Air Transportation After September 11th


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A Critical Assault on Liberty, Justice, Peace, and Freedom of the Skies

- Conspiracy to carry out criminal acts
- Terrorists took advantage of our open society to cause it great harm
- Instruments of terror were almost entirely of American origin
- Preserving justice and peace may restrict liberty and freedom
- Difficult balance between security and preserving individual rights
- Law enforcement vs. more restrictive laws
- Adapting to the diversity of evil

Sixteen of the 19 bombers were in US on legal visas

Visa extensions sent to 2 hijackers by INS in March, 2002
The Herndon Crisis: 11 Aircraft Unaccounted for (AW&ST, 12/17/01)

- 8 am: AAL 11 (B-767) takeoff
- 8:01: UAL 93 (B-757) takeoff
- 8:14: UAL 175 (B-767) takeoff
- 8:21: AAL 77 (B-757) takeoff
- 8:30: Possible hijacking reported
- 8:46: AAL 11 impact on WTC 1
- 9:03: UAL 175 impact on WTC 2
- ~9:15: 11 aircraft with “unusual information”, including AAL 77 and UAL 93
- 9:26: Nationwide departures halted
- 9:41: AAL 77 impact on Pentagon
- 9:45: All aircraft directed to land immediately @ nearest airport
- 10:10: UAL 93 crash in PA -- 9 “unusual” aircraft still airborne -- concern for attack on White House and Air Force One
- 10:39: All airport operations halted
- 11:06: All NAS operations suspended
- 12:16: Airspace is clear, except for military aircraft
The FAA reopened the National Airspace System to commercial and private aviation on Sept. 13 at 11 a.m. EDT
Terrorist Threats to Commercial Aircraft

- **On-Board Terrorists**
  - Trained pilots among passengers
  - Personal effects, carry-on luggage
    - Hand weapons
    - Explosives
  - Air crew
    - Malicious intent
    - Suicidal goal

- **External Terrorists**
  - Service workers
    - Aircraft maintenance
    - Food carts
  - Anti-aircraft weapons
    - Stingers
    - Kamikaze aircraft
    - Lasers
Was the Global Positioning System (GPS) an Enabling Technology for the Attacks?

Battery Life 8-24 hr
Number of User Waypoints 500
Display Size 2.2 x 1.5
Receiver** 12 channel
Unit Size 2.32 x 5 x 1.62
Unit Weight 9 oz
Database Options Americas, Pacific Intl, Atlantic Intl.
Jeppesen Database*** Full, plus ARTCC and FSS frequencies
Moving Map YES
Basemap 20 MI
Pixels 100 x 160
Display Type High-Contrast FTN 4 level gray
Standard Accessories Dash mnt, batteries
Built-in H.S.I. YES
IFR or VFR VFR
MSRP**** $549 (street: $475)
Government Security Actions

(Aerospace America 2/02)

- DoT Rapid Response Team reports on aircraft and airport security (10/01)
- Air Transportation Safety and Stabilization Act (10/01): $5B cash, $10B loan guarantees, *de facto* re-regulation of recipients
- Aviation and Transportation Security Act (11/01)
- Transportation Security Administration established, separate from FAA and NTSB
  - 10-minute delay (max) at check-in
  - Comprehensive screening of all checked baggage and cargo
  - Several thousand air marshals to be deployed by June 1, 2002
  - New focus on collecting intelligence
  - Federalization of screeners, giving them union protection
- Disparity between Congressional mandates and realistic goals
- Restructuring of INS, need for better cooperation among agencies
Passenger Screening at the Airport

- Increased check-in delays
- Intermittent concourse shut-down and re-screening
- Correct vs. politically correct policies
- Security vs. invasion of privacy and harassment
- Profiling, background check, personal interview (El Al experience)
- Cross-over point for short-range trips shifts -- other transportation modes become more attractive

“Flying simply is not fun anymore. It’s just too unpleasant.”
Andy Rooney, 60 Minutes, 2/10/02
Airport Security Systems and Operations

- Multi-tier check-in for known and unknown passengers
- Security procedures for air crews tailored to their status
- Low-tech solutions: baggage identification, bomb-sniffing dogs
- High-tech solutions: ID cards, biometrics, explosives detection
- No dearth of proposals: which to choose?
- Air terminal renovations for increased security
- Is BIG BROTHER our friend after all?
Security and Surveillance on Aircraft

- In-flight measures: last line of defense
- Strengthened cockpit door, defensive maneuvers, cabin depressurization, crew ID interlocks on controls, guns, Tasers
- Crew vigilance and procedures
- Defensive actions of full-time and “reserve” air marshals, athletic passengers
- Cockpit and cabin video cameras, transponders, ACARS, CVRs, DFDRs: independent power, inaccessible circuit breakers

