Aviation and Climate Change - Managing the Challenge of Growth

Meeting: Eco-Aviation 2010
By: Carl Burleson, Director, Office of Environment and Energy
Date: June 24, 2010
Outline

- Historical U.S. Aviation Performance
- The Evolving Challenges
- U.S. Way Forward: NextGen
- International Update
- Some Closing Observations
U.S. Experience: Tremendous Gains in Efficiency

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2007, Table 4-20: Energy Intensity of Passenger Modes (Btu per passenger-mile)

U.S. Experience: Absolute Reductions in Fuel Burn

U.S. Commercial Aviation Fuel Use

Year

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

Millions of Gallons

Source: Bureau of Transportation Statistics
The Challenge: Global Fuel Use Forecast to Grow

Global Fuel Use (billion kg per annum)

- FESG Baseline: Baseline Fuel Price
- FESG Baseline: Baseline Fuel Price, Low Trend Technology
- APO Reduced Trend Baseline: Baseline Fuel Price, Low 1% Trend Technology
- Strong Plus: Baseline Fuel Price, 1.5% Trend Technology
- Strong Plus: High Plus Fuel Price, 1.5% Trend Technology

Source: FAA Preliminary Analysis
The Challenge: Growing Role of Developing Countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>RPKs</th>
<th>% RPKs</th>
<th>Cum %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UNITED STATES</td>
<td>1244694456</td>
<td>33.43%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>EU</td>
<td>909917091</td>
<td>24.44%</td>
<td>57.9%</td>
</tr>
<tr>
<td>3</td>
<td>CHINA</td>
<td>272563311</td>
<td>7.32%</td>
<td>65.2%</td>
</tr>
<tr>
<td>4</td>
<td>JAPAN</td>
<td>153288868</td>
<td>4.12%</td>
<td>69.3%</td>
</tr>
<tr>
<td>5</td>
<td>AUSTRALIA</td>
<td>99614166</td>
<td>2.68%</td>
<td>72.0%</td>
</tr>
<tr>
<td>6</td>
<td>CANADA</td>
<td>94680009</td>
<td>2.54%</td>
<td>74.5%</td>
</tr>
<tr>
<td>7</td>
<td>SINGAPORE</td>
<td>82904045</td>
<td>2.23%</td>
<td>76.7%</td>
</tr>
<tr>
<td>8</td>
<td>REPUBLIC OF KOREA</td>
<td>69292450</td>
<td>1.86%</td>
<td>78.6%</td>
</tr>
<tr>
<td>9</td>
<td>UNITED ARAB EMIRATES</td>
<td>65121483</td>
<td>1.75%</td>
<td>80.3%</td>
</tr>
<tr>
<td>10</td>
<td>RUSSIAN FEDERATION</td>
<td>63192258</td>
<td>1.70%</td>
<td>82.0%</td>
</tr>
<tr>
<td>11</td>
<td>THAILAND</td>
<td>50809492</td>
<td>1.36%</td>
<td>83.4%</td>
</tr>
<tr>
<td>12</td>
<td>BRAZIL</td>
<td>50688932</td>
<td>1.36%</td>
<td>84.8%</td>
</tr>
<tr>
<td>13</td>
<td>MALAYSIA</td>
<td>49578130</td>
<td>1.33%</td>
<td>86.1%</td>
</tr>
<tr>
<td>14</td>
<td>INDIA</td>
<td>46150555</td>
<td>1.24%</td>
<td>87.3%</td>
</tr>
<tr>
<td>15</td>
<td>MEXICO</td>
<td>34122966</td>
<td>0.92%</td>
<td>88.3%</td>
</tr>
<tr>
<td>16</td>
<td>SOUTH AFRICA</td>
<td>29191380</td>
<td>0.78%</td>
<td>89.0%</td>
</tr>
<tr>
<td>17</td>
<td>INDONESIA</td>
<td>28243288</td>
<td>0.76%</td>
<td>89.8%</td>
</tr>
<tr>
<td>18</td>
<td>NEW ZEALAND</td>
<td>26092980</td>
<td>0.70%</td>
<td>90.5%</td>
</tr>
<tr>
<td>19</td>
<td>TURKEY</td>
<td>24297389</td>
<td>0.65%</td>
<td>91.2%</td>
</tr>
<tr>
<td>20</td>
<td>SAUDI ARABIA</td>
<td>23793457</td>
<td>0.64%</td>
<td>91.8%</td>
</tr>
</tbody>
</table>
The Challenge: Energy Costs Shaping the Industry

Fuel vs. Labor Costs

- 0.50
- 1.00
- 1.50
- 2.00
- 2.50
- 3.00
- 3.50
- 4.00
- 4.50
- 5.00

Year


Cents Per Mile

Fuel Costs Per Available Seat Mile
Labor Cost Per Available Seat Mile

Source: ATA
The Challenge - Multiple Evolving Frameworks

ICAO developing a combination of emission standards, policies, guidance on market-based measures, and goals to address aviation’s climate change impacts.

