Air Transportation: A Tale of Prisoners, Sheep and Autocrats
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Acknowledgements and Caveat

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• The GMU Center for Air Transportation Systems Research (CATSR) is chartered to conduct:
  • Interdisciplinary, Quantitative, Objective Research to Inform Engineering and Public Policy Decisions
  • “Speak Truth to Power”

• The Opinions Expressed in this talk are my own and do not represent the positions of the sponsors or the Center
Credits

Research Team at GMU that have contributed to these Insights:

- Dr. Rudolph C. Haynie, Ph.D. (2002), Col. US Army
- Dr. Yue Xie, Ph.D. (2005)
- Dr. Arash Yousefí, Ph.D. (2005)
- Dr. Loan Le, Ph.D. (2006)
- Danyi Wang, Ph.D. Candidate
- Babak Jeddi, Ph.D. Candidate
- Bengi Mezhepoglu, Ph.D. Candidate
- Ning Xie, Ph.D. Candidate
- Jeffery Wang, Ph.D. Candidate
- David Smith, Ph.D. Candidate
- Zohreh Nazeri, Ph.D. Candidate
- Dr. Lance Sherry, Exec. Dir. CATSR
- Dr. John Shortle, Assoc. Prof. SEOR, CATSR
- Dr. C.H. Chen, Assoc. Prof. SEOR, CATSR
- Dr. Karla Hoffman, Prof. SEOR, CATSR
- Dr. Don Gross, Research Prof. SEOR, CATSR
Why Fly?

• GOALS of any Air Transportation System
  • Safe Transit
  • Short Transit Time
  • Predictable Schedule
  • Affordable
  • Reasonable Comfort

• Have You?
  • Experienced a Flight Delay greater than 15 minutes?
  • Had a Flight Canceled by the FAA for Bad Weather?
  • Experienced a Security Line Longer than 15 minutes?
  • Decided to Drive or take the Train to a city that you used to fly to?
### 10 Worst Cities for Air Travel Predictability:
Probability of a Passenger Delay Greater than 1 Hour

<table>
<thead>
<tr>
<th>Destination Airport</th>
<th>2004</th>
<th>2005</th>
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<tbody>
<tr>
<td></td>
<td>Prob.(Delay&gt;1 hr)</td>
<td>Probability of Delay &gt; 1 hr</td>
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<tr>
<td>Chicago</td>
<td>12%</td>
<td>NJ Newark</td>
</tr>
<tr>
<td>NJ Newark</td>
<td>11%</td>
<td>NY LaGuardia</td>
</tr>
<tr>
<td>NY LaGuardia</td>
<td>10%</td>
<td>Atlanta</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>9%</td>
<td>Boston</td>
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<tr>
<td>Atlanta</td>
<td>8%</td>
<td>Philadelphia</td>
</tr>
<tr>
<td>Miami</td>
<td>7%</td>
<td>Chicago</td>
</tr>
<tr>
<td>Dallas Ft W</td>
<td>7%</td>
<td>Ft. Lauderdale</td>
</tr>
<tr>
<td>Orlando, Fl</td>
<td>7%</td>
<td>NY Kennedy</td>
</tr>
<tr>
<td>Ft. Lauderdale</td>
<td>7%</td>
<td>Miami</td>
</tr>
<tr>
<td>Wash. Dulles</td>
<td>7%</td>
<td>San Francisco</td>
</tr>
</tbody>
</table>

*It Does NOT Have to Be this Way!*

D. Wang, 2006
EOY 2005 US Airlines had Posted a $2.8B Cumulative Deficit
## Major Airlines In and Out of Bankruptcy: 1982 - 2007

<table>
<thead>
<tr>
<th>Airline</th>
<th>Chapter 11</th>
<th>Liquidation</th>
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<tbody>
<tr>
<td>ATA</td>
<td>10/04 to Pres</td>
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</tr>
<tr>
<td>American West</td>
<td>6/91 to 8/94</td>
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</tr>
<tr>
<td>Braniff (1)</td>
<td>5/82 to 9/83</td>
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<tr>
<td>Braniff (2)</td>
<td>9/89 to 11/89</td>
<td>1989</td>
</tr>
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<td>9/83 to 9/86</td>
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<td>Continental (2)</td>
<td>12/90 to 4/93</td>
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<tr>
<td>Delta</td>
<td>9/05 to Pres</td>
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</tr>
<tr>
<td>Eastern</td>
<td>3/89 to 1/91</td>
<td>1991</td>
</tr>
<tr>
<td>Independence</td>
<td>11/05 to 1/06</td>
<td>2006</td>
</tr>
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<td>Midway (1)</td>
<td>3/91 to 11/91</td>
<td>1991</td>
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<td>Midway (2)</td>
<td>8/01 to 10/03</td>
<td>2003</td>
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<tr>
<td>Northeastern</td>
<td>1/85 to 11/85</td>
<td>1985</td>
</tr>
<tr>
<td>Northwestern</td>
<td>9/05 to Pres</td>
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</tr>
<tr>
<td>Pan Am (1)</td>
<td>1/91 to 12/91</td>
<td>1991</td>
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<td>Pan Am (2)</td>
<td>2/98 to 6/98</td>
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<tr>
<td>TWA (1)</td>
<td>1/92 to 11/93</td>
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<tr>
<td>TWA (2)</td>
<td>6/95 to 8/95</td>
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</tr>
<tr>
<td>TWA (3)</td>
<td>1/01 to 4/01</td>
<td>2001</td>
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<tr>
<td>United</td>
<td>12/02 to 2/06</td>
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</tr>
<tr>
<td>US Airways (1)</td>
<td>8/02 to 3/03</td>
<td></td>
</tr>
<tr>
<td>US Airways (1)</td>
<td>9/04 to 9/05</td>
<td></td>
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</table>
Air Transportation System (ATS) is a Network with 6 Interacting Layers

