Assessing General Aviation Pilots' Weather Knowledge and Self-Efficacy

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The Problem...

- General Aviation accounts for a majority of weather related accidents
- Most GA weather-related accidents result in fatality
- NTSB Most Wanted List - loss of control
  - manage weather issues
Contributing Factors to the Unchanging High General Aviation Weather-Related Accident Rate

- Research indicates numerous contributing factors to the General Aviation Weather Problem
  - Lack of Aviation Weather Knowledge & Skills
  - Poor Decision Making
  - Weather Technology & Product Usability
  - Limited Weather Training
  - Conflicting & Out-of-Date Pilot Resources
How to assess pilot weather knowledge?

• Current method is through FAA Knowledge Test Questions
  ▫ Some questions are out of date and easy
  ▫ Very few questions focused on interpretation of current products

• A multidisciplinary team of Human Factors Specialists, Meteorologists, & Pilots developed an Aviation Weather Knowledge Test

• 95 Questions
  1. Basic Weather Theory
  2. Product Interpretation
  3. Weather Sources
204 Pilots Participated

- Both ERAU Students and GA pilots at EAA Airventure
- Average Age: 22.5 years
- Part 61: 60 pilots  & Part 141/142: 143 pilots

<table>
<thead>
<tr>
<th>Pilot Certificate and/or Rating</th>
<th>Number of Pilots (Total = 204)</th>
<th>Flight Hours (Median)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>41</td>
<td>35 hours</td>
</tr>
<tr>
<td>Private</td>
<td>72</td>
<td>105 hours</td>
</tr>
<tr>
<td>Private with Instrument</td>
<td>50</td>
<td>172 hours</td>
</tr>
<tr>
<td>Commercial with Instrument</td>
<td>41</td>
<td>260 hours</td>
</tr>
</tbody>
</table>
The Results!
Overall GA Weather Knowledge

- Scores increased with flight experience
- Statistically significant differences between
  - student vs private pilot groups
  - private vs commercial with instrument groups
- These trends were consistent
Basic Weather Theory, Product Interpretation, & Weather Product Sources

- Weather product sources was one of the highest scores

![Score Chart]

- Basic Weather Theory: 59
- Interpreting Weather Data: 58
- Weather Product Resources: 69
Impact of Flight Experience on Pilots’ Aviation Weather Knowledge

- Scores increased with more flight experience
Weather Hazard Product Interpretations

<table>
<thead>
<tr>
<th>Weather Hazard Products</th>
<th>Score (in Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather RADAR</td>
<td>51</td>
</tr>
<tr>
<td>AIRMET</td>
<td>51</td>
</tr>
<tr>
<td>Satellite Data</td>
<td>54</td>
</tr>
<tr>
<td>METAR &amp; PIREP</td>
<td>54</td>
</tr>
<tr>
<td>Convective SIGMET</td>
<td>64</td>
</tr>
<tr>
<td>Surface Charts</td>
<td>71</td>
</tr>
<tr>
<td>Upper Level Charts</td>
<td>77</td>
</tr>
</tbody>
</table>
Pilot Performance on IMC and VFR Knowledge and Skills

- This includes Surface Charts, Satellite Data, & PIREPs involving IMC weather.
Thunderstorm Knowledge and Skills

- Pilots scored low on thunderstorm principles and radar interpretation
GA Pilots’ Self-Efficacy

- Confidence level on weather topics
- Measured through a survey
- Positive correlation between knowledge scores and self-efficacy
Overall Summary

• General Aviation Pilots are weak in terms of weather knowledge
• Weakest Topics included
  ▫ Thunderstorms
  ▫ Radar interpretation
  ▫ AIRMETs
  ▫ ....and more
• The new automated weather products showed effectiveness through higher scores
Overall Summary

• The sample was 204 pilots – more participants will be needed to further verify the results
• More experience (flight hours) did relate to improved scores

• Weather self-efficacy was correlated positively with aviation weather knowledge.
Why the Knowledge Gap?

- Pilots can fail every weather question on FAA knowledge test and still achieve a passing score
- Lack of experience
  - GA pilots avoid flying on thunderstorm days?
- Convective weather and radar interpretation can be complex
- Lack of understanding of weather from instructor passed on to students?
- More instructional tools and focus needed on weather topics for GA pilots
- Consolidate weather info and ACs into a “Weather Handbook”
Thank you