Challenges Facing Civil Aviation in the 21st Century

By

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The world based on commercial aircraft departures.
1. Environmental Challenges
2. Safety Challenges
3. Security Challenges
4. Financial Challenges
Key Environmental Issues

Aircraft Engine Emissions

Noise

Source: ICAO

dB

Key Environmental Issues

CO

HC

CO2

NOx
Community Noise Impacts
Dealing with significant aircraft noise impacts around airports

Global climate
The potential impact of aviation on global climate

Water Quality
Limiting or reducing impact of aviation on water quality

Air Quality
Limiting or reducing impact of aviation on local air quality

Source: US FAA
Total $NO_x$ emissions from on-road transportation dwarf emissions from all other transportation modes combined (1998 data).
National greenhouse gas emissions in 2001 came from all sectors of the economy with all transportation equal to 27% of the total.
Mars
Thin atmosphere
(Almost all CO₂ in ground)
Average temperature: -50°C

Earth
0.03% of CO₂ in the atmosphere
Average temperature: +15°C

Venus
Thick atmosphere containing 96% of CO₂
Average temperature: +420°C
The Greenhouse effect

Solar radiation passes through the clear atmosphere. 
Incoming solar radiation: 343 Watt per m²

Some solar radiation is reflected by the atmosphere and earth's surface
Outgoing solar radiation: 103 Watt per m²

Some of the infrared radiation passes through the atmosphere and is lost in space
Net outgoing infrared radiation: 249 Watt per m²

Some of the infrared radiation is absorbed and re-emitted by the greenhouse gas molecules. The direct effect is the warming of the earth's surface and the troposphere.

Surface gains more heat and infrared radiation is emitted again

Solar energy is absorbed by the earth's surface and warms it...
... and is converted into heat causing the emission of longwave (infrared) radiation back to the atmosphere

168 Watt per m²

Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.
Projected changes in global temperature:
global average 1856-1999 and projection estimates to 2100

Global average temperature in °centigrade

IPCC estimate
High
Best (constant aerosol)
Best (increasing aerosol)
Low

The Kyoto Protocol

• Adopted in 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change promises to move the international community closer to achieving the Convention’s ultimate objective of preventing "dangerous anthropogenic [man-made] interference with the climate system".

• The developed countries commit themselves to reducing their collective emissions of six key greenhouse gases by at least 5% compared to 1990 levels, of which CO2 is most relevant to aviation. Each country’s emissions target must be achieved by the period 2008-2012.

• Countries will have a certain degree of flexibility in how they make and measure their emissions reductions. In particular, an international "emissions trading" regime will be established allowing industrialized countries to buy and sell emissions credits amongst themselves.

Source: EU Commission
Kyoto and ICAO

“The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation … working through the International Civil Aviation Organization….”

Kyoto Protocol to the United Nations Framework Convention on Climate Change Art. 2
Emissions Trading As An Alternative to Emissions Taxes

• Emissions trading imposes an overall limit of emissions while allowing the trading (market sale) of the right to pollute, thereby achieving emission reductions at least cost to society.
• If polluters emit more than their allotment, they must purchase an equivalent number of allowances from the carbon market.
• If they produce less, they may sell their allowances.
• Each entity can choose the least costly option to meet its quota. It can lower production, improve energy efficiency, or purchase allowances from other firms that emit less than their quota.
EU Milestones

• **20 Dec. 2006:** Commission presented draft legislation aimed at including aviation in the Emissions Trading Scheme.

• **26 June 2008:** MEPs and the EU's Slovenian Presidency reached a deal on the details of plans to include aviation in the EU's Emissions Trading Scheme as of 2012.

• **8 July 2008:** European Parliament backed compromise deal, paving the way for entry into force of the legislation.

• **24 Oct. 2008:** EU justice ministers approved a compromise deal on including aviation activities in the EU ETS

• **13 Jan. 2009:** Directive 2008/101/EC to include aviation into the EU Emissions Trading Scheme (ETS) was published in the Official Journal.

• **1 Jan. 2012:** Target date for aviation sector to start trading CO2.

• **1 Jan. 2013:** Revised EU-ETS due to come into force, covering not only power-intensive industries, but also aviation.

EU Commission proposes bringing air transport into EU Emissions Trading Scheme

- The proposed directive will cover emissions from flights within the EU from 2011 and all flights to and from EU airports from 2012.
- Both EU and foreign aircraft operators would be covered.
- Like the industrial companies already covered by the EU ETS, airlines will be able to sell surplus allowances if they reduce their emissions and will need to buy additional allowances if their emissions grow.

