Airline Industry Recent Trend Update (October 2009)

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

Prof. R. John Hansman

Traffic Source: Sage Analysis courtesy Prof Ian Waitz

rjhans@mit.edu

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

North America
34% Pax
24% Cargo
~160 Airlines
~4100 Airports

Europe
27% Pax
26% 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
5% Pax
7% Cargo
~20 Airlines
~230 Airports

Asia/Pacific
27% Pax
38% Cargo
~80 Airlines
~1800 Airports

Air Transport: ICAO, R. Schild/Airbus

Passenger and freight traffic represent 2007 RPK and FTK share estimates from ICAO & IATA data
Revenue Passenger Kilometers (RPK) by Region

Freight Tonne Kilometers (FTK) by Region

Economic Shocks

Demand Uncertainty

Market Indices 8/4/08-10/31/08

Source: Capital Link Shipping
Relationship Between Economy and Air Transportation

Economy

Direct / Indirect / Induced employment effects

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

Travel/Freight Need

Financial Equity/Debt Markets

Demand

Supply

Air Transportation System

Airlines

Revenue/Profitability

Pricing & Schedule

NAS Capability

Vehicle Capability
Correlation Between US GDP and Passenger Traffic

Data source:
- GDP: US Bureau of Economic Analysis through Q1 2009
- Recession data: National Bureau of Economic Research
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
U.S. Airlines Net Profit
Best Fit of Undamped Oscillation –
Cycle Period = 11.3 yr

Data source: ATA - available at: www.airlines.org & Airline Quarterly Reports (Net Profits and Losses Exclude Special Items)

World Airlines Net Profit
(from 1978 to 2009)

Note: IATA represents 250 airlines comprising 94% of the international scheduled air traffic

World Airlines Net Profits vs. Aircraft Deliveries

Phase Lag between Airline Net Profits & Aircraft Deliveries:
Hypothesize that instability driven by capacity response phase lag

Data source: ICAO data (Profit) and SpeedNews data (Aircraft deliveries)
World Airlines Net Profits vs. Aircraft Orders

Data source: ICAO data (Profit) and SpeedNews data (Aircraft orders)
U.S. Domestic ASMs and RPMs

Note: Data for 2009 - Jan to May - from DOT Form 41 available from BTS – Projected to full year 2009 based on Jan-May data

Trends in Aircraft Size

U.S. Airlines

Data source: Form 41 Traffic data from Bureau of Transportation Statistics (US carriers)
U.S. Domestic Average Load Factor

Note: Data for 2009 - Jan to May - from DOT Form 41 available from BTS

Historic Yield by Region (1995-2009)

Weakness in High Yield Passengers

Source: IATA 2009
Regional Passenger Traffic Overview
(% change 2008 vs. 2007)

Source: ICAO, Journal Vol.1 2009
U.S. Airline Quarterly Profits

Data sources: Airline Quarterly Reports (Net Profits and Losses Include Special Items)
Cargo Net Income

Data sources: Company Financial Information
Relative Growth
Cargo and Passengers

International passenger and freight tonne-kilometers
Source: IATA

Source: IATA 2009
Market Cap: US Majors
Oct. 24th 2009

Total Market Cap: $22.9 billion

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

(RPMs: May 2009 - Market Cap: Sept. 9th 2009)

Source: Google Finance for Market Cap data and Bureau of Transportation Statistics for RPM data
Market Cap: US Majors
26-May-2005

Total Market Cap: $21.2 billion

Data source: Yahoo Finance.
Consolidations

- **Recent US Consolidation**
  - Delta and Northwest (Oct 09)
  - USAir and America West
  - Potential for Additional Reactionary Moves

- **Recent International Consolidation**
  - Lufthansa and Austrian
  - Air France and KLM
  - Air France and Alitalia ??
  - Lufthansa and Swiss
  - China Southern and China Northern and Xingiang
  - Cathy Pacific and Dragon
  - BMI and Lufthansa (Virgin?)

