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

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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 Roccasceca, 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>
<tbody>
<tr>
<td>35 Instrument Rated pilots (4 female) from Embry-Riddle Aeronautical University</td>
<td>Elite-1000 flight simulator</td>
<td>Controlled Laboratory Environment</td>
<td>Simple correlational design</td>
</tr>
<tr>
<td>Mean age: 23</td>
<td>Desktop Computer</td>
<td>Cloud cover reached the ground</td>
<td>Descriptive statistics</td>
</tr>
<tr>
<td>Compensation: $25</td>
<td>iPad</td>
<td>No ability to detect obstacles by using visuals</td>
<td>CITI certified researchers</td>
</tr>
<tr>
<td></td>
<td>Aviation Safety Attitude Scale</td>
<td>Non-towered airport</td>
<td>ERAU Institutional Review Board</td>
</tr>
<tr>
<td></td>
<td>Hazardous Attitude Scale</td>
<td></td>
<td>Signed consent by all participants</td>
</tr>
</tbody>
</table>
## By the Numbers – Preliminary Results

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

24 (69%) Participants flew below (SPM)

On average the SPM of 24 (69%) participants equals 443 ft (MSL)

Distance these 24 participants flew below their stated personal minimums

231 ft

Average height at which these 24 participants executed “missed approach”

211.8 ft. (MSL)
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.

  Previous Bad Weather Experience
  Less Conservative with SPM
  Liberal Personal Minimums
  More Hazardous Events
• 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
Flight Chart

ILS or LOC RWY 9
DADE-COLLIER TRAINING AND TRANSITION (TNT)

DADE-COLLIER TRAINING AND TRANSITION (TNT)

AWOS-2
119.075
MIAI APP CON
126.6  306.975
UNICOM
123.0 (CTAF)

ADF or GPS REQUIRED

Pressure NA for arrivals at DEEDS INT on V33 westbound, V601 and V639 northbound.
Gps required from DEEDS to JAXEK.

LOM/IAF MONEY
222 TM =

LOCALIZER 108.3
HINT
113.9 DME F-264 Climb 86
WORPP DHP 343
ALTERNATE MISSED APCH FIX

Remain within 10 NM

HU 1800
GS 3.0o TCH 35

CATEGORIES
A
B
C
D
3-ILS 9
213.2 200 (200-91)
S-LOC 9
460-1 447 (500-1)
460-1 447 (500-1)
380-2

CIRCLING
460-1 480-1 480-1 500-1 567 (500-1)

MIAMI, FLORIDA
AirTo 15A 03APR14

25o 52' N 80o 54' W
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