- The ATS is a Public - Private Partnership with conflicting Objective Functions:
  - Public – Commerce, Safety, Politics, Lobbies
  - Private – Profit Maximization

- Passenger/Cargo Layer (Delays, Cancellations)
- Airline Layer (Routes, Schedules, A/C size)
- TSA/FAA Layer (ATC Radar, Radios, Ctr’s, Unions)
- Weather Layer (Thunderstorms, Ice Storms)
- Physical Layer (i.e. Cities, Airports, Demographics)
- Government Regulatory Control Layer
Air Transportation is Characterized as a Complex Adaptive System (CAS)
The US Air Transportation System is in Trouble and is Getting Worse

• This is BAD for the US Economy
• This is bad for YOU
• Congress is both the Problem and the Solution
• Who are the:
  • Prisoners?
  • Sheep?
  • Autocrats?
Background on Air Transportation
The Airline Route Structure and FAA Control System Looks Complicated
The FAA: A Government Operated Wireless Telecommunications Company

Air Traffic Management (ATM) System Operated by the FAA

- ARTCC
- Tower/TRACON
- ARTS-II/III
- VHF Comms
- Landlines
- GDPs
- AOC

En Route Radar Systems (ARSR, ATCBI, Mode-S)

Weather Radar Systems (NEXRAD/TDWR/ASR9 WSP)

Terminal Radar (ASR, Mode-S)

VOR/TACAN, ILS, NDB, Loran

HOST/PVD

ASDE, AMAS
Typical Day: 6,000 Aircraft Aloft & 2,000,000 Passengers
Typical Day: 6,000 Aircraft Aloft & 2,000,000 Passengers
Northeast Triangle is the Most Congested
Why is there Congestion?

Big Sky Theory is Still Appropriate Enroute:

Average FAA Air Traffic Controller Workload is LOW

Planar Projection of Workload Function ($WL_t$)

Yousefi, Ph.D. (2005)
Safety at Principle Network Nodes (i.e. Airports) is the Constraint

- Aircraft Safety Separation Time over the Runway Threshold sets the ATS capacity limits
- Critical Technical Parameters that Define Network Capacity:
  - Runway Occupancy Time (ROT)
  - Landing Aircraft Inter-Arrival Time (IAT)
  - $\text{Cap}_{\text{max}} = 90 \text{ sec IAT at } 10^{-3} P_{\text{SRO}} = 40 \text{ Arr/RW/Hr}$
  - Queuing Delay Onset at $\sim 80\% = 32 \text{ Arr/RW/Hr}$ limit for Predictable Performance
Queuing Delays set the Practical Capacity Limitation set by Safety Separation Standards

- Lack of Schedule Synchronization and 90 second IAT generate Queuing Delays above about 80% of Maximum Runway Capacity

![Theoretical Queueing Delay Graph](image)

- Cancellations begin
- 32 Arr/RW/Hr

\[ \text{Delay (Minutes)} \approx \frac{K \rho}{1 - \rho} \]
Data Analysis Process to Estimate: IAT, IAD and ROT pdf’s

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Threshold</th>
<th>Leave Runway</th>
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</thead>
<tbody>
<tr>
<td>Heavy</td>
<td>10:23:14</td>
<td>10:24:04</td>
</tr>
<tr>
<td>Large</td>
<td>10:26:16</td>
<td>10:27:12</td>
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</tbody>
</table>

Col. Clint Haynie, USA PhD., 2002
Yue Xie, PhD. 2005
ROT vs. IAT to find Simultaneous Runway Occupancy (SRO) Probability: est to be ~ 2 / 1000

- Detroit Metropolitan Airport (DTW)
  - Freq \((IAT < ROT)\) \(\approx 0.0016\) in peak periods and \(0.0007\) overall (including non-peak periods - 1870 total samples)
  - IMC: \(1 / 669 = 0.0015\) in peak periods
  - Correlation coefficient = 0.15 \([Babak, Shortle and Sherry, 2006]\)
It does Not Have to Be this Way

Changes in FAA Procedures, Airport Slot Controls and New Avionics Will Improve BOTH Safety and Capacity
Summary on Capacity

• 40 Arrival per Runway per Hour is current Safety Maximum

• 32 Arrivals per Runway per Hour is ONSET of Queuing Delays
  • Using Current (OLD) Technology
  • Using Current (OUTDATED) ATC Procedures

• FAA has Refused to Mandate New Technology and Procedures to Reduce the Variability in IAT to Increase BOTH Safety and Capacity
Current Problem: More departures and landings are scheduled than runway capacity can handle.

