	812	6.	France	5 412
7.	Netherlands	725	7.	Spain	3 693
8.	France	605	8.	Singapore	3 531
9.	India	481	9.	Thailand	3 255
10	Luxemburg	457	10	Netherland	3 249
1.	United States	46 613	2.	China	6 979
3.	Japan	3 910	4.	Russia	3 006
5.	Australia	1 930	6.	Canada	1 918
7.	Brazil	1 672	8.	Indonesia	1 257
9.	Mexico	1 232	10	Spain	1 209

\*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



	Country of departure	Fuel*		Country of departure	Fuel*
1.	United States	74 584	11.	United Arab Emirates	4 038
2.	China	18 282	12.	Korea	4 037
3.	United Kingdom	11 804	13.	Netherlands	3 983
4.	Japan	11 678	14.	Italy	3 974
5.	Germany	8 611	15.	Thailand	3 966
6.	France	6 715	16.	Singapore	3 889
7.	Australia	5 354	17.	Brazil	3 642
8.	Canada	5 121	18.	India	3 556
9.	Spain	4 953	19.	Mexico	3 054
10.	Russia	4 635	20.	Malaysia	2 374

\*Fuel consumption expressed in millions liters

# Fuel consumption by top 10 airlines



	AIRLINE	Fuel*
1.	American Airlines	11 490
2.	United Airlines	9 086
3.	Delta Airlines	8 465
4.	British Airways	7 172
5.	Northwest Airline	6 731
6.	Lufthansa	6 565
7.	Air France	6 167
8.	Southwest	5 412
9.	Singapore Airlines	5 386
10.	Continental	5 263

Source: ICAO based on OAG timetable

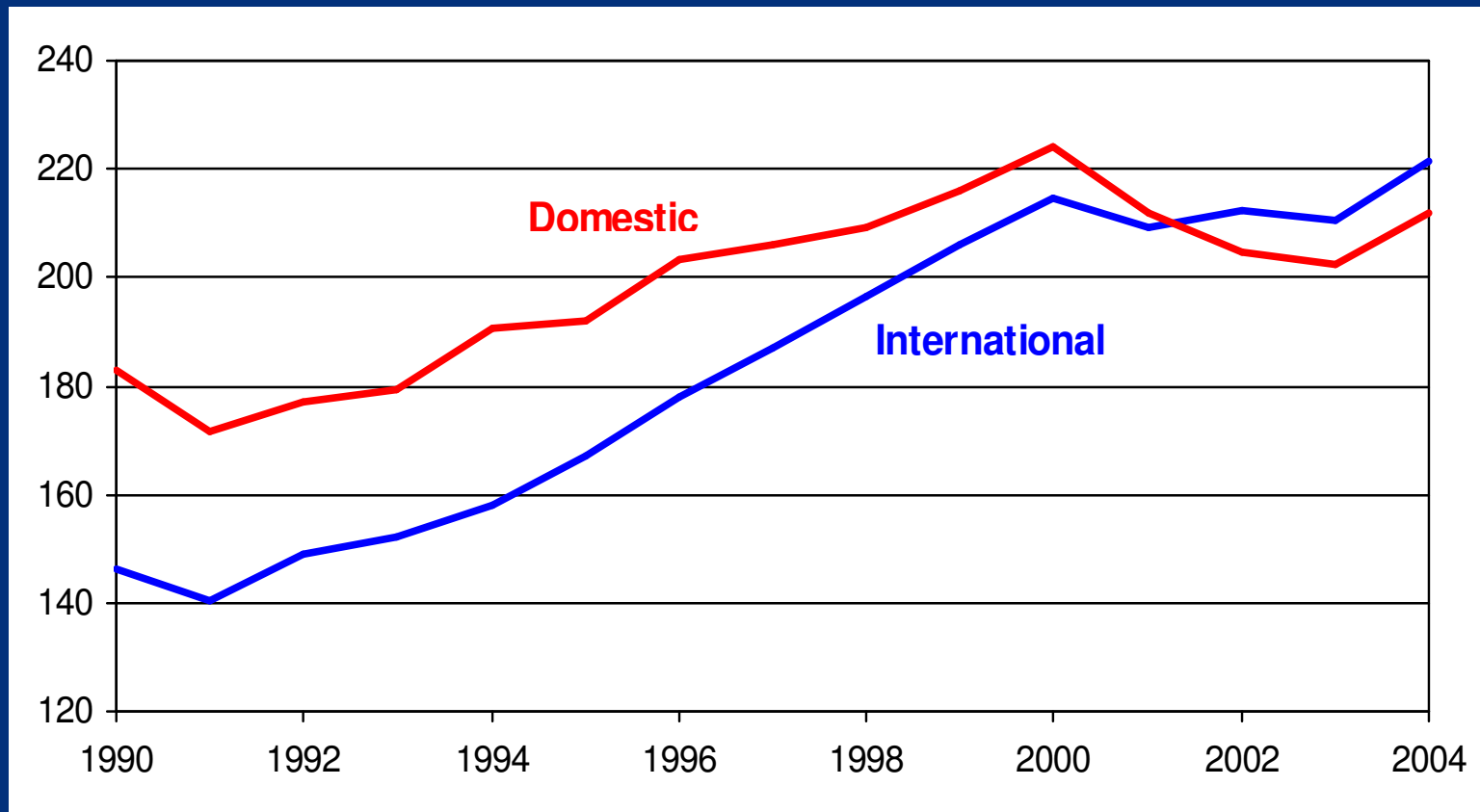
\*Fuel consumption expressed in millions liters



