Preventing Turbulence-Related Injuries in Part 121 Air Carrier Operations and Why is this Important?

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Why the NTSB Did This Research

• Turbulence-related accidents are the most common type of Part 121 accident

• From 2009 through 2018:
  • Turbulence accounted for 111 of 295 Part 121 accidents (38%)
  • All resulted in at least one serious injury
### Defining Events Ranked by FAR Part

<table>
<thead>
<tr>
<th>General Aviation</th>
<th>Part 135</th>
<th>Part 121</th>
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</thead>
<tbody>
<tr>
<td>1 Loss of Control-Inflight 18%</td>
<td>1 Powerplant Malfunc 15%</td>
<td>1 Turbulence 34%</td>
</tr>
<tr>
<td>2 Powerplant Malfunc 18%</td>
<td>2 Loss of Control-Inflight 14%</td>
<td>2 Ground Collision 14%</td>
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<tr>
<td>3 Loss of Control-Ground 14%</td>
<td>3 Abnormal Rwy Contact 12%</td>
<td>3 Abnormal Rwy Contact 10%</td>
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<tr>
<td>4 Abnormal Rwy Contact 13%</td>
<td>4 Loss of Control-Ground 9%</td>
<td>4 Cabin Safety Event 9%</td>
</tr>
<tr>
<td>5 Fuel 5%</td>
<td>5 Non-Powerplant Malfunc 8%</td>
<td>5 Ground Handling 9%</td>
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<tr>
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<td>21 Turbulence &lt;1%</td>
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- 2008-2016 US civil aviation accidents
- Defining events from 32-category CAST/ICAO taxonomy
EDR reported by DL957
DCA19CA206 near Denver, Colorado at FL150
Part 121 Turbulence Safety Research Report

- Published September 2021
- Issued 21 new safety recommendations
  - 18 to FAA
  - 2 to NWS
  - 1 to A4A, NACA, and RAA
- Reiterated 4 recommendations to FAA
Research Methodology

• Literature review
• Data analysis
• Case studies
• Stakeholder interviews

- Federal Aviation Administration (FAA)
- Air traffic control (ATC)
- Air carriers
- Meteorologists and commercial weather information providers
- Pilot and flight attendant unions
- Aircraft and airborne radar manufacturers
Safety Issue Areas

• Insufficient submission and dissemination of turbulence observations
• Lack of shared awareness of turbulence risks
• Need for mitigation of common turbulence-related injury circumstances
• Need for updated turbulence guidance
PIREPs

- PIREP information, such as “smooth ride” or “light turbulence,” though routinely provided was rarely disseminated

- In 2018, less than 10% of transmissions containing weather information made by pilots to ATC resulted in a PIREP
Automatic Dependent Surveillance – Broadcast (ADS-B)

- ADS-B Weather (Wx)
  - Weather broadcast capability via ADS-B data link
- ADS-B Wx PIREP
  - PIREP broadcast capability with EFB
- ADS-B Wx AIREP
  - AIREP continuous broadcast capability
Concerns with AIRMETs

- AIRMETs of limited value due to size
- Turbulence difficult to capture within limited AIRMET formats
Turbulence Tools for Tactical Decision-Making

- Turbulence reports do not allow for proactive turbulence avoidance
- Graphical Turbulence Guidance (GTG) hourly update rate
- Graphical Turbulence Guidance Nowcast (GTGN) not operational
Common Injury Circumstances

• In 28% of Part 121 accidents, flight crew had no warning of turbulence

• Injury data show
  • Occupants not wearing a seat belt
  • Occurred during descent
  • Locations are not uniformly distributed throughout the cabin
SAWS in ABQ

• Why should I care about part 121?
Safety Recommendations (paraphrased)

- Provide controllers with automated PIREP data-collection tools (FAA, reiteration)
- Populate PIREPs with data captured from controller displays (FAA, reiteration)
- Standardize distribution of PIREPs within ATC facilities (FAA)
- Provide a means of electronically accepting PIREPs from all users (FAA, reiteration)
- Require air carriers to disseminate all turbulence observations to the NAS as a condition of EWINS approval (FAA)
- Encourage industry efforts to incentivize PIREP sharing (FAA, reiteration)
Safety Recommendations (paraphrased)

• Issue AIRMETs with higher granularity (FAA, NWS)
• Distribute AIRMETs, SIGMETs, CWAs, total lightning, and hail information to controllers as selectable layers radar displays, and train controllers on their use (FAA)
• Operationalize a turbulence nowcast such as GTGN (FAA, NWS); develop guidelines for ATC use (FAA)
Safety Recommendations (paraphrased)

• Provide guidance on phases of flight and altitudes at which flight attendants should be seated, in particular during descent (FAA)

• Study how aircraft accelerations vary along the length of the aircraft during turbulence (FAA)

• Update turbulence Advisory Circular (FAA)
Safety Recommendations (paraphrased)

• Determine how to harmonize current and future EDR algorithm performance in operational environments and publish the results of this determination (A-21-27 to FAA)

• Incorporate the ADS-B Wx capability in the next version of the ADS-B TSO (A-21-28 to FAA)

• After the ADS-B TSO is revised as recommended in A-21-28, require that aircraft flown in Part 121 operations be retrofitted with ADS-B Wx capable equipment (A-21-29 to FAA)

• Require ADS-B Wx equipped aircraft to broadcast ADS-B Wx information when operating in airspace requiring ADS-B capability as defined by 14 CFR 91.225 (A-21-30 to FAA)
For More Information

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