Rare Events in Aviation: A Case-study of “Tarmac Delays”
Tarmac Delay

- Holding passengers in aircraft on Tarmac for > 2 hrs without access to food/water/services
- Holding passengers in aircraft on Tarmac for > 3 hours without option for deplaning
History

• 1999: Northwest Airlines stranded passengers on tarmac at Detroit.
  – No food, water and bathroom facilities.
• 2000: 1st Passenger Bill of Rights introduced but failed to muster enough votes for passage.
• 2001: Senator John McCain proposed the second Airlines Passenger Bill of Rights, but due to strong airline lobbying the legislation never passed.
  – Airlines pledged to undergo internal reviews of their customer service policies
• 2006: American Airlines (AAL 1348) strands passenger stranding in Austin for 9 hours
• 2007: St. Valentine’s Day Ice Storm
  – Jet Blue strands passengers at JFK
• Delta Flight 6499 June 25, 2007
  – [http://www.youtube.com/watch?v=R06dAgpmmbg&feature=related](http://www.youtube.com/watch?v=R06dAgpmmbg&feature=related)
• 2009: Passenger Bill of Rights Passes
Consumer Activist

- FlyersRights.org was formed in 2006 to give flying public a legal voice and recourse
- California Realtor, Kate Hanni, was stranded with her husband and two children for 9 hours on the tarmac in Austin, Texas.
- 25,000 members
- largest non-profit consumer organization in the United States representing airline passengers.
- http://www.youtube.com/watch?v=5gE4a4aHJa4
Passenger Bill of Rights

• On Dec 21st, 2009, Department of Transportation (DOT) announced Rule
  – prohibits U.S. aircraft on domestic routes from remaining on a Tarmac for more than three hours with travelers aboard

• Rule goes into effect April 29, 2010
  – JetBlue Airways Corporation ("JetBlue") and Delta Air Lines, Inc., ("Delta") request exemption during “Bay Runway” 13R/31L construction at JFK
Contents of Rule (1/2)

• Rule applies to all U.S. passenger airlines operating flights with more than 30 seats

• Airlines will be not allowed to schedule chronically delayed flights.

  – “Flights that operate at least 10 times a month are only chronically late if they arrive at their destination more than 30 minutes after their scheduled arrival time more than half the time.” Federal Report, 2009.

  – “And the delays must occur for more than four straight months before the airline risks a fine” Federal Report, 2009.
Contents of Rule (2/2)

• Requirements for Airlines:
  1. Adopt and publish contingency plans for lengthy tarmac delay their websites.
     1. Provide food and water for Tarmac Delays > 2 hours
     2. Passengers have rights to de-plane after 3 hours (with some limitations)
  2. Respond to consumer problems
     1. Airlines must designate an employee to monitor the effects of flight delays and cancellations
  3. Declare the operation of flights that remain chronically delayed to be an unfair and deceptive practice and an unfair method of competition
Contents of Rule (2/3)

• Requirements for Airlines (cont/d)
  1. Airlines cannot retroactively apply changes to their contracts of carriage
  2. Publish delay data on their websites.
  3. Adopt a customer service plan and self-audit adherence to it
# Tarmac Delay Statistics (PHL)

