Airline Industry Recent Trend Update (October 2007)

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With the help of the Faculty and Students of the MIT Global Industry Study

* Presentation for Educational Use Only
World Population Distribution & 2004 Air Transportation Activity

North America
36% Pax
26% Cargo
~160 Airlines
~4100 Airports

Europe
27% Pax
27% Cargo
~200 Airlines
~2400 Airports

Latin America/Caribbean
4% Pax
3% Cargo
~50 Airlines
~580 Airports

Africa
2% Pax
2% Cargo
~20 Airlines
~300 Airports

Middle East
4% Pax
6% Cargo
~20 Airlines
~230 Airports

Asia/Pacific
27% Pax
36% Cargo
~80 Airlines
~1800 Airports

Air Transport: ICAO, R. Schild/Airbus
Passenger and freight traffic represent RPK and FTK share in 2004
Scheduled Revenue Passenger-Kilometers by Region

Data source: ICAO, scheduled services of commercial air carriers (through 2005)
Freight Trends by Region

Data source: ICAO, scheduled services of commercial air carriers (through 2005)
Relationship Between Economy and Air Transportation

- **Economy**
  - Direct / Indirect / Induced employment effects

- **Economic Enabling Effect**
  - (Access to people / markets / ideas / capital)

- **Demand**
  - Travel/Freight Need

- **Supply**
  - Revenue/Profitability

- **Airlines**
  - Pricing & Schedule

- **Air Transportation System**
  - Financial Equity/Debt Markets

- **Vehicle Capability**
  - NAS Capability
Correlation Between US GDP and Passenger Traffic

Data source: RPMs: Bureau of Transportation Statistics, (BTS)

GDP: US Bureau of Economic Analysis

Recession data: National Bureau of Economic Research
Air Transportation Markets
2004 Data
Macro Scale Drivers
US Airline Net Profit

Cyclic Industry with Exponential Growth in Volatility Since Deregulation

Data source: ATA Annual Revenue and Earnings - Net Profit and Loss
US Airlines Net Profit
Best Fit of Undamped Oscillation
Cycle Period = 11.3 yr \hspace{1em} eFolding Time = 7.9 yr

Data source: ATA - available at: www.airlines.org & Airline Quarterly Reports
US Airlines Net Profit
Best Fit of Undamped Oscillation
Cycle Period = 11.3 yr  eFolding Time = 7.9 yr

Phase Shift -by one year- in 2001

Data source: ATA - available at: www.airlines.org & Airline Quarterly Reports
World Airlines Net Profit Model
Best Fit of Undamped Oscillation (2002 data)
Cycle Period = 10.5 yr   eFolding Time = 14.9 yr

Data source: ICAO Reports and ICAO News Releases
Net Profit and Aircraft Deliveries
Hypothesize that instability driven by capacity response phase lag

World Airlines Net Profits vs. Aircraft Deliveries

Source: ICAO data
U.S. Domestic ASMs and RPMs

Data source: ATA, US member airlines, scheduled mainline service (through 2006)
Trends in Aircraft Size

Data source: Form 41 Traffic data from Bureau of Transportation Statistics (US carriers)
Data source: ATA, US member airlines, scheduled mainline service (through 2006)
Data source: ATA Monthly Passenger Revenue Report, 7 US major airlines excluding Southwest (WN).
Historic Yield Trend
1995-2007

Data source: ATA Passenger Yield Report, 7 US major airlines excluding Southwest (WN).
Capacity Allocation Strategies
(Domestic vs. International ASMs – from 2005 to 2006)

Data source: Bureau of Transportation Statistics
Growth Limits
Constraints vs Damping

Upside: Capacity, Market

Downside: Financial

1Q07 losses
(8 major airlines)

Data source: ATA - available at: www.airlines.org & Airline Quarterly Reports
Airline Profits

Data source: Airline quarterly reports, profits and losses including reorganization items

9/11 Attacks

-17B including reorganization items

+23B including reorganization items
Cargo Operations Profitable

Data source: Companies’ annual reports
Market Cap: US Majors
4-Sept-2007

Total Market Cap: $44.5 billion

Data source: Yahoo Finance.
Market Cap: US Majors, 26-May-2005

Total Market Cap: $21.2 billion

Data source: Yahoo Finance.
RPM Share vs. Market Cap

Source: Yahoo! Finance and Bureau of Transportation Statistics
Low-Cost Carrier Envy
Emergence of LCCs

