Risk Management and Physical Security

Modeling Risk
Aviation Security
Safety vs. Security

- **Assets**: what you want to protect
- **Threats**: what could damage your assets
- **Safety**: limiting the impact of unintentional threats
  - E.g., weather, diseases, mechanical failures
- **Security**: defending against intentional threats arising from intelligent, motivated attackers
  - E.g., crime, terrorism
Risk

• Threats occur with different probabilities
• Risk takes into account likelihood of threat
• Informally
  \[
  \text{risk} = \text{threat} \times \text{probability}
  \]
• Insurance underwriter’s perspective
• Risk management
  o Assess risk
  o Deploy countermeasures to protect assets from threats
Modeling and Managing Risk
Risk Management

• Goal of a safety or security system is to reduce risk, not to reduce threat

• Reducing threat could lead us astray:
  o Focus too much on serious but unlikely threats
  o Focus too little on mild but very common threats
## Risk Matrix

<table>
<thead>
<tr>
<th>Low Threat</th>
<th>High Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Probability</strong></td>
<td><strong>Low Risk</strong></td>
</tr>
<tr>
<td><strong>High Probability</strong></td>
<td><strong>Medium Risk</strong></td>
</tr>
</tbody>
</table>
## Risk Matrix

<table>
<thead>
<tr>
<th>Low Probability</th>
<th>Low Threat</th>
<th>High Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lunch stolen from the fridge</td>
<td></td>
<td>Shark Attack&lt;sup&gt;2&lt;/sup&gt; Murder by Stranger Plane Crash</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>Heart Disease</td>
<td></td>
</tr>
<tr>
<td>Car Accident</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor Shoplifting</td>
<td>Common Cold&lt;sup&gt;1&lt;/sup&gt; Stoning your Toe</td>
<td></td>
</tr>
<tr>
<td>Stubbing your Toe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Countermeasures

• No countermeasure is perfect
• No countermeasure is free
  o Money
  o Time
  o Convenience
  o Social acceptability
  o Liability
  o Liberty
Trade-Offs

• Recall
  o We care about mitigating risks (not threats)
  o No countermeasure is perfect
  o No countermeasure is free
• The trade-off is balancing
  o Cost of countermeasures
  o Risk of not employing countermeasures
Trade-Offs

• We do this all the time
  o Clean the dishes
  o Lock your bike
  o Choosing between expiration dates
  o Others?
Trade-Offs: Consequences

• “Absolute security” never worth it
  o Want avoid car accidents? Never leave home.
  o Keep airplanes safe? Strip search every passenger.

• Sometimes less security is the better trade-off
  o Most shoplifting occurs in dressing rooms. Get rid of the dressing rooms?
  o Hire extra guards at the movie theater to prevent a few people sneaking in?

Book Recommendation

To learn more about the fundamentals of security...

*Beyond Fear: Thinking Sensibly about Security in an Uncertain World*

by Bruce Schneier

Aviation Security
Aviation Safety and Security

• Major economic, social, and political importance of aviation
• Safety well understood and with strong record
  o Air travel is much safer than car travel ...
  o 100 times safer!
• Security less understood
  o Many improvement post 9/11
  o Still lacking in various dimensions
Aviation Assets

- Passengers, crews, and ground personnel
- Airport runways, buildings and facilities
- Planes
- Luggage and cargo
- Economic impact
- Social impact
Safety Measures

• Examples
  o Aircraft maintenance
  o Personnel training and rest
  o Airport facilities maintenance
  o Air traffic control (ATC)
  o Pilot-ATC communication protocol
  o Weather monitoring
Challenges to Securing Aviation

• Vast attack surface
  o Huge airport surface and facilities
  o Millions of passengers and employees
  o Massive cargo loads

• Tradeoffs
  o Cost vs. security benefit
  o Convenience vs. security
  o Reality vs. perception of security
Bad People and Things on Planes

• What normally goes into a plane
  o People: passengers, crew, ground personnel
  o Things:
    luggage, packages, containers, ...
    catered food and beverages
    aircraft supplies
    fuel

• Can we effectively screen all of the above?
Screening Passengers

• Current approach: three checkpoints
  o Reservation: check if passenger on no-fly list
  o Entering airport: check boarding pass and ID, screen passenger and carry-on luggage
  o Boarding pane: check boarding pass and, maybe, ID

• Some issues with current approach
  o Different checks at each checkpoint
  o Hasty check of ID

• Can one fly under someone else's name?

Source: tsa.gov
Screening Things

• Checked luggage: scanned
  o Various forbidden items
  o “3-1-1” liquids rule

• Carry-on luggage: scanned
  o Various forbidden items

• Cargo: “intelligence-based” scanning

• Is the “3-1-1” liquids rule effective?

Source: tsa.gov
Guarding the Airport Perimeter

• Physical access control to the airport
  o Long perimeter at major airports
  o Roads and buildings bordering the airport
  o Garages, hotels, businesses within or near airport
  o Walls, barbed wire, cameras, sensors, patrolling
  o How well guarded is the perimeter?

• Beyond the 2D perimeter
  o 3D surface?

Source: murunwiremesh.com
Long Perimeter

Source: Google Maps
Public Roads and Buildings
Convenience

Source: Google Maps
Architectural Features

Source: Google Maps
What We Have Learned

• Safety vs. security
• Risk management
• Aviation security