## Tarmac Delay Grouped by Minutes

<table>
<thead>
<tr>
<th>Years</th>
<th>0-59m</th>
<th>60-119m</th>
<th>120-179m</th>
<th>180-239m</th>
<th>240-299m</th>
<th>300-359m</th>
<th>360-419m</th>
<th>TOTAL</th>
</tr>
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<tr>
<td>2005</td>
<td>122278</td>
<td>3620</td>
<td>456</td>
<td>69</td>
<td>6</td>
<td></td>
<td></td>
<td>126429</td>
</tr>
<tr>
<td>2006</td>
<td>105045</td>
<td>2833</td>
<td>339</td>
<td>85</td>
<td>10</td>
<td></td>
<td></td>
<td>108312</td>
</tr>
<tr>
<td>2007</td>
<td>99729</td>
<td>3729</td>
<td>445</td>
<td>122</td>
<td>31</td>
<td>4</td>
<td></td>
<td>104060</td>
</tr>
<tr>
<td>2008</td>
<td>97372</td>
<td>2770</td>
<td>248</td>
<td>81</td>
<td>27</td>
<td>1</td>
<td></td>
<td>100499</td>
</tr>
<tr>
<td>2009</td>
<td>75554</td>
<td>2644</td>
<td>329</td>
<td>54</td>
<td>6</td>
<td></td>
<td></td>
<td>78587</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>499,978</strong></td>
<td><strong>15,596</strong></td>
<td><strong>1,817</strong></td>
<td><strong>411</strong></td>
<td><strong>80</strong></td>
<td><strong>4</strong></td>
<td><strong>1</strong></td>
<td><strong>517,887</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Flights with Tarmac Delay &gt;= 2 hours</th>
<th>2313</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Flights with Tarmac Delay &gt;= 2 hours</td>
<td>0.44%</td>
</tr>
</tbody>
</table>
Tarmac Delays Statistics by Year (PHL)

Percentage of Flights per Year

- 2005: 126429, 25%
- 2006: 108312, 21%
- 2007: 104060, 20%
- 2008: 100499, 19%
- 2009: 78587, 15%
## Tarmac Delay Statistics by Month (PHL)

### Percentage of Flights (2+ TD)

<table>
<thead>
<tr>
<th>Month</th>
<th>Year - TD</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<tbody>
<tr>
<td>1</td>
<td>0.20 0.07</td>
<td>0.06</td>
<td>0.01</td>
<td>0.64</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.40 0.02</td>
<td>0.04</td>
<td>0.20 0.24 0.47</td>
<td>0.35 0.03</td>
<td>0.28 0.18</td>
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<tr>
<td>3</td>
<td>0.19 0.01</td>
<td>0.02</td>
<td>0.25 0.05 0.01</td>
<td>0.02</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.06 0.07 0.02 0.02</td>
<td>0.28</td>
<td>0.19 0.01</td>
<td>0.18 0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.08 0.27 0.04</td>
<td>0.24 0.07</td>
<td>0.07</td>
<td>0.17</td>
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</tr>
<tr>
<td>6</td>
<td>1.08 0.13 0.04</td>
<td>1.40 0.33 0.01</td>
<td>1.46 0.38 0.11 0.01</td>
<td>0.68 0.09 0.01</td>
<td>1.23 0.09</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.22 0.13 0.01</td>
<td>0.65 0.15</td>
<td>0.64 0.14</td>
<td>0.60 0.36 0.26 0.01</td>
<td>0.83 0.31 0.07</td>
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</tr>
<tr>
<td>8</td>
<td>0.37 0.09 0.01</td>
<td>0.45 0.04</td>
<td>0.48 0.09</td>
<td>0.38 0.08</td>
<td>0.63 0.04</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.11 0.05</td>
<td>0.55 0.31 0.07</td>
<td>0.42 0.33</td>
<td>0.15 0.04 0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.01 0.01</td>
<td>0.08 0.02</td>
<td>0.98 0.13 0.01</td>
<td>0.12 0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0.13 0.13</td>
<td>0.20 0.03 0.01</td>
<td>0.04</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.43 0.02</td>
<td>0.07</td>
<td>0.04</td>
<td>0.20 0.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Average per hour/year

- **2005**: 0.36 0.07 0.02 0.34 0.12 0.03
- **2006**: 0.42 0.18 0.09 0.02 0.24 0.12 0.08 0.01
- **2007**: 0.51 0.11 0.07

### Annual Percentage

- 2005: 0.44
- 2006: 0.49
- 2007: 0.72
- 2008: 0.45
- 2009: 0.70

June, consistently worst month.

