Single Pilot Safety

Accident Causation/Decision Making and Risk Management

Aaron McCarter
NTSB
NTSB and our Mission

• The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation -- railroad, highway, marine and pipeline -- and issuing safety recommendations aimed at preventing future accidents.
The Office of Aviation Safety

Responsible for the Safety Board’s aviation accident investigations

- Director
  Office of Aviation Safety
  - Deputy Director
    - Deputy Director
      - Major Investigations
      - Operational Factors
      - Aviation Engineering
      - Human Performance
      - Survival Factors
      - Writing & Editing
      - Eastern Region
      - Central Region
      - Western Pacific Region
      - Alaska Region
    - Chief Advisor
      International Aviation Safety Affairs
NTSB Structure

• The Board
  • Chairman
  • Vice Chairman
  • 4 Members with 1 Vacancy

• Multi Modal
  • Aviation
  • Railroad
  • Highway
  • Marine
  • Pipeline and Hazardous Materials

Robert Sumwalt
Chairman

T. Bella Dinh-Zarr
Member

Earl Weener
Member

Chris Hart
Member
NTSB Headquarters Support

• Operational Factors
  • Air Traffic Control, Weather

• Engineering
  • Powerplants, Structures, Systems, etc.
  • Materials, Recorders, Performance

• Human Performance & Survival Factors

• Transportation Disaster Assistance

• Writing and Editing
The Products of the NTSB

• Preliminary Report (within 5 business days)
• Factual Report (12-18 months)
• Probable Cause (1 month following the factual report)
• Safety Recommendations
  • Formal and Informal
  • The NTSB has issued over 11,600 formal recommendations in all modes of transportation, of which more than 80% have been adopted

The goal of the NTSB is Accident Prevention!
My Background

- NTSB, Air Safety Investigator
- Director of Safety
  - Haverfield Aviation: Helicopter Utility (Largest non-military MD fleet in world)
- Manager of Safety/SMS/IEP
  - Compass Airlines, Independence Air, Atlantic Coast Airlines
  - Maxjet
- Consultant
  - Safety Program Development and Safety Management System (SMS) Implementation
- Commercial Pilot
  - Everything from Banner Towing, Skydiving, Checks, Cargo, Transport
What is an Accident

- Aircraft accident means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

- Serious injury means any injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received…
  - Bone Fracture, Organ Trauma, Deep Tissue Damage

- Substantial damage means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement.
To Accident or Not to Accident

Accident  Incident  Accident
Holistic Data

- All NTSB Accident Data from 2012 to 2017*
- Single Pilot
- All “Aircraft” Types
- Part 91 and 135
- Broad Occurrence Codes & Specific Occurrence
- Fatal and Non-Fatal
<table>
<thead>
<tr>
<th>Year</th>
<th>Fatal</th>
<th>Serious</th>
<th>Minor</th>
<th>None</th>
<th>Total Accidents (Single Pilot)</th>
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<tbody>
<tr>
<td>2012</td>
<td>205</td>
<td>114</td>
<td>159</td>
<td>530</td>
<td>1008</td>
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<tr>
<td>2013</td>
<td>155</td>
<td>98</td>
<td>142</td>
<td>429</td>
<td>824</td>
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<tr>
<td>2014</td>
<td>181</td>
<td>107</td>
<td>138</td>
<td>415</td>
<td>841</td>
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<tr>
<td>2015</td>
<td>163</td>
<td>116</td>
<td>120</td>
<td>450</td>
<td>849</td>
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<tr>
<td>2016</td>
<td>132</td>
<td>98</td>
<td>148</td>
<td>477</td>
<td>855</td>
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<tr>
<td>2017</td>
<td>95</td>
<td>62</td>
<td>83</td>
<td>277</td>
<td>517</td>
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</table>

*Incomplete*
All Single Pilot Accident Data 2012-2017*

Accidents

Percent of Accidents
Single Pilot Accident Data by Occurrence 2012-2017*

- Loss of Control In-Flight: 19.74%
- System/Component Failure - Powerplant: 18.56%
- Loss of Control on Ground: 16.86%
- Abnormal Runway Contact: 13.25%
- Fuel Related: 4.79%
- Other: 2.73%
- Undershoot/Overshoot: 1.49%
- Loss of Lift: 1.46%
- Ground Collision: 1.32%
- Unintended Flight Into IMC: 1.47%
- Undershoot/Overshoot: 1.49%
- Unknown: 1.86%
- Controlled Flight Into Terrain: 3.04%
- System/Component Failure - Non-power: 4.36%
- Undershoot/Overshoot: 1.49%
- Loss of Lift: 1.46%
- Ground Collision: 1.32%
- Unintended Flight Into IMC: 1.47%
- Undershoot/Overshoot: 1.49%
- Unknown: 1.86%
- Controlled Flight Into Terrain: 3.04%
- System/Component Failure - Non-power: 4.36%
Part 91/135 Comparison


*Personal, Business, Corporate, and Positioning

- Loss of Control In-Flight
- System/Component Failure -...
- Controlled Flight Into Terrain
- Unintended Flight Into IMC
- System/Component Failure - Non...
- Other
- Fuel Related
- Low Altitude Operation
- Midair
- Abrupt Maneuver

Total
Fatal
Occurrence Categories Part 135


- Loss of Control In-Flight
- Controlled Flight Into Terrain
- System/Component Failure -...
- Unintended Flight Into IMC
- Low Altitude Operation
- Turbulence Encounter
- Loss of Control on Ground
- Ground Handling
- Fire - Non-Impact
- Abrupt Maneuver