Source: European Union
ETS to cost airline sector over €1bn annually: Study

By Graham Dunn

- Airlines could face a collective annual cost of over €1 billion ($1.4 billion) from 2012 under the sector's inclusion in the European Union's Emissions Trading Scheme (ETS), according to new independent research.

- A report estimates the aviation sector could face a shortfall of 77 million tonnes of CO2 when it enters the ETS in 2012. This equates to €1.1 billion at today's spot price of €14.40 per tonnes of CO2.

- "The cost is just an indication," explains the report's co-author, and senior analyst at Point Carbon, Andreas Arvanitakis. "The actual cost will be whatever the carbon price will be in 2012." But he describes the €1.1 billion annual cost figure as "conservative" given current forecasts of the spot price for carbon in 2012 of nearer €20 per tonne.

- Other sources predict it Europe’s ETS will cost €4 billion by 2020.
The Chicago Convention

- Article 1: “every State has complete and exclusive sovereignty in the airspace above its territory.”
- Article 11: the laws of a State shall be applied to all aircraft entering its airspace.
- Article 12: over the High Seas, the rules in force shall be those established by ICAO
The Chicago Convention

- Article 15: No fees or other charges shall be imposed by any State solely for the “right of transit over or entry into or exit from its territory of any aircraft of a contracting State . . . .”
- Article 24: fuel “shall be exempt from customs duty, inspection fees or similar national or local duties and charges.”
2. Safety Issues
• Article 12 of the Chicago Convention requires every contracting State to keep its regulations uniform, to the greatest extent possible, with those established under the Convention.

• Article 37 of the Convention attempts to achieve uniformity in air navigation, by requiring that every contracting State cooperate in achieving "... the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft personnel, airways and auxiliary services in all matters in which uniformity will facilitate and improve air navigation. To this end [ICAO] shall adopt and amend from time to time...international standards and recommended practices and procedures" addressing various aspects of air safety and navigation.
Article 38 provides that any State finding it impracticable to comply with SARPs, or which has or adopts regulations different therefrom, "shall give immediate notification" to ICAO of the differences. The Council is then obliged immediately to notify other States of such noncompliance.
Article 37 gives ICAO the authority to promulgate Annexes to the Chicago Convention. Member States must comply with the Annex standards and procedures, unless they promptly object under Article 38. Most do not exercise their right to object under Article 38. Thus, a State has an affirmative duty to harmonize its domestic law with the SARPs. But this duty is emasculated by the ability of a State to opt-out if it deems it impracticable to comply.
Article 33 of the Chicago Convention

Under Article 33, States are obliged to recognize the validity of the certificates of airworthiness and personnel licenses issued by the State in which the aircraft is registered, so long as the standards under which such certificates or licenses were rendered are at least as stringent as those established under the Chicago Convention.

The negative implications of Article 33 are that if a State fails to comply "with the minimum standards which may be established from time to time pursuant to this Convention", then other States are not obliged to recognize the validity of the Certificates of Airworthiness issued by the delinquent State, and may therefore ban such aircraft from their skies, even when they have conferred traffic rights to the State pursuant to Article 6 of the Convention.
“If doubts about airworthiness exist, one country may refuse to recognize another country’s certificate of airworthiness, but only if the certificating nation has not observed the minimum standards of airworthiness established in Annex 8 pursuant to Articles 33 and 37 of the Chicago Convention.”
IASA Categories

• **Category 1, Does Comply with ICAO Standards:** A country's civil aviation authority has been assessed by FAA inspectors and has been found to license and oversee air carriers in accordance with ICAO aviation safety standards.

• **Category 2, Does Not Comply with ICAO Standards:** The Federal Aviation Administration assessed this country's civil aviation authority (CAA) and determined that it does not provide safety oversight of its air carrier operators in accordance with the minimum safety oversight standards established by the International Civil Aviation Organization (ICAO).

