A Preliminary Comparison of Pilots' Weather Minimums and Actual Decision-Making

Nathan W. Walters  
*Embry-Riddle Aeronautical University*, nathanwray187@gmail.com

Mattie Milner  
*Embry-Riddle Aeronautical University*, milnerm1@my.erau.edu

Daniel A. Marte  
*Embry-Riddle Aeronautical University*, marted@my.erau.edu

Evan A. Adkins  
*Embry-Riddle Aeronautical University*, adkinse3@my.erau.edu

Marie Aidonidis  
*Embry-Riddle Aeronautical University*, aidonidm@my.erau.edu

*See next page for additional authors*

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Presenter Information
Nathan W. Walters, Mattie Milner, Daniel A. Marte, Evan A. Adkins, Marie Aidonidis, Matt B. Pierce, Abigail K. Pasmore, Angela Roccasecca, Stephen Rice, and Scott R. Winter

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A Preliminary Comparison of Pilot’s Weather Minimums and Actual Decision Making: A Case Study

Nathan W. Walters, M. Nicole Milner, Daniel A. Marte, Evan A. Adkins, Marie Aidonidis, Matthew B. Pierce, Abigail K. Pasmore, Angela Roccasecca, Stephen Rice, & Scott R. Winter
Problem Statement

- Adverse weather conditions remain a leading cause in aviation accidents.
The Problem

- Pilots continue to make poor decisions when flying in severe weather conditions.
- Training and technology have provided little assistance.

WEATHER ACCIDENT TREND

# Baseline Personal Minimums

<table>
<thead>
<tr>
<th>Weather Condition</th>
<th>VFR</th>
<th>MVFR</th>
<th>IFR</th>
<th>LIFR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ceiling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>2,500</td>
<td></td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td>5,000</td>
<td></td>
<td>999</td>
<td></td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>4 miles</td>
<td></td>
<td>1 mile</td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td>8 miles</td>
<td></td>
<td>3 miles</td>
<td></td>
</tr>
<tr>
<td><strong>Turbulence</strong></td>
<td>SE</td>
<td>ME</td>
<td></td>
<td>Make/Model</td>
</tr>
<tr>
<td>Surface Wind Speed</td>
<td>10 knots</td>
<td>15 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Wind Gust</td>
<td>5 knots</td>
<td>8 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crosswind Component</td>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>SE</td>
<td>ME</td>
<td></td>
<td>Make/Model</td>
</tr>
<tr>
<td>Shortest runway</td>
<td>2,500</td>
<td>4,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest terrain</td>
<td>6,000</td>
<td>3,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest density altitude</td>
<td>3,000</td>
<td>3,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Research Questions

- What is the difference in distance between pilot’s stated personal minimums and their actions toward a missed approach during missions where the cloud cover is lower than expected?
  - Distance below personal minimums
  - Distance below federal minimums
## Method & Design

<table>
<thead>
<tr>
<th>Participants</th>
<th>Equipment</th>
<th>Conditions</th>
<th>Design</th>
</tr>
</thead>
</table>
| - 35 Instrument Rated pilots (4 female) from Embry-Riddle Aeronautical University  
- Mean age: 23  
- Compensation: $25 | - Elite-1000 flight simulator  
- Desktop Computer  
- iPad  
- Aviation Safety Attitude Scale  
- Hazardous Attitude Scale | - Controlled Laboratory Environment  
- Cloud cover reached the ground  
- No ability to detect obstacles by using visuals  
- Non-towered airport | - Simple correlational design  
- Descriptive statistics  
- CITI certified researchers  
- ERAU Institutional Review Board  
- Signed consent by all participants |
<table>
<thead>
<tr>
<th>Total Participants</th>
<th>Participants who flew below stated personal minimums (SPM)</th>
<th>Participants who flew below federal minimums</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>24 (69%) Instrument Rated Pilots</td>
<td>22 (63%) Instrument Rated Pilots</td>
</tr>
</tbody>
</table>
## Participants Totals – Preliminary Results

<table>
<thead>
<tr>
<th></th>
<th>Average stated personal minimums (SPM): All participants</th>
<th>Average point “missed approach” executed: All participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Participants</td>
<td>367 ft. (MSL)</td>
<td>226.59 ft. (MSL)</td>
</tr>
<tr>
<td>35 Instrument Rated Pilots</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Preliminary results – Stated Personal Minimums (SPM)

<table>
<thead>
<tr>
<th>24 (69%) Participants flew below (SPM)</th>
<th>Distance these 24 participants flew below their stated personal minimums</th>
<th>Average height at which these 24 participants executed “missed approach”</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average the SPM of 24 (69%) participants equals 443 ft (MSL)</td>
<td>231 ft</td>
<td>211.8 ft. (MSL)</td>
</tr>
</tbody>
</table>
Participants who flew below Federal Minimums – Preliminary Results

<table>
<thead>
<tr>
<th>Federal regulated minimums for ILS</th>
<th>22 out of 35 (63%) instrument rated pilots</th>
<th>Feet (MSL) at which these 22 (63%) pilots executed miss</th>
</tr>
</thead>
<tbody>
<tr>
<td>213 ft. (MSL)</td>
<td>On average flew 40 ft. below federal regulated minimums</td>
<td>On average these pilots executed missed approach at 173 ft MSL</td>
</tr>
</tbody>
</table>
Discussion
Weather Ceiling Minimums

- Personal minimums were first introduced in 1996.

Diagram:

- Previous Bad Weather Experience
  - Less Conservative with SPM
  - Liberal Personal Minimums
  - More Hazardous Events
Decision Making

- What factors affect decision making?
- Particularly, what factors influence risky decision making?
• Can training improve response times to weather hazards for those with high risk tendencies?
Case Study: One Example
What Happened?

• One pilot did not correctly identify the information from his display.
Normal Flight Path
Estimated Participant Flight Path
Then this happened!
Which Led to This!
Lessons Learned
References


Questions