Flight Schedules Drive The Flight Delays
- Schedules are Uncoordinated (Anti-Trust Laws)
- Largely Un-regulated by Arrival Slot Allocations
- Scheduling Decisions Driven by Airline Concerns of
  - Market Access
  - Competition
  - Profitability

Delays at a Few Major Airports Impact the Entire Air Transportation Network.
Who are the Prisoners?
All Airlines have about the Same Delay Performance

<table>
<thead>
<tr>
<th>Airline</th>
<th>Rank</th>
<th>% On Time</th>
<th>Invol Bump per 10,000</th>
<th>% Cancelled</th>
<th>Lost Bags per 1,000</th>
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<td>3</td>
<td>87</td>
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<td>4</td>
<td>84</td>
<td>1</td>
<td>0.9</td>
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<tr>
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<td>5</td>
<td>79</td>
<td>0.5</td>
<td>1.2</td>
<td>6</td>
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<tr>
<td>Sky West</td>
<td>6</td>
<td>77</td>
<td>1.1</td>
<td>2.7</td>
<td>5.5</td>
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<td>77</td>
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<td>0.7</td>
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<td>20</td>
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<td>4.6</td>
<td>2</td>
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</table>

Median: 76, 1.1, 1.2, 5.6  
Mode: 77, 1.1, 1.2, 5.5  

Note: BTS Data for Nov. 2005 to Nov. 2006
Some Airports are Producers of Delay
- Some Try to Absorb Delay

<table>
<thead>
<tr>
<th>Airline</th>
<th>Atlanta Hartsfield</th>
<th>Denver</th>
<th>Chicago O'hare</th>
<th>Philadelphia</th>
<th>New York Kennedy</th>
<th>LaGuardia</th>
<th>Newark</th>
<th>Reagan</th>
<th>Dulles</th>
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<table>
<thead>
<tr>
<th>Time of Day Performance (Arrivals and Departures)</th>
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<tbody>
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<td>6 to 8 am</td>
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<tr>
<td>92 - 92</td>
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<td>87 - 95</td>
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<td>86 - 90</td>
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<td>91 - 90</td>
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<td>77 - 94</td>
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<td>83 - 90</td>
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</tbody>
</table>

| 5 to 6 pm                                        |
| 72 - 68                                          |
| 80 - 82                                          |
| 65 - 63                                          |
| 62 - 62                                          |
| 53 - 61                                          |
| 53 - 64                                          |
| 43 - 48                                          |
| 67 - 67                                          |
| 69 - 69                                          |

| 6 to 7 pm                                        |
| 70 - 69                                          |
| 79 - 79                                          |
| 62 - 63                                          |
| 56 - 63                                          |
| 46 - 64                                          |
| 49 - 56                                          |
| 41 - 50                                          |
| 72 - 78                                          |
| 71 - 75                                          |

| 7 to 8 pm                                        |
| 68 - 67                                          |
| 76 - 78                                          |
| 59 - 61                                          |
| 53 - 55                                          |
| 56 - 58                                          |
| 50 - 56                                          |
| 39 - 47                                          |
| 65 - 70                                          |
| 76 - 67                                          |

| 8 to 9 pm                                        |
| 63 - 67                                          |
| 81 - 80                                          |
| 56 - 60                                          |
| 60 - 60                                          |
| 47 - 55                                          |
| 49 - 57                                          |
| 41 - 47                                          |
| 69 - 70                                          |
| 67 - 68                                          |

| 9 to 10 pm                                       |
| 69 - 60                                          |
| 75 - 83                                          |
| 58 - 65                                          |
| 62 - 50                                          |
| 53 - 52                                          |
| 47 - 49                                          |
| 46 - 52                                          |
| 66 - 77                                          |
| 60 - 73                                          |

Note: Best airports for % departure Performance are Houston Bush, Denver International, Salt Lake city, and Tampa (approx. 86%)
Severe Congestion at NY area airports: a 40-year old Reality

Timeline recap of congestion management measures

HDR at EWR, LGA, JFK, DCA, ORD
- Limited #IFR slots during specific time periods
- Negotiation-based allocation

Perimeter rule at LGA, DCA

Deregulation

1969 - 1978

Removal of HDR at EWR

Slot ownership

1978 - 1985

Use-it-or-lose-it rule based on 80% usage

AIR-21

4.2000

Exempted from HDR at LGA certain flights to address competition and small market access

Introduction of Hub-and-Spoke Network System
New York LaGuardia Airport: Case Study

DATA (2005):