Canada (7, 1 in 2004)
CanJet
HMY Airways
JetsGo Airlines
Tango Airlines

USA (19, 4 in 2003/2004)
AirTran
Allegiant Air
American West
ATA
Frontier Airlines
Interstate Jet
JetBlue Airways
Midwest Express
Pan American
Southeast Airlines
Southwest Airlines

Europe (60, 3 in 2004)
Aer Arann
Air 2000
Air Baltic
Air Berlin
Air Finland
Air Luxor Lite
Air Polonia
Air Scotland
Air Southwest
Air Wales
Alpi Eagles
Azzurra Air
Hi Fly
Fly Me
Fly Nordic
Air Service +
Blue1
Blue Air
Central Wings
Dau Air
Iceland Express

South America (3)
Bra
Gol
U Air

Legend:
New in 2003 / 2004

Inter continental LCCs
Air Madrid
Condor
East Jet
LTU
Martinair
Zoom Airlines

Africa (2)
1Time
Kulula

Asia/Pacific (20, 8 in 2004)
Air Arabia
Air Asia
Air Deccan
Athena Air Services
Citilink
Freedom Air
Lion Airways
One-Two-Go
Skymark Airlines
Skynet Asia Airways
Aero Asia
Bangkok Air
Await
Origin Pacific
Spice Jet

Source: http://www.etn.nl/lcostair.htm, airline news
Low-Cost Carriers around the World

Source: Airline websites and Wikipedia low cost carrier list
Birth & Death of Low-Cost Carriers around the World

North America

Europe

Asia/Pacific

Latin America

Africa

Middle East

Legend
- Defunct
- Started operating in 2007
- Started operating in 2006
- Started operating in 2005
- Started operating in 2004
- Older

Source: Airline websites and LowCostAirlines.org
EU-US Open Skies Agreement

- On April 30, 2007 E.U. and U.S. signed a preliminary Open Skies accord
  - Allows EU airlines to operate direct flights between U.S. and any EU country (and some others)
  - Allows U.S. airlines reciprocal right, and ability to fly between EU city-pairs
  - Agreement will replace 22 bilateral air service agreements currently in place between the U.S. and the Member States
  - Implications for Alliance Anti-Trust Immunity
  - In effect March 30, 2008

- E.U. has made liberalized foreign control a prerequisite for a permanent agreement
  - U.S. domestic market lucrative as standalone and hub-feeder
    - Cabotage rights only granted to U.S. Incorporated airlines
    - U.S. incorporation requires meeting ownership caps
    - Without control, network composition cannot be shaped
  - Match EU’s 49% foreign control restriction
The North Atlantic: Market for Low Cost Carrier Expansion

- Proposed transatlantic route network by RyanAtlantic*

- Development of international parallel networks
- Phenomenon observed within the United States and Europe with the development on point-to-point parallel networks (between secondary airports) by Southwest and Ryanair

### Airline Alliances

#### US DOT Antitrust Immunity

**Star Alliance**
- Adria Airways (JP)
- Air Canada (AC)
- Air New Zealand (NZ)
- ANA (NH)
- Asiana Airlines (OZ)
- Austrian Airlines (OS)
- Blue1 (KF)
- bmi (BD)
- Croatia Airlines (OU)
- LOT Polish Airlines (LO)
- Lufthansa (LH)
- SAS (SK)
- Singapore Airlines (SQ)
- South African (SA)
- Spanair (JK)
- Swiss Intl Air Lines (LX)
- TAP Portugal (TP)
- Thai Airways Intl (TG)
- Turkish Airlines (TK)
- United (UA)
- US Airways (US)

**Oneworld**
- American Airlines (AA)
- British Airways (BA)
- Cathay Pacific (CX)
- Finnair (AY)
- Iberia (IB)
- Japan Airlines (JL)
- LAN (LA)
- Malév (MA)
- Qantas (QF)
- Royal Jordanian (RJ)

