Security and BHS

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Outline
- Broad impact of security considerations and issues
- Security tasks
- Baggage handling systems (BHS)
- Hold baggage processing
- Examples and statistics
- Current developments
Increasing Importance of Security-Related Issues

- Over the past 25 years, and especially since 2001, security has become
  - The most important source of uncertainty in planning for passenger terminal facilities
  - The fastest-growing cost element at airports

- Security regulations change rapidly in response to events and airport planners and operators have no choice but to comply with any change mandates

- Changes may affect not only security processing requirements (facilities, equipment, personnel) but also fundamental aspects of air transport operations (e.g., liquid-explosives scare of 2006 => 20% increase in checked bags)

Costs of Security

- Cost of passenger screening at airport terminals is roughly $6 billion per year (TSA cost plus equipment cost)
- 1,100 EDS and 6,000 Explosive Trace Detection machines at 429 airports installed in 2002 – 2004!
- Cost in Europe is roughly $4 billion (similar to US on a per passenger basis)
- Security processing and “early presentation” requirements also increase the time that passengers allocate to travel
- Cost of this additional time may be huge; for example: (20 extra minutes per departing passenger)x(500 million passengers)x($0.5 per passenger minute) = $5 billion!
### Who Pays?

- Passengers and airlines in US pay for roughly 50% of the $6 billion airport security costs through ticket taxes and charges to airlines.
- General tax funds pay for the remainder.
- User burden varies widely from country to country.
- Users requiring special services often pay extra.
- European Parliament (summer 2006): “Aviation security is a government responsibility; governments should pay for most of the costs, except when special arrangements are sought.”
  - Principle not applied to date.

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### Who Provides the Service?

- Varies widely according to national law:
  - Government (special agency like TSA; national Police; national Army)
  - Airport operator
  - Subcontractor (“outsourcing”)
- In all cases, national government retains responsibility for authorizing and monitoring arrangements.
- Labor issues arising with increasing frequency; can disrupt airport operations.
Centralized vs Decentralized Arrangements

- In centralized arrangements, passengers are screened soon after check-in, typically before entering concessions area.
- In decentralized arrangements, passengers are screened at the entrance of the gate lounges or of the bus gates.

Advantages and disadvantages to both arrangements:
- Economies of scale
- Effectiveness of screening
- "Sterility" of concession areas
- Impact on concession revenues
- Passenger perceptions of LOS

Major Security Tasks

- Passenger and Hand Baggage Screening
- Hold Baggage Screening
- Access Control
- Baggage Reconciliation
What Is “Best” Configuration of Screening Devices?

\[ P = \text{Prob[declare safe, given a dangerous bag]} \]
\[ Q = \text{Prob[declare unsafe, given a harmless bag]} \]

Two independent detectors

\[ P_1 = 0.1, \quad Q_1 = 0.01 \]
\[ P_2 = 0.04, \quad Q_2 = 0.01 \]

<table>
<thead>
<tr>
<th>Loading Policy</th>
<th>Conditional Probability of Loading a Dangerous Bag</th>
<th>Conditional Probability of Rejecting a Harmless Bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared Safe by Either Detector</td>
<td>13.6% [= P_1+(1-P_1)\cdot P_2 ]</td>
<td>0.01% [= Q_1\cdot Q_2 ]</td>
</tr>
<tr>
<td>Declared Safe by First Detector</td>
<td>10% [= P_1 ]</td>
<td>1% [= P_2 ]</td>
</tr>
<tr>
<td>Declared Safe by Both Detectors</td>
<td>0.4% [= P_1\cdot P_2 ]</td>
<td>1.99% [= Q_1+(1-Q_1)\cdot Q_2 ]</td>
</tr>
</tbody>
</table>

Source: Prof. A. Barnett

Baggage Reconciliation

- Or “Positive Passenger Bag Matching” (PPBM)
- Assures that passengers and their bags are on same flight
- Mandatory on international flights and in many countries on domestic flights
- But not an “either / or” proposition!
- Estimated impact on US domestic flights:
  - ~ 1.5% of departures would be delayed
  - given a late departure, average delay would be 14 minutes
  - Cost to airlines and passengers ~ $100 million per year
- Worthwhile?
“Exceptionalism” of International Flights to US

- Special screening requirements
  - Pre-processing of passengers
  - Passenger list transmission
  - CTX 5500, CTX 9000 machine screening is required (must often go through entire BHS)
  - Sales of duty-free liquor, etc
- Additional security charges paid

Baggage Claim (Arriving Passengers)

- Simplest, as a process, part of baggage handling
- Yet, may be the most important as far as passenger perceptions are concerned
- Passenger information is critical in shaping perceptions
  - “Time to first baggage”, etc
- IATA guidelines:
  - ~ 0.3 m (~1 ft) of linear frontage per passenger for bag claim devices (wide body: ~ 80 – 120 m; narrow body: ~ 30 – 50 m)
  - ~ 9 m (or more) between bag claim devices
- Issue of load distribution for terminals sharing flights subject to or exempt from customs inspection (e.g., extra-Schengen vs. Schengen)
- Bag claim halls at large terminals may be vast, especially when many long-range flights are involved
Ongoing Developments

- Very fast evolution of BHS
- Increased sophistication, complexity, automation
- “Demise” of linear, decentralized terminal concept has given further impetus
- Huge costs (e.g., Amsterdam system of ~$500 million)
- Increased role of radio frequency identification (RFID) technologies: more reliable than bar code tags, can incorporate a lot of information, cost is rapidly declining
- “Big players” entering the field

Theoretical vs. Actual Performance

- The actual performance and capacity of large and complex BHS often falls far short of the theoretical values
- Numerous technical problems may surface (e.g., unreliable mechanical components, difficulty in reading tags)
- Flow control problems may also contribute to serious performance deterioration (e.g., queuing problems, bottlenecks, load imbalances)
- Denver International in the 1990s is well-known example ($500 million increase in cost, 15 months of delay in airport opening at $30 million per month)