- Throughput: 93,129 flights/yr
- Average Flight Delay: 38 min
- Seat throughput: 8,940,384 seats
- Revenue Passengers: 6,949,261 (LF=0.78)
- Average aircraft size: 96 passenger
- Average Inter-City fare: $133
NY LGA with 67 daily markets

Average daily frequencies of LGA nonstop markets (ASPM Q2, 2005)
Network Delays Driven by Uncoordinated and Over-Scheduled Flights: e.g. LGA, EWR, JFK

- High utilization rates (>80%) increase delays exponentially
- Delays at major airports impact the Entire Air Transportation Network

Airline Demand Driven by Market Access/Competition/Profitability Concerns

Runway Capacity is Set by Aircraft Safety Separation Standards

1 Hr

Scheduled operations vs. Facility-reported Capacity (ADR+AAR) (Source: ASPM)

Average delay per flight (Source: ASPM)
Current Government Rules at LGA Lead to Poor Use of Runway Resources

- Inefficient use of resources
- Airports lose
- Airlines lose (Low load factor/Small Aircraft)
- Airports win
- Airlines win (High load Factor/Large Aircraft)
Why do the Airlines Schedule beyond the Maximum Safe RW Capacity with Flights that Loose Revenue?

- There is No Government Regulation to Limit Schedules to Safety or Compensate Passengers for Delays and Cancellations!
  - Errors in the 1978 Deregulation Act
- Passenger Surveys Indicate that Frequency and Price are the Most Desirable Characteristics of a Flight
- Passengers are NOT told of Consequences of Schedule to travel Predictability
- If any One airline decided to offer Rational Schedules, their Competition will offer more frequency to capture Market Share
  - Thus still producing Delays and Cancellations for ALL

- In Game Theory, this is called the PRISONER’S DILEMMA
Answer to Question Number 1

Who are the Prisoners?

The Airlines!
A Natural Question? Is there an Optimal Allocation of Scarce Runway Resources?

- What would happen if Schedules at major airports were Capped by Predictable Runway Capacity and allocated by a market mechanism?
  - What markets would be served?
  - How would airline schedules change?
    - Frequency
    - Equipment (#seats per aircraft)
  - How would passenger demand change?
    - At airport
    - On routes
  - How would airfares change?
    - What would happen to airline profit margins?
  - How would airport and network delays be altered?
Airline Competitive Scheduling: Modeling Framework

Network Flow Optimization Problem

Demand-Price Elasticity

Auction 32 Slots/Hr

ASPM, BTS databases

Flight schedules
Fleet mix
Average fare
Flight delays

(Le, 2006)
**Research Results – Win Win**

**Airlines Adapt with Aircraft Size and Frequency to Congestion constraint: Positive impacts to passengers, airports, airlines, and ATC**

<table>
<thead>
<tr>
<th>Airlines</th>
<th>Airports</th>
<th>Air Traffic Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced frequency with larger aircraft</td>
<td>• Increased passenger throughput</td>
<td>• Reduced delays</td>
</tr>
<tr>
<td>• Most Markets Retained</td>
<td>• Reduced delays (70%)</td>
<td>– Reduced delays</td>
</tr>
<tr>
<td>• More Profitable (90% of Optimum)</td>
<td></td>
<td>– Demand within capacity</td>
</tr>
<tr>
<td><strong>Passengers</strong></td>
<td></td>
<td>– Reduced Prob. SRO</td>
</tr>
<tr>
<td>• Markets served: Little change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Airfares no change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Improved Predictability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**• Airports**

- Increased passenger throughput
- Reduced delays (70%)

**• Air Traffic Control**

- Reduced delays
  - Demand within capacity
  - Reduced Prob. SRO
Question Number 2

Who are the Sheep?
Weather is Blamed for Most Flight Delays: NOT Necessarily TRUE

- July 7, 2004: Line of thunderstorms moves across eastern U.S.
- Weather GDPs at 10 airports
- 87,000 Flight minutes of ground delay imposed

- INEFFICIENT: most of the delay is applied to flights that are not part of the problem (80% on this day)
- INEFFECTIVE: control only a fraction of the flights in the problem area
- INEQUITABLE: only flights bound for large airports are ever affected

FAA Knows Very Little about Weather and Route Structure Disruption
FAA GDP “Weather Holds” Lead to Delays and Cancellations that were NEVER Affected by Weather

- 80% of GDP-controlled flights (2289 of 2872) did not traverse FCA ⇒ inefficient, high cost; over 69,000 minutes of UNNECESSARY Flight Delay

Some Little Known Facts

• Modern Jet Aircraft “Gate-to-Gate” Travel Time is the Same or Longer than Propeller aircraft (DC-6 circa 1947) for many routes in NE Triangle
  • Typical Jet Aircraft is 70% Faster and fly's 80% Higher

• Jet Aircraft can fly Over most bad weather

• Modern Commercial Jet Aircraft can land in very low visibility

• Airport Congestion Causes Most ATC Delays and Airline Schedule Padding Masks Real “Gate-to-Gate” Delay
Passenger Quality of Service Metrics are NOT Currently used for System Control