**SkyTeam**
- Aeroflot (SU)
- Aeroméxico (AM)
- Air France (AF)
- Alitalia (AZ)
- Continental (CO)
- Czech Airlines (OK)
- Delta (DL)
- KLM (KL)
- Korean Air (KE)
- Northwest (NW)

*Existing Immunity*

*Immunity Application In Progress*

Source: Wikipedia, BTN Online
U.S. – China Aviation Agreement

- **Strong Competition in 2006**
  - IAD- Beijing United

- **New Routes Assigned Sept 2007**
  - Atlanta-Shanghai Delta 2008
  - San Fran-Guangzhou United 2008
  - Chicago-Beijing American 2009
  - Newark-Shanghai Continental 2009
  - Detroit-Shanghai Northwest 2009
  - Phil-Beijing USAirways 2011.

Source: Detroit Free Press 10/18/2006
Trends in Fuel Price

Average Crude Oil and Jet Fuel Prices

Jet Fuel (R)
Crude Oil (L)

Data source: ATA: Fuel Cost and Consumption (oil data through Jun 2007, jet fuel data through Mar 2007)
Unit Costs for Labor and Fuel

Productivity Improvements Driving Cost Relief
Network Restructuring, Work Rules, Human Capital,
Outsourcing, Technology

Source: ATA US Airline Cost Index: Major & National Passenger Carriers, Q3 2005
Positive Views of Employee Morale

Don’t have current survey data trend may have reversed

Source: The Wilson Center for Public Research, Inc. – based on 150,674 interviews conducted with pilots or flight attendants from 1/1/2001 to 9/20/2005
U.S.A. and Canadian Operators Accident Rates
Hull Loss and/or Fatal accidents – Worldwide Commercial Jet Fleet – 1959 through 2005
U.S.A and Canadian Operators Accident Rates
Hull Loss and/or Fatal accidents – Worldwide Commercial Jet Fleet – 1986 through 2005

Accident rate (accidents per million departures)

Year

Rest of the World
U.S.A. & Canadian operators
Sao Paulo Runway Overrun
17 Jul 2007

Source: Intl Herald Tribune
Growth Limits
Constraints vs Damping

Upside: Capacity, Market

Downside: Financial

1Q07 losses (8 major airlines)

Data source: ATA - available at: www.airlines.org & Airline Quarterly Reports
US Flight Delays from 1995 to 2007

Data source: FAA Operational Network (OPSNET)
Flight Cancellations from 2000 to 2007 (by month)

(top 11 airlines from 2000 to 2002, top 20 airlines from 2003 to 2007)
New York Airport Flight Delays*
from 1995 to 2007

* Note: 12 month moving average

Data source: FAA Operational Network (OPSNET)
Taxi Out Times

[ASPM data from H Balakrishnan]
Consumer Complaints
from 1997 to 2007*

Note: 2007 data point represents average consumer complaints (per 100,000 enplanements) for January to March 2007
Congestion Driven Schedule Creep

Source: ASDI data
Historical Evolution of Scheduled Block Time
(Month of April / from 1996 to 2006)

NY La Guardia – Chicago O’Hare

Houston – Dallas

Data source: Department of Transportation, Bureau of Transportation Statistics
Annual Growth Rate of Scheduled Block Time
(top 1950 OD routes)

- Analysis based on top 3000 OD routes (US Domestic – by US carriers)
- Filtered down to 1950 OD routes with uninterrupted service between 1996 and 2006 (April)
- OD routes covering 76% of total passengers in the U.S. in 2006

Data source: Department of Transportation, Bureau of Transportation Statistics
OEP and NGATS

10 Year Plan
FAA

RNP
RNAV
ADS-B

20 Year Plan
Multi-Agency
FAA, DOD, Commerce
DHS, NASA, DOT, OSTP
Automatic Dependent Surveillance Broadcast (ADS-B)

ATC-Based Applications
- Surveillance
- Separation procedures
- Trajectory-based operations

Cockpit-Based Applications
- Self-separation
- Equivalent VFR operations
- Traffic & runway awareness
- Airspace, weather, terrain awareness
- Precision Navigation

Ground Component
- ADS-B Out
  - Position & intent broadcast from aircraft to ground or other aircraft

Air Vehicle Component
- ADS-B In
  - Information transmitted from ground to the aircraft