*TD: Tarmac Delay*
Tarmac delays by Airline (PHL)

Tarmac Delays by Airlines
Jan 2005 - Oct 2009

US Airways Inc.
Southwest Airlines Co.
United Air Lines Inc.
American Airlines Inc.
Northwest Airlines Inc.
Delta Air Lines Inc.
AirTran Airways Corporation
Continental Air Lines Inc.
Others
Tarmac Delays by Destination - PHL

Tarmac Delays by Destination
Jan 2005- Oct 2009

- ORD: 13.58%
- ATL: 5.27%
- BOS: 4.67%
- DFW: 4.41%
- MCO: 4.15%
- DEN: 3.93%
- LAS: 3.63%
- LAX: 3.50%
- PIT: 3.46%
- DTW: 3.29%
- PHX: 3.16%
- MDW: 3.11%
- Others (Less than 3%): 43.84%
Conclusions I

• Tarmac Delays are in-the-tails-of-the distribution
  – Complex phenomena
  – Infrequent situations
  – Scenarios that fall through the cracks

![Diagram of Tarmac Delays](image)
<table>
<thead>
<tr>
<th>Stakeholder (critical only)</th>
<th>Roles and Responsibilities (and Authority to Mitigate Tarmac Delays)</th>
<th>Ability to Monitor Individual Flight Status on the Surface</th>
<th>Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight-crew</td>
<td>Operate the flight. Have final say on flight readiness and progress. Rely on dispatch to file flightplans, approve fuel, authorize flight, get gate assignment. Rely on air traffic control to provide clearance. Has no authority or mechanism to avoid tarmac delays.</td>
<td>Flight-crew know the status of their flight.</td>
<td>Fully aware of tarmac delay status of their flight. Does not have full knowledge of scope of TFM initiatives or status of airline network operations. Relies on contact with Ramp/Ground Controller and Dispatch.</td>
</tr>
<tr>
<td>Airline Dispatcher</td>
<td>Manages flights from gate-to-gate. Has full legal authority for operation of each flight. Has full legal responsibility for flight (e.g. violation of immigration laws, etc). Has authority, along with Supervisor, to prioritize airline flights.</td>
<td>Detailed trajectory information of flight while airborne. No information of position of flight on airport surface. Voice and data communication with flight-crew and Station Manager. Dispatch automation provides OOOI status of flight (gate-out, off, on, gate-in).</td>
<td>Does not have full knowledge of scope of TFM initiatives or status of airline network operations. Relies on contact with ATC Liaison. (In some circumstances) can be overloaded and must work highest priority items first. Can temporarily lose track of tarmac delay flights.</td>
</tr>
<tr>
<td>Airline Dispatcher – ATC Liaison</td>
<td>Coordinates airline dispatch requests with ATSCCC Traffic Flow Programs. Has authority to negotiate on behalf of tarmac delay flights, but may require cooperation of ATSCCC and other airlines.</td>
<td>See Airline Dispatcher, plus automation to support TMI “programs” (e.g. Flight Schedule Monitor)</td>
<td>Is not alerted to tarmac delay status of each flight. Does not have detailed knowledge of the status of individual flights. Does have access to TFM initiative data. Is not automatically alerted about tarmac delay flights.</td>
</tr>
<tr>
<td>Airline Dispatch/AOC – Supervisor</td>
<td>Oversees all airline dispatch operations. Monitoring “big picture” and airline trends. Not focused on individual flights. Has authority to prioritize airline flights.</td>
<td>See Airline Dispatcher, plus automation to support TMI “programs” (e.g. Flight Schedule Monitor)</td>
<td>Is not alerted to tarmac delay status of each flight.</td>
</tr>
<tr>
<td>Airline Station Manager (and Gate and Ground Personnel)</td>
<td>Coordinates ground support for all flights at gates. No explicit responsibilities for flights that have pushed-back or not gated-in. Has no authority to mitigate tarmac delayed flights.</td>
<td>No automation support. Has eyes and ears on the airport surface and contact with dispatch.</td>
<td>Is not alerted to tarmac delay status of each flight.</td>
</tr>
<tr>
<td>Stakeholder (critical only)</td>
<td>Roles and Responsibilities (and Authority to Mitigate Tarmac Delays)</td>
<td>Ability to Monitor Individual Flight Status on the Surface</td>
<td>Gaps</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Ramp Controller</td>
<td>Coordinates flights push-back/gate-in and ramp trajectories. No authority with regard to mitigating tarmac delays.</td>
<td>Has flight strips for all flights on taxiways. In good visibility has eyes out the tower cab.</td>
<td>Flight strips provide indication.</td>
</tr>
<tr>
<td>Ground Controller</td>
<td>Coordinates flight trajectories on airport taxiway system. No authority with regard to mitigating tarmac delays.</td>
<td>Has flight strips for all flights on taxiways. In good visibility has eyes out the tower cab.</td>
<td>Flight strips provide indication.</td>
</tr>
<tr>
<td>ATSCCC NOM</td>
<td>Provides oversight of Traffic Management Initiatives at the ATSCCC. Has more of a NAS-wide responsibility than the TFMU (see below). Responsibility for flights involved a TMI “program.” Has authority to intercede on behalf of airline in negotiation with other airlines and TFMU.</td>
<td>Has detailed information of all flights in a TMI “program”</td>
<td>Is not alerted to tarmac delay status of each flight. Has knowledge of excessive departure queuing at airports.</td>
</tr>
<tr>
<td>ATSCCC TFMU</td>
<td>Provides oversight of Traffic Management Initiatives at the ATSCCC. Responsibility for flights involved a TMI “program.” Has authority to prioritize flights within the scope of rules of TMI’s.</td>
<td>Has detailed information of all flights in a TMI “program.” May only be assigned a sub-set of airports.</td>
<td>Is not alerted to tarmac delay status of each flight. Has knowledge of excessive departure queuing at airports.</td>
</tr>
<tr>
<td>Airport Management/Operations</td>
<td>Manage and operate the airport as a “public utility.” Coordinate outsourced operations. Responsibility for emergency and abnormal operations. Has no authority with regard to tarmac delays. Under new DOT rule has some responsibility for providing resources and infrastructure to deplane passengers. Can support airlines, but not intervene in airlines operations.</td>
<td>No automation support. Has eyes and ears on the airport surface and contact with dispatch.</td>
<td>Is not alerted to tarmac delay status of each flight. May have knowledge of excessive departure queuing at airports.</td>
</tr>
</tbody>
</table>
Authority vs. Information