United Airlines orders 1300 Tasers
Remote Control of a Commandeered Aircraft is Not a Good Idea

- Frequency of hijacking incidents
- Time to develop systems
- Cost of airborne and ground-based components
- Feasibility of retrofit to older aircraft
- Maintenance of systems
- Training of ground personnel and air crews
- Reliability of systems (e.g., Predator and Global Hawk losses)
- Likelihood of causing accidents where no terrorism was present
Automated Avoidance of High-Value Sites is Not a Good Idea

- Analogy to ground proximity warning, terrain avoidance, traffic-collision avoidance systems (which assume cooperative crew)
- All of prior concerns, plus ...
- Definition of high-value sites to be protected
- Radius and altitude of protection bubble
- Navigation around contiguous bubbles
- Sensing/estimation of site location
- Definition of safe avoidance flight paths
- Interface between automatic and manual control systems
Enhanced Real-Time Monitoring is a Good Idea

- Early warning against use of aircraft as WMD or destruction of aircraft
- Downlink cockpit and cabin video, digital flight data
- Increased knowledge of aircraft intent
- Cost efficiency of 24/7 air patrol vs. “hot” alert
- But ....
- Will fighter/homeland defense aircraft shoot down threatening aircraft?
- Can anti-aircraft installations protect high-value sites?
Air Traffic Control and the National Airspace System (NAS): Present

- Reduced number of flying aircraft (-15-20%)
- Short-term (18-month) reprieve for NAS growth rate; capacity crunch by 2010
- Security takes budget priority over advanced ComNavSurv systems
- System development progressing at a glacial pace, though some hardware/software upgrades in place

'Huge' Budget Shortfall Looms for FAA

(AW&ST, 3/18/02)
Air Traffic Control and the National Airspace System: Future

- Increased reliance on GPS
  - WAAS, LAAS
  - Selective Availability, level of signal degradation
  - Deprivation of service in national emergency? (e.g., jamming, outage)
- Russian and European alternatives (GLONASS/GNSS)
- Enhanced telemetry (e.g., ADS-B, IFF, Mode S, leading to TCAS-4)
- Need for collaborative air traffic management, increased robustness
Impact on Commercial Airlines

- Fear-of-flying factor
- Schedule reductions of ~15%
- Load factors recovering but still down 20%; downsizing of aircraft in many markets
- Largest-ever losses; layoffs of 90,000, lower fares to lure flyers back
- High carrying costs, low margins, need for high cash flow
- Perennial labor issues, fare wars, etc.
- Alliances, consolidation, and bankruptcy; survival of the fittest
- On-time performance improved: 85% (11/02) vs. 73% (11/01)

(AS&ST, 3/18/02)
Much of the Commercial Fleet is Grounded

- 7,000 commercial aircraft; airlines park up to 2,000: B-727s, DC-10s, B-737s, MD-11s, DC-9s, MD-80s
- Older, less-efficient aircraft mothballed, put up for sale
- Major upgrade to world’s air freighter fleet foreseen
Even before September 11, the airline industry was heading toward a significant recession.

Note: Unit Revenue = RASM = Revenue per available seat mile, Unit Cost = CASM = Cost per available real mile

Source: DOT

1998-2001 Cost Increases: Fuel and labor
2000-2001 Price Declines: 10-yr-high prices in 2000, dot.com bust, recession, stock market, tightening corporate budgets
Traffic, Capacity, Load Factor: Network Airlines vs. Southwest Airlines

(AW&ST, 3/18/02)
Earnings and Market Value of Commercial Airlines

- UAL earnings/share estimates: $10.50 ('98), $10.06 ('99), $2.38 ('00), -$36.33 ('01), -$22.28 ('02), -$7.50 ('03)
- AMR estimates: $7.52 ('98), $6.26 ('99), $4.65 ('00), -$3.71 ('01), -$4.09 ('02), $2.70 ('03)
- LUV estimates: $0.52 ('98), $0.59 ('99), $0.79 ('00), $0.64 ('01), $0.64 ('02), $0.98 ('03)

Current debt of the top 7 network airlines is ~$70B-75B
Effect of Major Events on Traffic and Passenger Enplanements

(HW&ST, 11/19/01, 3/18/02)

- Historically, traffic rebounds after negative events
- 2-year hiatus in revenue-passenger-mile (RPM) growth foreseen
- Effect of more successful attacks? widened war against terrorists? airline bankruptcies? law suits related to 9/11?
- Substitution of teleconferencing, e-mail, etc. for long-distance travel
Possible Airline Industry Directions
(J. Wangermann, Booz-Allen-Hamilton, 1/02)

Re-think customer segmentation (behavior, trip purpose, actual or potential profitability, not just miles flown)

Re-focus/redefine services at each stage of travel on customer segments (reservations, pre-travel, airport, onboard, etc.)