Avionics Integration

ATC Integration

Air Traffic Control

Other Aircraft

Air to Air

Air to Ground

Coverage Volume

Global Navigation Satellite System

Operating Procedures

Aircraft Cockpit

Automatic Dependent Surveillance Broadcast (ADS-B) Mandate NPRM

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

14 CFR Part 91
RIN 2120–AI92

Automatic Dependent Surveillance—Broadcast (ADS–B) Out Performance Requirements To Support Air Traffic Control (ATC) Service

AGENCY: Federal Aviation Administration (FAA), DOT.
ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes performance requirements for certain avionics equipment on aircraft operating

- ADS-B “Out” mandate by 2020
- Impacts
  - Class A, B, C
  - Mode C veil (30 nm radius)
  - Class E above 10,000
- Requires DO-260A Change 2
- Nav Source Requirements
  - NAC of 9 ~30 meters
  - NIC of 7 (0.3 nm)
- Final commitment date of 2013 for all ground infrastructure
Air Traffic Controller Staffing

ATO Hiring Forecast vs. Losses

Time to CPC (Certified Professional Controller)
Terminal; 8 - 24 months
Enroute: 36 - 60

Source: Air Traffic Controller Workforce Plan - 2004
FAA Reauthorization ‘07

- Funding Modernization (NGATS)
- Contributions from the general fund? (18% > 50%)
- The “battle” over user fees:
  - Airlines vs Business Aviation

<table>
<thead>
<tr>
<th>Tax</th>
<th>Rate</th>
<th>Percentage of Total Tax Collections in FY 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ticket Tax</td>
<td>7.5% on Airfares</td>
<td>49.7%</td>
</tr>
<tr>
<td>Segment Tax</td>
<td>$3.20 per Flight Segment</td>
<td>19.6%</td>
</tr>
<tr>
<td>Rural Airport Tax</td>
<td>7.5% on Airfares from Rural Airports</td>
<td>0.8%</td>
</tr>
<tr>
<td>Waybill Tax</td>
<td>6.25% on Price of Freight and Mail Transferred by Air</td>
<td></td>
</tr>
<tr>
<td>GA and Jet Fuel</td>
<td>GA Fuel: 19.3 cents/gallon, Jet Fuel: 21.8 cents/gallon</td>
<td>1.9%</td>
</tr>
<tr>
<td>Commercial Jet Fuel</td>
<td>4.3 cents/gallon</td>
<td>5.8%</td>
</tr>
<tr>
<td>International Departures/Arrivals</td>
<td>$14.10 per international departure/arrival</td>
<td>14.4%</td>
</tr>
<tr>
<td>Alaska/Hawaii Tax</td>
<td>$7.00 per domestic departure/arrival to Alaska or Hawaii</td>
<td>0.8%</td>
</tr>
<tr>
<td>Frequent Flyer Tax</td>
<td>7.5% on proceeds of third party sales of frequent flyer miles</td>
<td>1.6%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: FAA
New FAA Leadership

- Administrator
  - Nomination of Bobby Sturgel

- COO ATO
  - Hank Krakowski
Aviation Remains Perceived Target
Expanding Security Burden

NO LIQUIDS OR GELS OF ANY KIND WILL BE PERMITTED IN CARRY-ON BAGGAGE. THESE ITEMS MUST BE IN CHECKED BAGGAGE. This includes all beverages, shampoo, suntan lotion, creams, tooth paste, hair gel, and other items of similar consistency. Read our Permitted and Prohibited Items list.
Trends in Aircraft Size

Data source: Form 41 Traffic data from Bureau of Transportation Statistics (US carriers)
Source: based on manufacturers’ a/c specifications. Full pax range of standard version.
A 380 Orders

Data source: Aircraft manufacturers website
Airbus – orders through May 31st 2007