- Most Research Emphasis has been on Flight Delay and Airline Economic Benefits from Reduced Fuel Consumption
- Little attention has been placed on the Passenger Quality of Service (PQOS) or on the real Lost Human Productivity
- Lost Passenger Productivity due to System Inefficiencies may EQUAL Airline fuel burn Losses
- Flight Cancellations are as Important to Understand and Model as Flight Delays
GMU Research Findings on Passenger Delay and Flight Cancellations

• Total Passenger Trip Delay (TPTD) metric defined (Danyi Wang (2006) work in progress)

• FAA defined Major 35 Airport Network:
  • 2004 data
  • 3,000,000 flights, 1044 City Pairs
  • 20.5% delayed > 15 min (52,100,000 Hours Delayed)
  • 1.78% flights CANCELLED (34,300,000 Hours Delayed)

• At $30/Hr = $2.6 Billion/yr Lost Productivity

• There is No Federal Requirement for the Airlines to Provide any Compensation
Passenger’s Rights (USA)

- Airlines don’t Guarantee their Schedules
  - Lottery ticket Predictability
- There are No Federal Requirements re Delays or Cancellations
- Airlines are free to Bargain with each passenger they strand
- Overbooking is Legal
- Rights for Involuntary BUMPING
  - 1-2 hrs delay = $200 max
  - >2hrs delay = $400 max
- Europe Has Adopted a Passenger’s Bill of Rights!
Do You Feel More Secure at Airports Today?

- Terrorist Goal is to achieve **HEADLINES** to achieve National Policy Change Objectives
  - Knives and Guns not the Problem
  - **Cockpit Door Locks VERY COST EFFECTIVE**
- **NO Static Defense Line is EVER Perfectly Secure**
  - French Maginot Line is a Classic Example
  - Nitro Glycerin – Easy to Make and High False Alarm Rate
- **Large Security Lines CREATE Massed Soft Targets at Multiple Airports at the Same Time of Day**
  - These Killing Zones are **BEFORE** the Explosive Security Check Points!
- **Long Security Queues are Exacerbating Air Transportation POOR PREDICTABILITY**
- **Passengers are Treated as SHEEP to be Pacified by a FALSE SENSE of SECURITY!**
US Airport Security Policy is to Build a New Maginot Line

- Maginot Line: Post WW I French Defense against Germany
  - Constructed 1930-1939
  - Defeated May-June 1940
- General Carl von Clausewitz
  - “If you entrench yourself behind strong fortifications, you compel the enemy to seek a solution elsewhere” *Von Kriege* ~ 1830
Security Case Study:
Washington Dulles Airport
Computer Simulation of Passenger Flow through the Security Queue
Details of Computer Simulation:
Security Screening Area and Process

Preparation of carry-on baggage and personal items before going through magnetometer
Magnetometer
X-ray for carry-on baggage and personal items
Recombination with carry-on baggage and personal items
Extra security procedures for selected passengers
Extra security hand-search of carry-on baggage
Hand search
Extra Security for selected Pax
Slow Passenger Screening Process Generates Queues of over 2 to 3 Aircraft Equivalents

Soft Target Killing Zone
Passengers and Airlines are Paying for a National Placebo

• Over $2 Billion/Yr are paid out of Airline Profit Margins to Make a Public Statement

• Airlines are **NOT Financially Capable** of Making this Donation to a National Publicity Fund
  • Systemic Deep Operating Deficits
  • Low Profit Margins
  • Defaulting on Pension Plans

• National Public Relations Statements should be Paid for out of General Revenue Funds – if at all
Who are the Sheep?

YOU ARE!
What has Changed since 1947?

• Transonic vs. Subsonic Aircraft
• 40,000 ft vs. 20,000 ft Altitude
• Avionics:
  • Flight Management Systems
  • Required Navigation Perf. 0.1nm
  • Required Time of Arrival
  • Traffic Collision Avoidance System
  • AOC Data Links
  • Zero Visibility Landing Systems
• ATC radar Separation

WHAT HAS NOT CHANGED
• Air Traffic Controllers talking to Pilots using WW II AM Radio Technology
FAA: 2 Separate Functions with an Inherent Conflict of Interest

• A Safety Regulatory Agency
  • Airlines
  • Aircraft Manufactures

• An Air Traffic Management Operator
  • Safety Oversight of ITSELF
  • Many Industrialized Nations have Separated this Function from the Gov’t Oversight Agency
    – Australia, Canada, Germany, New Zealand, United Kingdom, etc.
My Opinion on WHY

• FAA Organization, Culture and Engineering Expertise is Totally Inadequate to the Task of Designing, Acquiring and Maintaining a Modern Telecommunications System
  • Exhibit Monopolist Behavior
  • Not Held Accountable!
• It is NOT in the Self Interest of a Wealthy, and Politically Powerful Union (NATCA) that has:
  • Total job Security (civil service protection)
  • Ability to Directly Lobby with the Public and Congress
  • VERY HIGH PAY and Wealthy PAC (some >$200,000/yr)
  • Short Work Hours (< 5 hours/day)
  • Low Educational Entrance Requirements (High School)
• No Accountability for Poor System Performance
My Observations on ATM Change

• Congress has had to **MANDATE EVERY** Significant change in FAA Technology or Procedure since the 1950s
  • FAA Management Technically Unqualified
  • Air Traffic Controllers Union (NATCA) Opposes any Productivity Change or Safety Oversight!