- **International Strategic Investment in US Carriers**
  - Lufthansa and JetBlue
  - Virgin and Virgin America
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
## 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)
- Continental (CO) **NEW**
- 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 (LX)
- 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)
- Czech Airlines (OK)
- Delta (DL)
- KLM (KL)
- Korean Air (KE)
- Northwest (NW)

### Prior Immunity
- Source: Wikipedia, BTN Online
Trends in Crude Oil and Jet Fuel Price

Unit Costs of Labor and Fuel

Data source: ATA U.S. Airline Cost Index.
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. and Canadian Operators Accident Rates by Year

Annual fatal accident rate (accidents per million departures)

Year

1989 Through 2008

Rest of the world
U.S. & Canadian operators
USAir 1549
15 - Jan - 2009
Crew Issues
Training
Commuting and Fatigue
Compensation ($16K - $20K)
Professionalism
• NW 188 overflew destination airport (MSP) by approximately 150 miles

• Flight from San Diego to Minneapolis/St. Paul

• Cause under investigation but has re-raised concerns over crew fatigue

Source: Times online
Pilot Fatigue Rulemaking

- Congressional Hearings on Fatigue
- FAA formed Flight and Duty Time Limitations and Rest Requirements ARC
- Were scheduled to submit draft NRPM language by Sept 1, 2009
US Flight Delays

from 1995 to 2009

Data source: FAA Operational Network (OPSNET)
Flight Cancellations from 2000 to 2009 (by month)

(top 11 airlines from 2000 to 2002, top 20 airlines from 2003 to 2007)
New York Airport Flight Delays*
from 1995 to 2009

* Note: 12 month moving average

Data source: FAA Operational Network (OPSNET)
Evaluation of Taxi Out Fuel Burns for Major Airports

Percentage of Top 20 Taxi-out Fuel Burn

Source: H Balakrishnan

Percentage of Top 20 Departures

ATL  ORD  DFW  LAX  IAH  CLT  PHX  LGA  JFk  BOS  SFO  SLC  MCO  IAD  MSP  DTW  PHL  EWR  LAS  DEN
Long Term Plans for System Transformation

- Common recognition that existing US and European ATM systems will not scale to meet future demand

- Reflected in major long term initiatives
  - US  NextGen
  - Europe  SESAR
NextGen Implementation Plan

- Focus on first phase of NextGen Transition to 2018
NextGen Implementation Plan

SURFACE TRAFFIC MANAGEMENT
Automation optimizes taxi routing. Provides controllers and pilots all equipped aircraft and vehicle positions on airport. Real-time surface traffic picture visible to airlines, controllers and equipped operators. Surface movement management linked to departure and arrival sequencing. ADS-B and ADSX contribute to this function. Tax times reduced and safety enhanced.

CRUISE
RNAV, RNP and RVSM utilize reduced separation requirements increasing airspace capacity. Aircraft fly most optimal path using trajectory-based operations considering wind, destination, weather, and traffic. Re-routes determined with weather fused into decision making tools are tailored to each aircraft. Data Communications reduce frequency congestion and errors. ADS-B routes available for equipped aircraft.

SURFACE TRAFFIC MANAGEMENT
Runway exit point, assigned gate and taxi route sent by Data Communications to pilots prior to approach. Pilot and controller workload reduced and safety improved.

SINGLE AUTHORITY SOURCE
Operators and traffic managers have immediate access to identical weather information through one data source.

DEPARTURE MANAGEMENT
RNAV and RNP precision allow multiple departure paths from each runway. Departure capacity increased.

ARRIVAL MANAGEMENT
Arrival sequence planned hundreds of miles in advance. RNAV and RNP allow multiple precision paths to runway. Equipped aircraft fly precise horizontal and vertical paths at reduced power from descent point to final approach in almost all types of weather. Time and fuel are saved. Noise, emissions and holding are reduced.

ENHANCED SURFACE TRAFFIC OPERATIONS
Pilots and controllers talk less by radio. Data Communications expedite clearances, reduce communication errors. Pilot and controller workloads reduced.

FLIGHT PLANNING
PUSH BACK / TAXI
TAKEOFF
DOMESTIC / OCEANIC CRUISE
DESCEINT
FINAL APPROACH / LANDING

PHASES OF FLIGHT Mid-Term 2018
NextGen Implementation Plan

Integrated Mid-Term Capability

- Clearance delivery and frequency changes
- D-ATIS
- Digital delivery of flight specific Traffic Management Initiatives (e.g., re-routes) to the cockpit.