• Ramp/Ground Controller have information (but not authority)
• TFMU has authority (but not information)
• Dispatcher (has some information, but no authority)
• Dispatch Liasson/Supervisor has authority (but no information)
Question

• Given:
  – Phenomenon in-tails-of-distribution
    • Complex, infrequent, variability
  – Authority/Information gap
• Will Rule solve the problem?
Solution: Tool (for Information to those in Authority)
“Lost Flight/Tarmac Delay” Tool

Target Users:
• NOM at ATSCC
• ATC Liasson Airline
  Dispatchers/AOC “Super”
• Station Manager
• Airport Management

Operator Task List:
1. Know of all flights on tarmac longer than <threshold time>
2. Identify flights above caution/warning thresholds
3. Check on flight status (e.g. EDCT, Mx, .....
4. Based on 3, take mitigation steps:
   1. If TMI then .....?
   2. If Airline, then contact airline
      1. Look up airline contact info
      2. Send message/make call
      3. Add agenda item to 2hr telecon
   3. If unable 2, then contact airport
“Lost Flight” Tool Reqs

Objective: Provide decision support for mitigation of “Lost Flights” and “Tarmac Delays”

Functional Requirements:
1. Detect all flights on tarmac in excess of <time threshold>
2. Provide status on these flights
3. Provide contextual information (airport status, TMI status, …)
4. Alert all flights on tarmac approaching <caution threshold> and <time threshold>
5. Provide operator with necessary contact information to initiate mitigation strategies