December 2009 Copenhagen solved nothing on international bunker fuels. Next steps uncertain.

EU steps to include international aviation continue. Multiple problems with data and legislation. Likely to produce legal conflict with multiple countries.

U.S. Congress considering a number of climate and energy bills. Unclear what and when legislation will pass.
The Challenge: Solve Multiple Environmental Issues

Community Noise Impacts
Reducing and mitigating significant noise around airports

Air Quality
Limiting or reducing significant impact on local air quality

Energy
Progress in fuel efficiency

Water Quality
Reducing significant water quality impacts

Global Climate
Addressing aviation’s effect on global climate
The Challenge:

- *Enable increased mobility while reducing environmental impacts in absolute terms*

Our Plans

- Absolute reductions in significant noise and air quality impacts
- Aggressive efficiency improvements of at least 2% per year
- Carbon neutral growth by 2020, absolute reductions by 2050
- Aircraft and engine CO$_2$ and other emissions standards

The Solution Set

- Continued Local Mitigation
- Advance Understanding and Analytical Capability
- Accelerate Operational Changes
- Mature New Aircraft Technology
- Develop Alternative Fuels
- Policy, Standards, and Market Based Measures
Continued Local Mitigation Efforts

- **Airport Configuration and Operation for Better Efficiency**
  - New runways, extensions, taxiways, preferential runway use

- **Airport Ground Measures**
  - Run-up areas, aircraft taxiing, noise shielding

- **Aircraft Flight Procedures**
  - Optimized profile descent, departure profiles

- **Program Support Measures**
  - Noise monitoring, complaint response, pilot education, noise advisory committees, noise abatement officer, property advisory services, periodic program review

- **Voluntary Airport Low Emissions (VALE) Program**
  - Financing low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements for airports in clean air non-attainment and maintenance regions
Better Science and Integrated Modeling

• Use better science-based understanding of the impacts of aviation emissions on climate change to make informed decisions.

• Improved metrics, measurement techniques, and modeling to quantify and predict impacts and to understand inter-relationships of aviation environmental factors.

• Pursuing research roadmaps to better understand noise and air quality impacts.
Enhanced Air Traffic Management Capabilities

**Surface**
- Limiting build up of queues on the airport surface
- Gate-hold strategies
- Taxi route planning, including the use of perimeter taxiways
- Operational procedures such as tow-outs and single engine taxi

**Departure**
- Continuous climb departures

**Cruise**
- En route traffic optimization
- Cruise climb
- Additional cruise lanes

**Approach**
- Optimal Profile Descents (OPDs)—successor to Continuous Decent Arrivals (CDA)
- Radar Navigation (RNAV) and Required Navigation Performance (RNP) enabling more precise and predictable departure, cruise and approach
Encourage New Aircraft Technology

- Environmental and energy drivers are shaping future aircraft and propulsion system design.


- The combination of advanced engine technologies and changes in airframe configurations are key contributors to carbon-neutral growth.

- Continuous Lower Energy, Emissions, and Noise (CLEEN) Program hopes to foster technology acceleration.
Develop Alternative Fuels

- Sustainable Alternative fuels offer potential benefits for energy use and the environment.

- Commercial Aviation Alternative Fuel Initiative (CAAFI)
  - R&D
  - Commercialization
  - Environmental Issues
  - Qualification

- Rapid Progress since 2006

<table>
<thead>
<tr>
<th>Jatropha</th>
<th>Halophytes</th>
<th>Camelina</th>
<th>Algae</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Jatropha" /></td>
<td><img src="image2.png" alt="Halophytes" /></td>
<td><img src="image3.png" alt="Camelina" /></td>
<td><img src="image4.png" alt="Algae" /></td>
</tr>
</tbody>
</table>
- Developing an Environmental Management Systems (EMS) Approach for NextGen
- Developing and implementing aggressive environmental targets for NextGen
- Working on CO2 standard for aircraft
- Researching use of market-based measures
Building International Consensus on Way Forward

- **Ongoing Work at ICAO’s Committee on Aviation Environmental Protection (CAEP)**
- **Build on 2009 ICAO High Level Meeting on Aviation & Climate Change**
  - Voluntary global fuel efficiency goal of 2% per year
  - Mandatory reporting by Contracting States
  - Work on goals of “greater ambition”, principles for use of market-based measures (MBMs), and addressing special needs of developing states.
- **Seeking Agreement on:**
  - Global Sector Goal of Carbon Neutral Growth (2020 vs 2005)
  - Agree on Principles to Resolve Issues on MBMs
  - A “De Minimus” Threshold
- **Process is Challenging**
Some Closing Observations

- Energy and climate change issues could prove the most significant challenges to aviation growth.

- **NextGen will not** achieve capacity goals without addressing environmental issues.

- We believe ambition is important in tackling the twin challenges of energy and climate.

- The U.S. NextGen plan offers an integrated approach of technology, operational and policy innovation to address environmental constraints.