# Annex 1 emissions



## ■ Annex 1 International aviation emissions of CO<sub>2</sub>



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**

**Argentina**

**Australia**

**Brazil**

**Canada**

**China**

**Egypt**

**France**

**Germany**

**India**

**Italy**

**Japan**

**Netherlands**

**Poland**

**Russian Fed.**

**Singapore**

**South Africa**

**Spain**

**Sweden**

**Switzerland**

**Tunisia**

**United Kingdom**

**United States**



# **CAEP Members and 13 Observers**

**Greece**

**EC**

**ICCAIA**

**Norway**

**ICSA**

**IFALPA**

**ACI**

**IATA**

**UNFCCC**

**ACAC**

**IBAC**

**WMO**

**CANSO**



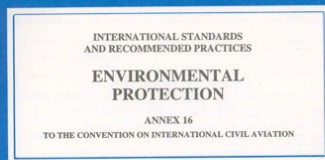
# ICAO policy options to reduce emissions

- 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<sub>x</sub>, HC, CO and smoke
- Mid and long term goals (10 and 20 years)



## Annex 16 Vol. II

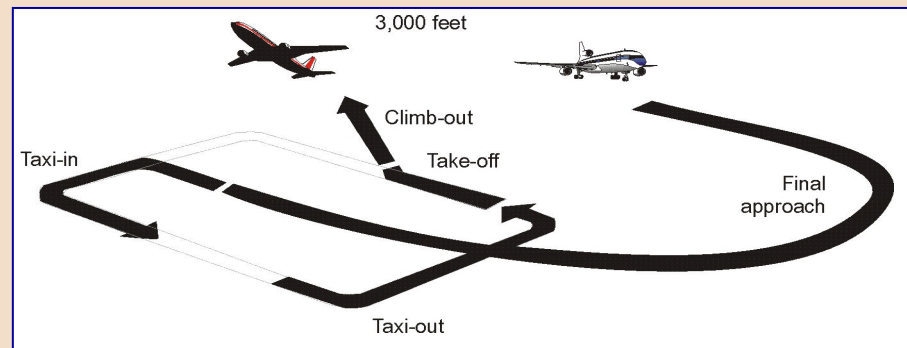
### ICAO ENGINE EXHAUST EMISSIONS DATA BANK

FIRST EDITION — 1995



## Doc 9646

INTERNATIONAL CIVIL AVIATION ORGANIZATION



#### Civil Aviation Authority

CAA Home Printer Version



#### Aircraft Engine Emissions Home Page

##### Safety Regulation

##### Environmental

- FAQs
- Documents
- Contacts
- Airworthiness Approval Notes
- Certification of Products and Modifications
- ICAO Engine Emissions Databank
- Introduction
- Individual Engine Datasheets
- Contacts
- Record of Changes

#### ICAO Aircraft Engine Emissions Databank

This DataBank 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 UK CAA is hosting this DataBank on behalf of ICAO and is not responsible for the contents.

##### Introduction

Background information for the ICAO Aircraft Engine Emissions Databank.

##### 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 Databank

Download the DataBank.