Performance Requirements
1. Accuracy
2. 5 minute update rate

Technology Requirements
1. Web-based (for multiple location access)
Input/Output & Data Sources

- Surface Track Data
- Gate-In, Gate-Out, Wheels-Off, Wheels-On
- Airline Contact Info
- TMI/Fly.faa.gov
- CDMNet
- Geopolitical Airport Surface Images
- Flight Status Updates (ADL)
- Flight Status Updates (ADL)
- Flight Status Updates
- Dispatch/AOC
- ATSCC/TFMU
- Station Manager
- ARINC

Data processing

GUI
Delayed flights on Tarmac (departures or arrivals)

National Airspace System – Airport Tarmac Delay “hot-spots”

Information Panel (e.g. Airport Status Information - faaInfo.gov)
SCENARIO: Flight B6345, Sch. Dep GMT 13:25, Cur. GMT 15:15, TARMAC DELAY: 1:50:00
SCENARIO: Flight B6345, Sch. Dep GMT 13:25, Cur. GMT 15:15, TARMAC DELAY: 1:50:00

- Due to WEATHER / WIND, departure traffic destined to Newark International Airport, Newark, NJ (EWR) is currently experiencing delays averaging 2 hours and 45 minutes.
- Due to WEATHER / WIND, departure traffic destined to La Guardia Airport, New York, NY (LGA) is currently experiencing delays averaging 2 hours and 1 minute.
- Due to WX / LOW CGS, departure traffic destined to Philadelphia International Airport, Philadelphia, PA (PHL) is currently experiencing delays averaging 1 hour and 49 minutes.

General Departure Delays: Traffic is experiencing gate hold and taxi delays.

Turns orange after 2 hours (note: not a tarmac delay until 3 hours)
Location of flights
Red = Lost Flight (> 3 hrs)
Orange = Potential Lost Flight (> 2hrs)
Green = Delayed flights

Data Block:
• Flight Number
• Arrival/Departure
• Status

Due to WX / LOW CIGS, departure traffic destined to Philadelphia International Airport, Philadelphia, PA (PHL) is currently experiencing delays averaging 1 hour and 49 minutes.

General Departure Delays: Traffic is experiencing gate hold and taxi delays
SCENARIO: Delayed Flights 07-23-2008 GMT 22:30:00

JFK Airport
Red: Lost Flights
Orange: Potential Tarmac Delays
Green: Delayed Flights

Flight B6123
Tarmac Time: 4:25

Delayed flights GMT: 22:30
**SCENARIO:** Critical Time at JFK GMT: 23:45:00

**Delays by Destination:**
- Due to WEATHER / WIND, departure traffic destined to Newark International Airport, Newark, NJ (EWR) is currently experiencing delays averaging 2 hours and 45 minutes.
- Due to WEATHER / WIND, departure traffic destined to La Guardia Airport, New York, NY (LGA) is currently experiencing delays averaging 2 hours and 1 minute.
- Due to WX / LOW CIGS, departure traffic destined to Philadelphia International Airport, Philadelphia, PA (PHL) is currently experiencing delays averaging 1 hour and 49 minutes.

**General Departure Delays:** Traffic is experiencing gate hold and taxi delays.
04:25:00  JFK  B6  123  13:35:00  MCO  GMT:21:05:00-EDCT 2008-07-23 16:35:00
04:30:00  JFK  CO  070  15:29:00  IAH  GMT:21:05:00-EDCT 2008-07-23 15:44:00
02:45:00  JFK  OH  5360  16:25:00  BDL  GMT:21:05:00-EDCT 2008-07-23 16:00:00
02:45:00  EWR  XE  2904  14:31:00  MCI  GMT:21:05:00-EDCT 2008-07-23 14:51:00
02:55:00  JFK  B6  141  14:41:00  DIR  GMT:21:05:00-EDCT 2008-07-23 14:30:00
02:45:00  JFK  AA  117  14:40:00  LAX  GMT:21:05:00-EDCT 2008-07-23 14:05:00

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