Aviation and GHG Emissions: Managing the Challenge of Growth

Meeting: Group on International Aviation and Climate Change

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Outline

• The Historical Record
• Some Evolving Issues
• NextGen- The US Way Forward
• Some Closing Observations
The Record: Significant Improvements

Energy Intensity Per Passenger Mile

Btu/passenger-mile


Source: FAA Emissions Primer
The Record: US Aviation GHG Emissions

Each square represents 1% of total emissions inventory

Non-Transport
- Electric Utilities
- Industry
- Agriculture
- Commercial
- Residential

Transport
- Transportation
- Aviation

Source: U.S. EPA DATA - 2005
The Record: Recent Structural Changes

Significant Restructuring US Aircraft Fleets...

...and secular change in airline fuel costs...

Source: ATA
The Record: US Aviation Emissions Growth Down

Aviation Fuel Efficiency Actual vs Target

Source: FAA

US Commercial Aviation Fuel Consumption

Source: BTS
The Record: Difference In Mature Market Performance

Percentage Change in Aviation Emissions
Growth- 2000 to 2006

Source: Volpe: Note EU 15
Evolving Issues: Multiple Environmental Challenges

Community Noise Impacts

Air Quality

Energy

Water Quality

Global Climate
Challenge: No Simple Solutions - Trade-offs in Impacts

**Continuous Descent Approach**
- Reduced Noise
- Reduced Fuel Burn/CO₂

**Improved aerodynamic efficiency and reduced weight**
- Reduced CO₂
- Reduced Noise
- Reduced NOₓ

**Nacelle Modifications**
- Reduced Noise
- Increased Fuel Burn/CO₂

**Increased engine bypass ratio**
- Reduced Fuel Burn / CO₂
- Reduced Noise
- Increased NOₓ

**Increased Engine Pressure Ratio & Temperatures**
- Reduced Fuel Burn / CO₂
- Reduced HC and CO
- Increased NOₓ

**Noise**
- Fuel Burn/CO₂
- Other Emissions
Growing Demand

- **Shift to smaller aircraft, more airports**
- **Shift to more passengers / flight**
- **2% Shift to Micro Jets**
- **Increase 10+ pax/flight**
- **Flights 1.4-3X**
- **Passengers 1.8-2.4X**

... as is the environmental footprint...

... and this is coupled with environmental capacity constraints.

<table>
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<tr>
<th>Preliminary Emissions for NextGen 2X Growth Scenario</th>
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<tr>
<td>HC</td>
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<td>CO</td>
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Source: NextGen Integrated Plan, 2004

Ozone PM 2.5

Airports with Restrictions

Compiled by Tam et al., 2007 from Boeing data 9/13/05
NextGen Vision

*Provide environmental protection that allows sustained aviation growth*

Key Initiatives:

- Better Scientific Understanding
- Accelerate ATM Modernization
- Encourage New Aircraft Technology
- Develop Alternative Fuels
- Consider Cost-Beneficial Market-Based Measures
- Accelerate International Collaboration
The Way Forward: Understanding the Problem

- Better science-based understanding of the impacts of aviation emissions on climate change
- Improved metrics, measurement techniques, and modeling capability to quantify and predict impacts and to understand inter-relationships of aviation environmental factors
Opportunities

- New technologies to improve air traffic management will help reduce emissions. An example is RVSM – Reduced Vertical Separation Minimums. Full implementation of RVSM may reduce fuel use by ~300 million gallons each year.
- Other operational approaches, such as continuous descent arrivals, can reduce fuel burn as well as noise.
- Reducing congestion, and optimizing airport ground and terminal air space operations offer great promise for future reductions of noise and emissions.
Opportunities

• Historically new technology accounts for 90% of environmental footprint reduction

• New concepts offer promise for improvement

• Collaborative demonstrations with industry can stimulate technology transition

• Need a balance in maturing technologies and enabling revolutionary concepts
The Way Forward: Pursuit of New Fuels

• Synthetic Fuels May Be More Environmentally Friendly
• Looking at the Full Range of fuels
• Helps Manage Interdependencies
• Enhances Energy Security
• Commercial Aviation Alternative Fuel Initiative
The Way Forward: Market-Based Measures (MBMs)

- US believes MBMs can have a role.
- MBMs should not be a first resort.
- MBMs should be cost-beneficial in their application.
- Applying MBMs to another country’s airlines should be consistent with ICAO guidance and only on the basis of mutual consent.
- Need to think about positive incentives for technology change.
The Way Forward: International Collaboration

Work through various ICAO activities to develop and implement a credible, global framework for the aviation community to address greenhouse gas emissions.

Conduct research to identify and better measure the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems. Cooperative efforts ongoing with numerous countries, research organizations, and industry around the globe.

The Atlantic Interoperability Initiative to Reduce Emissions (AIRE) seeks to accelerate development of operational procedures that will reduce aviation’s environmental footprint on a “gate-to-gate” basis- covering each stage of aircraft operations: surface, departure, enroute, and arrival.
Some Closing Observations

• Aviation greenhouse gas emissions may prove the most significant long-term challenge to growth.

• It’s critical we understand impacts and have robust information and good metrics.

• International goals in efficiency or emission intensity should be considered.

• As with noise, there is no “one best solution” and various countries’ solution set will differ.

• Technology and operational improvements- with alternative fuels- could eliminate need for demand reducing market-based measures.

• Need to identify accelerate opportunities for international collaboration.