Focus delivery mechanisms to counter niche players:
  - Less cross-subsidy across segments
  - High density, no-frills services on larger aircraft
  - 4-class service (First Class, Business, Premium Economy, Economy)
  - Trunk -> Regional shift

Create global brand through partnerships

Degree of “Unbundling” Required

Low

High
Near-Term Outlook Grim for Airframe and Parts Manufacturers (AW&ST, 1/28/02)

- 5 years to full economic recovery
- Parked aircraft return to service before ordering new aircraft
- “Not a going-out-of-business scenario”
- Most suppliers have a diversified customer base
- Lag between airline turn-around and new aircraft orders
- Bankruptcy of a single large airline would have major effect
- Divestiture, mergers, and acquisitions; Enron effect
How are Airframe and Parts Manufacturers Responding?

- Boeing cuts delivery estimates by 150 aircraft in next 15 months; layoffs of up to 30,000 people, proceeds with *Sonic Cruiser*; backlog of 980 aircraft (through 2002); diversification strategy: smaller percentage of earnings from commercial aircraft

- Airbus does not cut back, proceeds with *A380*, forecasts 15% earnings growth; backlog of 1,714 aircraft (through 2004)

- With engine manufacturers and suppliers, 100,000 layoffs likely

- USAF may lease 100 transports (B-767, A330?) as tankers
Boeing Prediction of Total Commercial Fleet (pre-9/11); ATA, CSFB Delivery Estimates

The World Fleet Will More Than Double Over the Next 20 Years

- 2000: 14,548 airplanes (66% single-aisle, 19% twin-aisle, 7% smaller regional jets)
- 2020: 32,954 airplanes (58% single-aisle, 22% twin-aisle, 15% smaller regional jets)

Additions and Removals Impact the World Fleet

Order Backlog and Aircraft Production Forecast

Source: Company data, Credit Suisse First Boston estimates

*Estimated for 2001-09

(AW&ST, 3/18/02)
The Boeing Airliner Strategy

- Focus on point-to-point comfort and convenience
- Address need for more, smaller aircraft
- Reduce travel time for high-end market
The Airbus Airliner Strategy

- Capture market for very-large passenger aircraft
- Address need for very-large freighter aircraft
- Maintain spectrum of aircraft
General Aviation: Part of the Solution or Part of the Problem?

- General Aviation: business and private aircraft, professional and amateur pilots
- Fixed-Base Operators (FBO), flying schools, traffic reporters, banner tows, crop dusters
- Disturbed individuals crash on White House lawn (1994) and fly into Tampa building (2001)
- Alleged hijackers received pilot training in the US
- Large bizjet could be a WMD
- Crop duster could spread toxic material in urban area
Rational Response for General Aviation

- Increase security at 4,500 public-use airports
- Tighten FBO procedures
- Require IFR-like flight plans near all urban areas
- Conduct thorough background checks for pilot training and license
- Adopt airline-like security for business aircraft operations
Prognosis for General Aviation

- Increased delays at commercial air terminals favor increased use of GA
- Explosive growth in the use of business jets and the market for fractional shares, charter flights
- Continuing need for safe, reliable, “user-friendly” small aircraft
Research Areas for the FAA, NASA, and Academia

- **FAA**
  - Prevention of incidents before boarding
  - Communications of aircraft intent
  - Cooperative air traffic management
  - Alternative airline economics

- **NASA**
  - Aircraft design and operational issues
  - Human factors of crew response to terrorist attack
  - High-technology development

- **Princeton/MIT/Ohio University**
  (http://www.princeton.edu/~stengel/JUP.html)
  - Exploration of high-risk/high-payoff alternatives
Recommendations: Security and the National Airspace System

Security

- Lock the barn door before the horse is stolen
- Distinguish between ideas - words - posturing - effective action
- Focus 90% of effort on 90% of threat
- Audit agency and individual accountability for security
- Prevent hijackers from boarding aircraft
- Keep truly hazardous devices off aircraft
- Preserve liberty, peace, justice, and freedom
- Maintain Eternal Vigilance: the next threat will be different

National Airspace System

- Support for security and vigorous program of NAS improvements
- Address economic as well as security issues
- Provide seamless connection between civilian and military air traffic assets
Recommendations: Airlines and Aerospace Industry

Airlines

- Improve crew response to terrorist threat
- Accept re-regulation of critical aspects of airline operation
- Adopt back-to-basics approach: simplified operation, rational yield management, supportable route structure, optimal aircraft types
- Develop new modal infrastructure
- Integrate trunk and regional jet service

Manufacturers

- Diversify products beyond commercial transports
- Consolidate where synergies are real; divest where links are illusory
- Focus on manufacturability, reliability, maintainability, and product improvement
One More Time ...

Eternal Vigilance