Delay and Wake Vortex Issues
Break Even Aprox 420
A-380 First Delivery
B-787

-300 (290-330 pax) (3000-3500 nm)
-800 (210-250 pax) (8000-8500 nm)
-900 (250-290 pax) (8600-8800 nm)
# B 787 Orders

approx 710 firm orders

- Aeroflot
- Aeromexico
- Air Berlin
- Air Canada
- Air China
- Air India
- Air New Zealand
- Air Pacific
- ALAFCO (leasing company)
- All Nippon Airways
- Arik Air
- Arkia Israel Airlines
- Avianca
- Aviation Capital Group
- Azerbaijan Airlines
- Boeing Business Jet
- CASGC
- China Eastern Airlines
- China Southern Airlines
- CIT Aerospace (leasing company)
- Continental Airlines
- Ethiopian Airlines
- First Choice Airways
- Garuda Indonesia
- Hong Kong Airlines
- Icelandair
- ILFC (leasing company)
- Japan Airlines
- Jet Airways
- Kenya Airways
- Korean Air
- Kuwait Airways
- LCAL (leasing company)
- LOT Polish Airlines
- Monarch Airlines
- Northwest Airlines
- Pegasus Aviation Finance (leasing company)
- PrivatAir (BBJ)
- Qantas
- Royal Air Maroc
- Royal Jordanian Airlines
- S7 Airlines
- Shanghai Airlines
- Singapore Airlines
- Travel Service
- TUI Group
- Vietnam Airlines
- Virgin Atlantic Airways

B-787 First Flight and Initial Delivery Delay (6 mo)

- Out of sequence production work
- Parts shortages
- Software
- Systems Integration
“All New” A350
Not your fathers A330

250-300 Seats
7500-8800 nm Range

13 Orders Prior to Paris Air Show
182 Firm Orders Currently

Source: http://www.airbus.com
High Fuel Price Favoring Turboprops

<table>
<thead>
<tr>
<th>Backlog (firm orders)</th>
<th>ATR42/72*</th>
<th>Bombardier Q series**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>179</td>
<td>113</td>
</tr>
</tbody>
</table>

* as of Aug 2nd 2007
** as of July 31th 2007

Data source: Aircraft manufacturers website – ATR aircraft & Bombardier
Very Light Jets
Small turbofan aircraft

Aircraft characteristics*

- Passengers: 4 to 8
- Acquisition price: $m 1.4 to 3.6
- Cruise speed: 340 to 390 kts
- Operating ceiling: 41,000ft to 45,000ft
- Range: 1100 to 1750 NM
- Take off field length: 2200ft to 3400ft

Orders

- Eclipse: 2300
- Adam: 75
- Mustang: 330+

* for twin-engine VLJs (excludes D-Jet)
Environmental Issues

Noise

- Stage 4 (Equipment)
- Airports (Capacity)

Emissions

Intergovernmental Panel on Climate Change
Environmental Impacts

• Aviation is responsible for
  - 2% of global carbon dioxide (CO₂) emissions today
  - 13% of CO₂ emissions from all transport sources, compared to 75% from road transport
  - Impact of NOx, contrails, sulphate and soot particles is not well estimated
  - From 1990 to 2003, the EU’s Greenhouse gas emissions from international aviation increased by 73%, or 4.3% per year.\(^{(1)}\)

• Fuel Efficiency
  - New aircraft are 70% more fuel efficient than 40 years ago and 20% better than 10 years ago.
  - Modern aircraft achieve fuel efficiencies of 3.5 liters per 100 passenger km.
  - Airlines are aiming for a further 25% fuel efficiency improvement by 2020.

• Aircraft Noise
  - New aircraft are 50% quieter than 10 years ago.
  - The number of people exposed to aircraft noise worldwide has gone down by 35% between 1998 and 2004.
  - Research initiatives target a further 50% reduction by 2020.

Data source: IATA website; \(^{(1)}\) EUROPA Press Releases
# Environmental Marketing: Carbon-Offset Programs

<table>
<thead>
<tr>
<th>Company</th>
<th>Type</th>
<th>Location</th>
<th>Partner/Program</th>
<th>Mechanism</th>
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<tbody>
<tr>
<td>United States</td>
<td>Airline</td>
<td>United States</td>
<td>planting/river protection</td>
<td>Clean energy projects</td>
</tr>
<tr>
<td>United States</td>
<td>Airline</td>
<td>United States</td>
<td>Portfolio of projects</td>
<td>Clean energy projects</td>
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<tr>
<td>United States</td>
<td>Travel Agency</td>
<td>United States</td>
<td>Go Zero</td>
<td>Planting Trees</td>
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<td>Business Av.</td>
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<td>Portfolio of projects</td>
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