##### Search

 Go






# **Work in progress on technology and standards - 2010**

- CO<sub>2</sub> / 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 NO<sub>x</sub> Standard by about 40%



# Operational measures

- CO<sub>2</sub> emissions are directly proportional to fuel burn
  - 1 tonne of fuel is equivalent to 3.16 tonnes of CO<sub>2</sub>
- 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

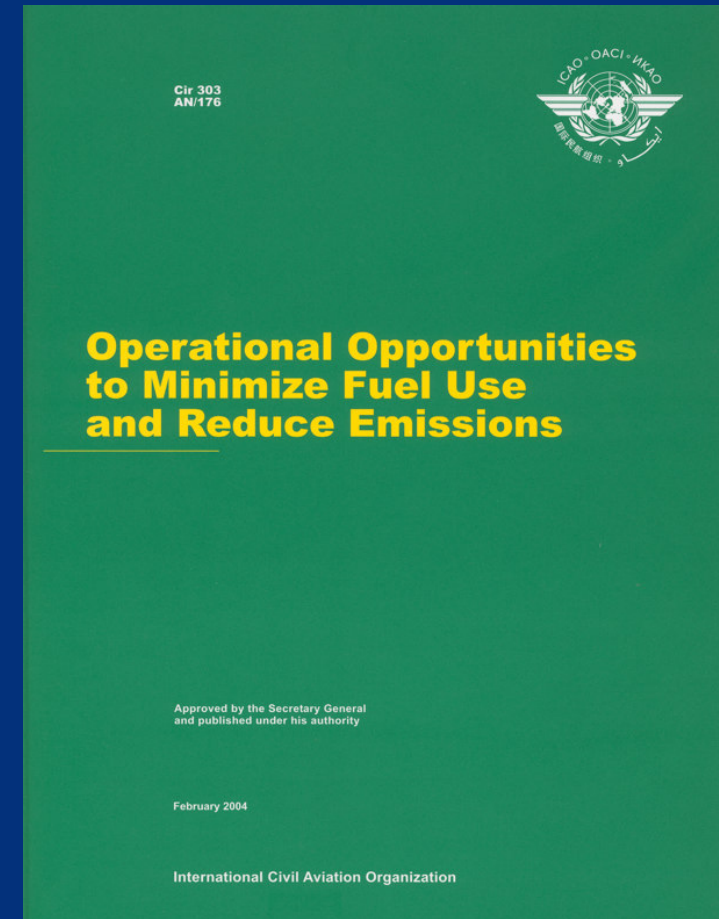


- Support implementation of the ICAO Global Air Navigation Plan and its ATM global initiatives
- Facilitate the removal of **major impediments** to improving the global ATM system:
  - Encourage the organization and management of airspace based on **operational requirements** as opposed to **national 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



- Global Air Navigation Plan for CNS/ATM Systems (Doc 9750)
- 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 Carbon Calculator



## ICAO CARBON EMISSIONS CALCULATOR

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



**Methodology  
available**

[Click here to read the ICAO Methodology](#)

Restart

Calculate

Add a Flight

[Help us to improve the calculator](#)

[www.icao.int](http://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



# **1st GIACC meeting Feb. 2008**



- **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**

# 2<sup>nd</sup> 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



## ICAO/GIACC PROCESS

GIACC/1 – 25-27 Feb08

GIACC/2 – 14-16 Jul08

GIACC/3 – 16-18 Feb09

GIACC/4 – 1-3 Jun09

High Level Meeting in  
connection with  
COP/15 (date tbd)

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CAEPSG/2-Sept08

CAEPSG/3-Jun09

CAEP/8-Feb10

## UNFCCC PROCESS

AWG5KP/LCA/1 – 31Mar-4Apr08

AWKPG5/LCA/2 – 2-13 Jun08

AWGKP6/LCA/3 – 21-27 Aug08

AWGKP6/LCA/4 – 1-12 Dec08

AWGKP7/LCA/5 – Mar09

AWGKP7/LCA/6 – 1-12Jun09

AWGKP8/LCA/7– Aug/Sept09

AWGKP8/LCA/8– 30Nov/11Dec09  
(COP/15)

WORKSHOPS / INFORMAL  
GROUPS



# 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

[www.icao.int/icao/env](http://www.icao.int/icao/env)



## ICAO Environmental Report 2007



# ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION



## Aviation & the Environment

Though its CO<sub>2</sub> and NO<sub>x</sub> 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

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**THANK YOU**