Total
Fatal
## Drilling Down into the Cause

<table>
<thead>
<tr>
<th>Finding category</th>
<th>Finding subcategory</th>
<th>Finding section</th>
<th>Accidents</th>
<th>Citing Percentage of Accidents</th>
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<tbody>
<tr>
<td>Aircraft</td>
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<td></td>
<td>3227</td>
<td>79.1%</td>
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<tr>
<td>Personnel issues</td>
<td></td>
<td></td>
<td>3392</td>
<td>83.2%</td>
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<tr>
<td>Environmental issues</td>
<td></td>
<td></td>
<td>1920</td>
<td>47.1%</td>
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<tr>
<td>Organizational issues</td>
<td></td>
<td></td>
<td>48</td>
<td>1.2%</td>
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<tr>
<td>Not determined</td>
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<td></td>
<td>381</td>
<td>9.3%</td>
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## Drilling Down into the Cause-/Expanding the Aircraft Category

<table>
<thead>
<tr>
<th>Finding category</th>
<th>Finding subcategory</th>
<th>Finding section</th>
<th>Accidents Citing</th>
<th>Percentage of Accidents</th>
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<tr>
<td>Aircraft</td>
<td>Aircraft handling/service</td>
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<td></td>
<td>Aircraft oper/perf/capability</td>
<td>(general)</td>
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<td>Aircraft capability</td>
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<td></td>
<td>Performance/control parameters</td>
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<td>Aircraft power plant</td>
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<td>Aircraft propeller/rotor</td>
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<td>71</td>
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<td>Aircraft structures</td>
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<td>Aircraft systems</td>
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<td></td>
<td>Fluids/misc hardware</td>
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<tr>
<td>Personnel issues</td>
<td></td>
<td></td>
<td>3392</td>
<td>83.2%</td>
</tr>
<tr>
<td>Environmental issues</td>
<td></td>
<td></td>
<td>1920</td>
<td>47.1%</td>
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<tr>
<td>Organizational issues</td>
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<td></td>
<td>48</td>
<td>1.2%</td>
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<tr>
<td>Not determined</td>
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<td><strong>Grand Total</strong></td>
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<td><strong>4078</strong></td>
<td><strong>100.0%</strong></td>
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<td>Finding section</td>
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<td>Percentage of Total Accidents</td>
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<tr>
<td>---------------------------</td>
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<td>-------------------------</td>
<td>--------------------------</td>
<td>------------------------------</td>
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<tr>
<td>Personnel Issues</td>
<td>Action/decision</td>
<td>Action</td>
<td>621</td>
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<td>Info processing/decision</td>
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<td>Experience/qualifications</td>
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<td>Knowledge</td>
<td>30</td>
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<td>Training</td>
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<td>Physical</td>
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<td>Alertness/Fatigue</td>
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<td>Health/Fitness</td>
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<td>Impairment/incapacitation</td>
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<td>Physical characteristic</td>
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<td>Sensory ability/limitation</td>
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<td>Psychological</td>
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<td>Attention/monitoring</td>
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<td>Cognitive limitation</td>
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<td>Mental/emotional state</td>
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<td>Perception/orientation/illusion</td>
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<td>2.75%</td>
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<td>Personality/attitude</td>
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<td>Task performance</td>
<td>(general)</td>
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<td>Communication (personnel)</td>
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<td>Inspection</td>
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<td>Maintenance</td>
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<td>Planning/preparation</td>
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<td>Record-keeping</td>
<td>4</td>
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<td></td>
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<td>Use of equip/info</td>
<td>2118</td>
<td>51.94%</td>
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<tr>
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<td>Workload management</td>
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<td>10</td>
<td>0.25%</td>
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<tr>
<td></td>
<td>Miscellaneous</td>
<td></td>
<td>18</td>
<td>0.44%</td>
</tr>
</tbody>
</table>

Drilling Down into the Cause-Expanding the Human Category
So, What Can Be Done?

**Risk Identification** – Identify any hazards that will affect your flight. A hazard is an object or event that could create a risk to the flight. WX, Inexperience, New Aircraft Type, New System, Airplane just get out of annual?

**Risk Assessment** – Each risk must be assessed in terms of its likelihood and its severity.

**Risk Mitigation** – Unacceptable “high” (i.e., “red”) risks must be mitigated by taking action to lower likelihood and/or severity to lower levels.
Cessna T210M

- VFR flight - Torrance, CA to Aspen
- Solo, 13,500’ MSL , > 3 hours
- Pilot updated weather w/ FSS 4 times
  - Each update included icing AIRMET
- Night & IMC (snow) approaching Aspen
  - Pilot received IFR clearance
- While reading back flight plan info to ATC, left 180 turn, then rapid descent
- In-flight breakup
Risks/Hazards

• Single Pilot, Night, IMC (snow), Single Engine, and Mountainous
• AIRMET for icing
• “SoCal” IMC versus “Mountain” IMC
• 13,500’ MSL for > 3 hours
• “Get homeitis” (owned home in Aspen)
  • Operational Pressure.
Lessons Learned

• Aviate, Navigate, Communicate
  • ATC can wait
• Challenging IMC can occur quickly
  • Get the IFR clearance prior
• If in doubt, take the “pit stop”
• Know your limitations and the airplanes
Questions & Discussion