*Source: FAA*
Consequences of Category 2:

1. The air carriers from the assessed state are restricted to current levels of any existing service to/from the United States;
2. No reciprocal code-share arrangements between air carriers for the assessed state and U.S. carriers are allowed; and
3. The carrier’s aircraft are subject to additional inspections at U.S. airports.
21 States:

Bangladesh
Belize
Cote D’Ivorie
Croatia
Democratic Republic of the Congo
Gambia
Guyana
Haiti
Honduras
Indonesia
Israel
Kiribati
Nauru
Nicaragua
Paraguay
Philippines
Serbia and Montenegro
Swaziland
Ukraine
Uruguay
Zimbabwe

Croatia removed from this list
Barbados, Ghana, Montenegro, Saint Maarten added
Bangladesh
Barbados
Belize
Cote d’Ivorie
Democratic Republic of Congo
Gambia
Ghana
Guyana
Haiti
Honduras
Indonesia
Kiribati
Montenegro
Nauru
Nicaragua
Paraguay
Philippines
Serbia
Saint Maarten
Swaziland
Ukraine
Uruguay
Zimbabwe

FAA BLACKLIST
Nov. 2012
THE EU PROMULGATED REGULATIONS GOVERNING OPERATING BANS ON FOREIGN CARRIERS IN LATE 2005.

THE REGULATION PROVIDES THAT BANS ARE TO BE IMPOSED "ACCORDING TO THE MERITS OF EACH INDIVIDUAL CASE", EVALUATING "WHETHER THE AIR CARRIER IS MEETING THE RELEVANT SAFETY STANDARDS".

THE PHRASE "RELEVANT SAFETY STANDARDS" IS DEFINED AS "THE INTERNATIONAL SAFETY STANDARDS CONTAINED IN THE CHICAGO CONVENTION AND ITS ANNEXES . . . AS WELL AS, WHERE APPLICABLE, THOSE IN RELEVANT COMMUNITY LAW."
On March 22, 2006, the European Union published a consolidated blacklist of 92 airlines to be banned from EU skies. The blacklist is updated every three months. The list is dominated by African airlines. The original list included 50 carriers from the Democratic Republic of Congo, 13 from Sierra Leone, 11 from Equatorial Guinea, 6 from Swaziland, 3 from Liberia as well as airlines in Kazakhstan, Thailand, and North Korea.
Afghanistan
Angola
Benin
Congo
D.R. Congo
Djibouti
Equatorial Guinea
Ghana
Indonesia
Kazakhstan
Kyrgyz Republic
Liberia
Gabon
Mauritania
Mozambique
Philippines
Sao Tome and Principe
Sierra Leone
Sudan
Suriname
Swaziland
Zambia
Late 2011: The EU blacklists airlines

- Aeromajestic and Interisland Airlines, a Filipino company, Stellar Airways from the Democratic Republic of Congo and Equatorial Congo from the Republic of Congo were banned because they failed to provide documented evidence that they comply with international safety standards. Honduran carrier Rollins Air was placed on the list after France raised concerns about the airline’s safety.
- Three Boeing 767s operated by Jordanian Aviation were prohibited from using European airspace.
- Three Russian carriers were left off the EU blacklist - VIM AVIA, Yakutia and Tatarstan Airlines - after Russian authorities imposed operating restrictions on the companies.
- Although the EU’s air safety committee was "very concerned" with the performance of Albanian airlines, the commission kept them off the list too after Albanian authorities took "very strong" safety enforcement measures.
- The EU flight-ban list now counts 273 airlines from 20 countries.

ICAO Oversight

In 1994 the ICAO General Assembly passed Resolution A32-11, which established ICAO’s Safety Oversight Programme [SOP].

ICAO in 1999 replaced the SOP with a more meaningful and mandatory Universal Safety Oversight Audit Programme [USOAP].
Principal Deficiencies

- Absence of basic aviation laws;
- Failure of the CAA to enforce safety laws and regulations;
- Failure of national laws to conform to SARP.
In 2005, the ICAO Council approved a procedure for disclosing information about a State having significant SARPs deficiencies in its aviation safety obligations.

In 2006, aviation Directors-General from 153 of 189 member States agreed that by March 23 2008, the names of those States that fail to agree to full transparency of their USOAP audits will be posted on the ICAO website.

More than 100 States have already agreed to transparency. By September 2006, 79 States had made their USOAP audits publicly available on the ICAO web site. By Nov. 2008, 161 State audit results were posted at: http://www.icao.int/fsix/auditRep1.cfm

ICAO and IATA also signed a MOU "to share safety-related information from their respective audit programs to better identify potential safety risks and prevent aircraft accidents", as well as share accident and incident monitoring. The two have agreed that "experts from each organization will be allowed to participate as observers in audit missions of the other, upon request."
3. Security
Terrorism

• Terrorism is ideologically or politically motivated violence directed against civilian targets.
• Terrorism is unconventional warfare, and psychological warfare, designed to instill fear.
• Terrorism is a symptom of a more pernicious disease found among the militarily weak, the politically frustrated, and the religiously fanatic.
"The nation’s vast air, land, and maritime transportation systems are marvels of innovation and productivity, but they are designated to be accessible, and their very function is to concentrate passenger and freight flows in ways that can create many vulnerabilities for terrorists to exploit. . . .