• My experience of Negotiating with NATCA
  • NATCA PAC contributes over $1 million/yr to Congressional Campaigns
  • Habitual Record of Deceit
    – Both Public and Private
  • Habitual Record of Intimidation as a Tactic
  • Exaggerated Self Image of Perfection and Technical Expertise
  • High IQ with Limited Education
  • Selection Process → Authoritarian Personalities:
    – Refusal to Relinquish CONTROL over Anything

• **The Worst Kind of Autocrat**
Who are the Autocrats?

TSA,
FAA ATM Organization
and NATCA!
The Solution Lies with Congressional Action

The Passenger’s Welfare and National Economic Growth are the Victims

- **SHEEP** - Passenger/Cargo Layer (Delays, Cancellations)
- **PRISONERS** - Airline Layer (Routes, Schedules, A/C size)
- **AUTOCRATS** - TSA/FAA ATC Layer (Radar, Radios, Ctr’s, Unions)
- Weather Layer (Thunderstorms, Ice Storms)
- Physical Layer (i.e. Cities, Airports, Demographics)
- Government Regulatory Control Layer

**SOLUTION**
Congressional Action Options

- Do Nothing
  - Decrease Air Travel Predictability and Safety
  - Decrease National Economic Growth Rate
Congressional Action Options

• Do Nothing
  • Decrease Air Travel Predictability and Safety
• Provide a Passenger’s Bill of Rights
  • Airline Accountability
Congressional Action Options

• **Do Nothing**
  - Decrease Air Travel Predictability and Safety

• **Provide a Passenger’s Bill of Rights**
  - Airline Accountability

• **Acknowledge Gov’t Inability to Ever Provide Perfect Security**
  - Move to Layered Defense Philosophy and General Tax Funding
Congressional Action Options

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• Mandate Slot Controls
  • Increase Travel Predictability
    – Decreased Delays and Flight Cancellations
  • Increase Separation levels of Safety
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  • Increase Separation levels of Safety

• Mandate Aircraft Technology Equipage
  • Increase Capacity and Safety
    – Aircraft Separation Assurance
    – Aircraft Required Time of Arrival and Nav Performance
Congressional Action Options

- **Do Nothing**
  - Decrease Air Travel Predictability and Safety

- **Provide a Passenger’s Bill of Rights**
  - Airline Accountability

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  - Increase Separation levels of Safety

- **Mandate Aircraft Technology Equipage**
  - Increase Capacity and Safety
    - Aircraft Separation Assurance
    - Aircraft Required Time of Arrival and Nav Performance

- **Mandate ATM service Outsourcing**
  - Increase Productivity and Safety Oversight
Only You can put enough pressure on the Congress to Change the Future

It is time for the Sheep to Arise and March on the Capital to Demand Action!
Center for Air Transportation System Research
Publications and Information

- Other Useful Web Sites
  - http://catsr.ite.gmu.edu
  - http://mytravelrights.com
BACKUP Material
Summary of European Passenger Bill of Rights -
http://news.bbc.co.uk/1/hi/business/4267095.stm

- **Overbooked Flights**
  - Passengers can now get roughly double the existing compensation if they are bumped off a flight.
    - Compensation must be paid immediately.
    - These passengers must also be offered the choice of a refund, a flight back to their original point of departure, or an alternative flight to continue their journey.
  - May also have rights to meals, refreshments, hotel accommodation if necessary even free e-mails, faxes or telephone calls.

- **Cancelled Flights**
  - Offered a refund of your ticket, along with a free flight back to your initial point of departure, when relevant. Or, alternative transport to your final destination.
  - Rights to meals, refreshments, hotel accommodation if necessary, even free e-mails or telephone calls.
    - Airlines can only offer you a refund in the form of travel vouchers if you agree in writing
  - Refunds may also be paid in cash, by bank transfer or cheque
  - If the reason for your flight's cancellation is "within the airline's control", it must pay compensation.
  - Compensation for cancellations must be paid within seven days.

