Mitigating Turbulence Impacts in Aviation Operations

General Aviation Perspective

Rune Duke
Senior Director, Airspace & Air Traffic Services
Aircraft Owners & Pilots Association
AOPA Air Safety Institute Nall Report
General Aviation Weather Accidents Last 10 Years

- VFR into IMC: 259 (217 fatal)
- Poor IFR technique: 44 (42 fatal)
- Thunderstorms: 48 (32 fatal)
- Icing: 85 (27 fatal)
- Non-convective turbulence: 33 (15 fatal)
August 2018 NTSB Recommendations

• NWS forecasters may use inconsistent criteria to issue AIRMETs in concert with convective SIGMET

• Noted some forecasters issue AIRMET, some believe convective SIGMET is sufficient

• Convective SIGMET has limited scope and nonconvective turbulence may extend past this area

NTSB recommended clearer guidance on AIRMET issuance for nonconvective turbulence; formal training on low-level turbulence
Encounters with Unforecast Adverse Weather

CONUS vs. Alaska: In the past 12 months, how many times have you...

- Experienced unforecast adverse weather in flight?
  - CONUS: 31% Never, 53% 1 - 3 times, 9% 4 - 6 times
  - AK: 17% Never, 42% 1 - 3 times, 19% 4 - 6 times

- Diverted, landed, or turned back due to adverse weather?
  - CONUS: 55% Never, 41% 1 - 3 times
  - AK: 29% Never, 50% 1 - 3 times

- Re-evaluated your pre-flight planning due to adverse weather?
  - CONUS: 12% Never, 43% 1 - 3 times, 26% 4 - 6 times
  - AK: 8% Never, 30% 1 - 3 times, 26% 4 - 6 times
<table>
<thead>
<tr>
<th>Category</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling and visibility / flight category</td>
<td>37%</td>
<td>63%</td>
</tr>
<tr>
<td>Icing</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>Convection / thunderstorms</td>
<td>36%</td>
<td>64%</td>
</tr>
<tr>
<td>Winds</td>
<td>31%</td>
<td>69%</td>
</tr>
<tr>
<td>Turbulence</td>
<td>49%</td>
<td>51%</td>
</tr>
<tr>
<td>Other</td>
<td>29%</td>
<td>71%</td>
</tr>
</tbody>
</table>
Turbulence Limitations

• 49% of pilots perceived limitations in weather information related to turbulence
• No difference between Alaska and CONUS
• Many respondents believed that turbulence reports lacked detail and accuracy

We guess where the turbulence is, but really don’t know unless we get a pirep

Severity categories affected by type of airplane, need more PIREPs, need better forecasting

Knowing the type of turbulence is important to understanding what to expect: shear, mountain wave, convective, terrain friction...
Efforts to Increase PIREP Submission

- Alaska PIREP Working Group of FAA and industry formed following 2015 Valdez, AK fly-in and STOL competition
- NTSB PIREP Forum in 2016
- NTSB PIREP recommendations in 2017
- FAA adds PIREPs as an ATO Top 5 issue in 2017

- Recognition of systemic issues
  - Pilot, ATC, FSS culture
  - Submission automation
  - Reporting format
  - Lack of tracking and quality assurance
How often do you usually provide an unsolicited PIREP? By location

<table>
<thead>
<tr>
<th>Location</th>
<th>Always</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>4%</td>
<td>23%</td>
<td>42%</td>
<td>26%</td>
<td>6%</td>
</tr>
<tr>
<td>CONUS</td>
<td>11%</td>
<td>35%</td>
<td>38%</td>
<td>15%</td>
<td></td>
</tr>
</tbody>
</table>
PIREP Fields are Important

• PIREP provided at FAI04545 but recorded as over FAI
• Entering PIREP information in wrong field impacts automation and plain language interpretation – Reduces utility of PIREP
Differences in Plotting

• Lat/long issues
• Placed PIREP over mountain instead of valley
Must Have: PIREP Submission Integration

• AOPA conducted PIREP survey in 2016 in support of NTSB’s PIREP Special Investigation Report

• Better automation/technology would improve submittal rate
  • Integrate into apps/avionics
  • Include GPS provided position

• Simplify process/form for inflight transactions

AWC PIREP submission form
Charting Changes

PIREP quick reference guide added to all Chart Supplements
Pilot/Controller Communication Improvements

- “Chop” is considered a type of turbulence
- Inconsistency in pilot/controller guidance
- Not all moderate chop being submitted as PIREP
- Pilot/Controller Glossary updated to harmonize terminology – and expectations – between pilots and ATC
- Mountain wave also defined
Further Effort Needed on PIREPs

Controllers and Flight Service
• Emphasis on null reports
• Best practices for solicitation
• Confirmation PIREP is accepted into the system to benefit forecasters and pilots not on the frequency
• Efficiency of transaction

Pilots
• Emphasis on null reports, counter PIREP myths
• Integration of PIREP submission with EFB
• Training on PIREP format
• FIRCs, BFR’s, safety seminars, other outreach
WTIC Capabilities for General Aviation

- Flight Information Service-Broadcast (FIS-B) is one of the key GA elements of ADS-B

- For aircraft that are ADS-B In equipped, FIS-B delivers NEXRAD radar images, AIRMETs, SIGMETs, PIREPs, and other weather reports directly to an EFB or cockpit multifunction display

- Other solutions are available like SiriusXM Aviation
FIS-B Utilization

- 69% of respondents use FIS-B
- 18% plan to use FIS-B
- Over 80% of pilots routinely fly with an EFB
FIS-B Improvements: Turbulence Forecast

- FIS-B Turbulence Forecast product provides turbulence data representing a 1-hour forecast of turbulence energy throughout CONUS
  - 12 altitude levels—every 2,000 feet, from 2,000 feet msl to 24,000 feet msl

- Graphical Turbulence Guidance (GTG) forecast product from NWS
  - This model is run on an hourly basis.
    Transmission interval: 15 minutes

- Maximum turbulence severity in either the Mountain Wave or Clear Air Turbulence source
### General Aviation Top 5 Requested Improvements

#### How important are each of the following improvements to weather info?

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Extremely important</th>
<th>Important</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved forecast performance</td>
<td>61%</td>
<td>36%</td>
<td>3%</td>
</tr>
<tr>
<td>Increased frequency of updates</td>
<td>45%</td>
<td>48%</td>
<td>7%</td>
</tr>
<tr>
<td>Easier to understand (plain language)</td>
<td>45%</td>
<td>35%</td>
<td>20%</td>
</tr>
<tr>
<td>Mobile friendly website</td>
<td>42%</td>
<td>44%</td>
<td>14%</td>
</tr>
<tr>
<td>More graphical weather products</td>
<td>40%</td>
<td>47%</td>
<td>12%</td>
</tr>
</tbody>
</table>
Comparing Graphical and Textual Products

- Pilots highly desire graphical products
- Similar comfort level with interpreting graphical product
Graphical Turbulence Guidance Pilot Feedback

• Like the altitude cross sections
• Graphical depiction
• Want regional views

• GTG Nowcast – GTGN
• Better decision making
Pilot Education

- Informed consumers – Aware of best practices
- Training requirements – Knowledge exam changes
- Utilizing technology to make smart decisions
- Know before you go mentality
- Understanding limitations, lag time, and constraints of your specific equipment and plan accordingly
- Never become distracted by technology – Flying always comes first
Thank you!