“Designed and organized for the efficient, convenient, and expeditious movement of large volumes of people and goods, transportation systems must have a high degree of user access.”

Transportation Research Board
But, war is the terrorism of the rich …
and terrorism is the war of the poor.
Aviation Security Conventions

- Chicago Convention of 1944 – 191 States
- Tokyo Convention of 1963 – 185 States
- The Hague Convention 1970 for the unlawful seizure of aircraft – 185 States
- The Montreal Convention 1971 for the suppression of unlawful acts against the safety of aviation – 188 States
- The MEX Convention 1991 on the marking of explosives – 143 States

As of May 2010
OTHER INTERNATIONAL AGREEMENTS

• **US-Cuba Memorandum of Understanding (1973)**

• **The European Convention of 1977** provides that hijacking is not deemed to be a political offense exception that avoids extradition.

• **The Bonn Declaration of 1978**, an agreement of G-7 leaders, provides that all flights would be ceased immediately to or from any nation that refused either to return the hijacked aircraft or to prosecute or extradite a hijacker.
• States tend to be reactive rather than proactive.
• They also tend to “fight the last war.”
Transportation security can best be achieved through coherent security systems that are well integrated with transportation operations and are deliberately designed to deter terrorists even as they selectively guard against and prepare for terrorist attacks. In particular, layered security systems, characterized by an interleaved and concentric set of security features, have the greatest potential to deter and protect. Layered systems cannot be breached by the defeat of a single security feature—such as a gate or guard—as each layer provides backup for the others, so that the impermeability of individual layers is not required. Moreover, the interleaved layers can confound the would-be terrorist. Calculating the odds of breaching a multi-tiered system of defense is far more difficult than calculating the odds of defeating a single, perimeter protection.
Post deregulation: the market cycles have hit deeper troughs.
THE MAGNITUDE OF THE FINANCIAL CRISIS

- 2000 – U.S. profit $2.5 billion
- 2001 - U.S. losses $8.3 billion
- 2002 - U.S. losses $11.4 billion
- 2003 - U.S. losses $1.7 billion
- 2004 - U.S. losses $9.1 billion
- 2005 - U.S. losses $27.2 billion
- 2006 - U.S. profit $18.2 billion
- 2007 - U.S. profit $7.7 billion
- 2008 - U.S. losses $23.8 billion
- 2009 - U.S. losses $2.5 billion
- 2010 – U.S. profit $3.6 billion
- 2011 – U.S. profit of $11 billion

US Carriers cumulatively lost $55 billion in the last decade.
Industry financial performance during the most recent downward cycle is worse than in any prior recession . . .

- 1970 - $200 million
- 1981-1982 - $1.4 billion
- 1990-1994 - $13 billion
- 2001-2009 – $55 BILLION
All of aviation is profitable, except the core.
The U.S. airline industry lost all the profit earned since the Wright Brothers’ inaugural flight.
This is true, even adjusted for inflation
OUR AIRLINES, ONCE WORLD LEADERS, ARE NOW LAGGARDS IN EVERY CATEGORY, INCLUDING FLEET AGE, SERVICE QUALITY AND INTERNATIONAL REPUTATION.

THE FINANCIAL HEALTH OF THE INDUSTRY, AND OF THE INDIVIDUAL CARRIERS, HAS BECOME EVER MORE PRECARIOUS. MOST HAVE BEEN THROUGH THE BANKRUPTCY PROCESS AT LEAST ONCE, AND SOME HAVE PASSED THROUGH ON MULTIPLE OCCASIONS.

I FEEL LITTLE NEED TO ARGUE THAT DEREGULATION HAS WORKED POORLY IN THE AIRLINE INDUSTRY. THREE DECADES OF DEREGULATION HAVE DEMONSTRATED THAT AIRLINES HAVE SPECIAL CHARACTERISTICS INCOMPATIBLE WITH A COMPLETELY UNREGULATED ENVIRONMENT. TO PUT THINGS BLUNTLY, EXPERIENCE HAS ESTABLISHED THAT MARKET FORCES ALONE CANNOT AND WILL NOT PRODUCE A SATISFACTORY AIRLINE INDUSTRY, WHICH CLEARLY NEEDS SOME HELP TO SOLVE ITS PRICING, COST AND OPERATING PROBLEMS.
“Since the invention of the wheel, in the long term no one has made money moving people.”

Anon.
welcome to the institute of

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