- **Delayed Flights**
  - Airline may be obliged to supply meals and refreshments, along with accommodation if an overnight stay is required.
  - If the delay is for five hours or more, passengers are also entitled to a refund of their ticket with a free flight back to your initial point of departure if this is relevant.
### Some Airlines Routinely Offer Flights that are Very Late Most of the Time (a few examples)

<table>
<thead>
<tr>
<th>Airline</th>
<th>Time</th>
<th>From</th>
<th>To</th>
<th>%</th>
<th>Median Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Airlines</td>
<td>5:55 PM</td>
<td>JFK</td>
<td>SJU</td>
<td>90</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>6:25 PM</td>
<td>EWR</td>
<td>ORD</td>
<td>88</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>8:25 PM</td>
<td>EWR</td>
<td>ORD</td>
<td>84</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>8:45 PM</td>
<td>ORD</td>
<td>EWR</td>
<td>84</td>
<td>46</td>
</tr>
<tr>
<td>COMAIR</td>
<td>6:00 PM</td>
<td>JFK</td>
<td>BOS</td>
<td>97</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>7:35 PM</td>
<td>JFK</td>
<td>ATL</td>
<td>97</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>6:50 PM</td>
<td>IAD</td>
<td>JFK</td>
<td>85</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>6:30 PM</td>
<td>JFK</td>
<td>DCA</td>
<td>67</td>
<td>51</td>
</tr>
<tr>
<td>Continental Airlines</td>
<td>7:10 PM</td>
<td>ORD</td>
<td>EWR</td>
<td>83</td>
<td>93</td>
</tr>
<tr>
<td>Northwest Airlines</td>
<td>1:37 PM</td>
<td>DTW</td>
<td>ATL</td>
<td>87</td>
<td>35</td>
</tr>
<tr>
<td>Southwest Airlines</td>
<td>6:10 PM</td>
<td>PIT</td>
<td>PHL</td>
<td>86</td>
<td>34</td>
</tr>
<tr>
<td>US Airways</td>
<td>6:30 PM</td>
<td>EWR</td>
<td>CLT</td>
<td>90</td>
<td>45</td>
</tr>
</tbody>
</table>
## Airports with Routes that have Average Passenger Delays >45 min. over 20% of the Time

<table>
<thead>
<tr>
<th>Airport</th>
<th>Number of Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ Newark</td>
<td>20</td>
</tr>
<tr>
<td>NY JF Kennedy</td>
<td>8</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>8</td>
</tr>
<tr>
<td><strong>NY LaGuardia</strong></td>
<td><strong>6</strong></td>
</tr>
<tr>
<td>Atlanta Hartsfield</td>
<td>4</td>
</tr>
<tr>
<td>Chicago O’Hare</td>
<td>3</td>
</tr>
<tr>
<td>St. Louis</td>
<td>3</td>
</tr>
<tr>
<td>CLE</td>
<td>3</td>
</tr>
</tbody>
</table>
Research Results:
Detailed Data at 90% of Profit Optimality

Estimated Effect of Slot Controls at LGA Using Market Mech

- Market Change
- # flts/day
- Max Enpl/day
- Avg AC Seat Cap
- Avg Fare
- Avg Flt Delay

LGA IMC Capacity

Aircraft Size

Airfare

Max enpl/day

Markets served

Frequency of Service

Delays

Arrival Rate per 15min Time Slot
Background

- 60% of flights that entered FCA (842 of 1425) were uncontrolled by SWAP GDPs ⇒ low effectiveness and inequitable

- 80% of GDP-controlled flights (2289 of 2872) did not traverse FCA ⇒ inefficient, high cost; over 69,000 minutes of unnecessary delay

## TSA funding History

<table>
<thead>
<tr>
<th></th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
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<tbody>
<tr>
<td>$</td>
<td>-</td>
<td>-</td>
<td>$ 2,638.62</td>
<td>$ 2,334.00</td>
<td>$ 2,618.80 for passenger and baggage screening</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>-</td>
<td>$ 161.00</td>
<td>$ 172.46</td>
<td>$ 173.37 for aviation checkpoint security</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>$ 174.50</td>
<td>$ 150.50</td>
<td>$ 210.00</td>
<td>$ 180.00</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>$ 265.00</td>
<td>$ 309.00</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>-</td>
<td>$ 43.00</td>
<td>$ 50.00</td>
<td>$ 55.00</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>-</td>
<td>$ 15.00</td>
<td>$ 8.00</td>
<td>$ 13.20</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>$ 100.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
- IMC (Bad Weather Conditions)
- 3 nm pairs
- 523 samples (during peak periods)
- Fit: Erlang(1.5;0.35,6): mean 3.6 nm, std. dev. 0.86 nm.
Inter-Arrival Time (IAT)

- IMC (Bad Weather Conditions)
- 3 nm pairs
- 523 samples (during peak periods)
- Fit: Erlang(40;11,6): mean 106 sec, std. dev. 27 sec.
• 669 samples for *all* aircraft types, peak IMC periods
• Sample mean is 49.1 sec.
• Sample std. dev. is 8.1 sec.
Unprofitable daily markets at LGA

- Three markets that are not profitable to operate on a daily basis are identified to be Lebanon-Hanover, NH (LEB), Roanoke Municipal, VA (ROA), and Knoxville, TN (TYS).

