Air Safety Fundamentals:
Lessons Learned From the Deadliest Disasters in Aeronautics

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Introduction

- Average aviation crashes per year since 2000: 167
- Average aviation deaths per year since 2000: 1184 people

<table>
<thead>
<tr>
<th>Principal cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Error</td>
<td>67.57 %</td>
</tr>
<tr>
<td>Aircraft Failure</td>
<td>20.72 %</td>
</tr>
<tr>
<td>Weather</td>
<td>5.95 %</td>
</tr>
<tr>
<td>Sabotage</td>
<td>3.25 %</td>
</tr>
<tr>
<td>Other</td>
<td>2.51 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing</td>
<td>50.39 %</td>
</tr>
<tr>
<td>Flight</td>
<td>27.73 %</td>
</tr>
<tr>
<td>Takeoff</td>
<td>20.96 %</td>
</tr>
<tr>
<td>Taxiing</td>
<td>0.64 %</td>
</tr>
<tr>
<td>Parking</td>
<td>0.28 %</td>
</tr>
</tbody>
</table>
Human error: The Tenerife Disaster

- March 27 1977. Tenerife, Canary Islands
- 583 fatalities

KLM flight 4805

Pan Am flight 1736
Human error: The Tenerife Disaster

**Reasons**
- Usage of non-standard terminology
- Poor cockpit resource management
- Foggy weather
- Radio interference

**KLM attempted takeoff and collided with Pan Am**
- Everyone on KLM killed
- 61 survivors on Pan Am
June 9, 2005. Logan International Airport, Boston MA
Co-pilot realized planes were on collision course
  - Advised pilot not to take-off
Planes passed within about 170 feet of each other
Technical failure: Trans World Airlines flight 800

- July 17 1996, New York–JFK Airport
- 230 fatalities

Trans World flight 800 (Boeing 747)  
Destroyed fuselage recovered from Atlantic
Technical failure: Trans World Airlines flight 800

- **NTSB conclusion**
  - Short circuit caused fuel tank explosion
- **Fuel tank regulation change**
  - Must be filled with nitrogen instead of oxygen

Memorial at Long Island

Destroyed fuselage recovered from Atlantic
August 12 1985. Tokyo to Osaka
520 fatalities, 4 survivors
Weather: Air France flight 447

- June 1 2009. Rio de Janeiro to Paris
- Disappeared over Atlantic (Senegalese airspace)
- 228 fatalities

Airbus A330

Satellite image of stormfronts
Weather: Air France flight 447

- **Cause**
  - Inability to measure airspeed caused deactivation of autopilot
  - Pilots became confused, inappropriate procedure put into action

[Images: Vertical stabilizer recovery, Pitot probe on a small plane]
Conclusions

- Accidents are prevented by learning from mistakes
- The examples in this presentation are only a few of thousands of disasters
- Improve engineering methodology, regulation authority, flight operations, and airport security
Questions?

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