- Uplink of RNAV/RNP procedures
- Negotiated optimized profile descents with required time of arrival (RTA)
- Further expanded capacity with Integrated Arrival Departure Management
- Tailored arrivals with FMS integration

- Expanded use of performance-based navigation
- Integrated arrival/departure management
- Curved segments for de-conflicted flows between nearby airports
- Optimized profile descents

Data Communications

RNAV/RNP

ADS-B

- RNP + ADS-B for CASP
- RNP + RTA + ADS-B for spacing to optimized runway throughput

Expect expanded synergy among technologies

- Surveillance provided in areas without coverage today
- Enable improved separation management services
- Expanded STMS coverage
- ADS-B in surface safety with traffic and own ship on EFB moving map
- ADS-B In/CDTI assisted visual separation
NextGen Mid Term Implementation
Task Force Recommendations

• Surface
  □ Surface Situational Awareness Phase 1: Deploy ground infrastructure to capture and integrate surface activities (40)
  □ TFM Common Operational Picture: Define consistent views of operational data for collaborative decision-making (43)
  □ Surface Connectivity & Surface Situational Awareness Phase 2 among FOCs, FAA, Airports (38, 41)

• Runway Access
  □ Increase capacity and throughput to converging and intersecting runways (9)
  □ Improve parallel runway operations in a phased manner, where near-term commitment and implementation successes dictate the need for mid-term investments (37a, 12, 13, 14)
NextGen Mid Term Implementation
Task Force Recommendations

• Metroplex
  □ Optimize RNAV and RNP operations, institute tiger teams that focus on quality at each location (29, 32a, 32b)
  □ Integrate procedure design to deconflict airports and expand use of terminal separation rules (4, 21a)

• Cruise
  □ Special Activity Airspace: Efficient management and use of SAA through real-time data exchange of status and schedules (35)
  □ Improve time-based metering and leverage operator capabilities (24, 25)
  □ Develop Area Navigation-Based En Route System (30)

• Access to the NAS
  □ Low Altitude Non-Radar: Extend radar-like services to low altitude airspace without radar surveillance (28)
  □ Implement LPV procedures for airports without precision approaches (22)
NextGen Mid Term Implementation
Task Force Recommendations

• Data Communications
  □ Digital ATC-Aircraft Communications for Revised Departure
    Clearances, Weather Reroutes, and Routine Communications (16,
    17, 39, 42a, 44)

• Integrated Air Traffic Management (I-ATM)
  □ Integrated CDM/TFM/ATC Solution to traffic flow problems (47)
  □ Improved Collaborative ATM (C-ATM) Automation: C-ATM
    automation to negotiate user-preferred routes and alternative
    trajectories (7b, 8, 46)

• Overarching Recommendations
  □ Achieving Existing 3 and 5 Mile Separation Standards
  □ Incentivizing Equipage
  □ Streamlining Operational Approval and Certification
Trends in Aircraft Size

U.S. Airlines

Data source: Form 41 Traffic data from Bureau of Transportation Statistics (US carriers)
RJ-NB Boundary Blurred

Source: based on manufactures’ a/c specifications. Full pax range of standard version.
B 787 Delayed First Flight
A 350

250-300 Seats
7500-8800 nm Range

Approximately 483 Firm Orders

Source: http://www.airbus.com
Advanced Engines in Development

- P&W Geared Turbofan
- GE Unducted Rotor
Environmental Issues

Noise

- Stage 4 (Equipment)
- Airports (Capacity)

Emissions

Intergovernmental Panel on Climate Change
Green House Gas Emissions

- Cap and Trade Discussions
- CO2 Efficiency Standards
- Alternative Fuel Demonstrations
- Copenhagen Climate Conference
  □ Dec 2009

Each square represents 1% of total emissions inventory

<table>
<thead>
<tr>
<th>Non-Transport</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Utilities</td>
<td>Transportation</td>
</tr>
<tr>
<td>Industry</td>
<td>Aviation</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td></td>
</tr>
</tbody>
</table>

Source: US EPA data, 2005