<table>
<thead>
<tr>
<th>Runway Cap.</th>
<th>Market</th>
<th>seats/AC</th>
<th>Fare</th>
<th>Passengers</th>
<th>RPM Yield</th>
<th>Flights/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>unconstrained</td>
<td>LEB</td>
<td>19</td>
<td>$153</td>
<td>50</td>
<td>$0.72</td>
<td>6</td>
</tr>
<tr>
<td>10,9,8,7</td>
<td>ROA</td>
<td>37</td>
<td>$186</td>
<td>77</td>
<td>$0.46</td>
<td>5</td>
</tr>
<tr>
<td>6,5,4</td>
<td>TYS</td>
<td>50</td>
<td>$125</td>
<td>85</td>
<td>$0.19</td>
<td>2</td>
</tr>
</tbody>
</table>
Why has the FAA not Significantly Changed the ATC System since 1960’s?

- Variance Reduction in Operational Separation
  - Slot Controls and Introduction of New Procedures and Technology are the Keys to Both Increasing Capacity and Safety
- Digital Data Links (DDL) have been Planned since 1980 and not delivered yet
  - WW II technology Radios!
- Aircraft Computerized Flight Management Systems (FMS)
  - Required Time of Arrival (RTA) capability since the 1980s.
  - Required Navigation Performance (RNP) and 4D Trajectory Control since 1990s.
- Aircraft-based collision avoidance technology (TCAS)
  - Fully Deployed since 1995
- GPS/DDL (ADS-B) aircraft self separation technology has been deployed in Alaska and proven since 2000!
- The National Air Traffic Controllers Union (NATCA) has OPPOSED ALL of these Technology Introductions since before 1980!
  - Opposed introduction of RADAR in the 1950s
# Most US Airlines are Still in Financial Difficulty

## GAO Airline Data (August 2004)

<table>
<thead>
<tr>
<th>Airline</th>
<th>Enplanements 2003 (millions of passengers)</th>
<th>% of Total</th>
<th>Gov't Loan ($ Millions)</th>
<th>% Gov't Assist</th>
<th>Classification</th>
<th>Net Income * ($millions)</th>
<th>Net Equity * ($millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sowthwest</td>
<td>74.7</td>
<td>11.5</td>
<td>271</td>
<td>11.9</td>
<td>LCC</td>
<td>313</td>
<td>5,504</td>
</tr>
<tr>
<td>AMR Corp</td>
<td>104</td>
<td>16</td>
<td>361</td>
<td>15.8</td>
<td>Legacy</td>
<td>(761)</td>
<td>(1,545)</td>
</tr>
<tr>
<td>UAL Corp</td>
<td>66</td>
<td>10.2</td>
<td>300</td>
<td>13.1</td>
<td>Legacy</td>
<td>(1,644)</td>
<td>(7,921)</td>
</tr>
<tr>
<td>Delta Air Lines Inc.</td>
<td>84</td>
<td>13</td>
<td>390</td>
<td>17</td>
<td>Legacy</td>
<td>(5,198)</td>
<td>(5,796)</td>
</tr>
<tr>
<td>Continental Airlines Inc.</td>
<td>38.5</td>
<td>5.9</td>
<td>173</td>
<td>7.6</td>
<td>Legacy</td>
<td>(363)</td>
<td>(296)</td>
</tr>
<tr>
<td>Northwest Airlines Corp.</td>
<td>51.8</td>
<td>8</td>
<td>205</td>
<td>9</td>
<td>Legacy</td>
<td>(848)</td>
<td>(3,172)</td>
</tr>
<tr>
<td>US Airways Group Inc.</td>
<td>41.3</td>
<td>6.4</td>
<td>216</td>
<td>9.4</td>
<td>Legacy</td>
<td>(611)</td>
<td>(3,393)</td>
</tr>
<tr>
<td>Expressjet Holdings Inc.</td>
<td>11.2</td>
<td>1.7</td>
<td>3</td>
<td>0.1</td>
<td>Regional</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Jetblue Airways Corp.</td>
<td>8.9</td>
<td>1.4</td>
<td>23</td>
<td>1</td>
<td>LCC</td>
<td>47</td>
<td>756</td>
</tr>
<tr>
<td>Airtran Holding Inc.</td>
<td>11.7</td>
<td>1.8</td>
<td>38</td>
<td>1.7</td>
<td>LCC</td>
<td>12</td>
<td>293</td>
</tr>
<tr>
<td>Alaska Air Group Inc.</td>
<td>15</td>
<td>2.3</td>
<td>38</td>
<td>1.7</td>
<td>Legacy</td>
<td>(15)</td>
<td>665</td>
</tr>
<tr>
<td>ATA Holdings Corp.</td>
<td>9.4</td>
<td>1.5</td>
<td>37</td>
<td>1.6</td>
<td>LCC</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>America West Holdings</td>
<td>20</td>
<td>3.1</td>
<td>81</td>
<td>3.6</td>
<td>LCC</td>
<td>(90)</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>536.5</strong></td>
<td><strong>82.8</strong></td>
<td><strong>2136</strong></td>
<td><strong>93.5</strong></td>
<td></td>
<td><em>(9,158)</em></td>
<td><em>(14,877)</em></td>
</tr>
</tbody>
</table>

* 12 months (2004) source: Poole and Cordle, 2005

AMR includes American AL, American Eagle and Executive Airlines
EOY 2005 US Airlines had Posted a $2.8B Cumulative Deficit