

## Bird Hazard Mitigation Training for Part 141 General Aviation Pilots: An Experimental Study

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**BIRD STRIKE**  
CONFERENCE



PURDUE AVIATION TECHNOLOGY

## INTRODUCTION

- ✈ From 1990 through 2018 → 209,950 wildlife strikes in the U.S.,
- ✈ Approximately 95% of those incidents involved birds;
- ✈ Seventy aircraft destroyed as a result of wildlife strikes!
- ✈ 13 bird strikes → 32 fatalities;
  - ✈ 244 wildlife strikes → 319 people injured!
    - ✈ 224 bird strikes → 299 people injured!
- ✈ General aviation community;
  - ✈ 97% of the strikes occurred below 3,500 feet AGL;
  - ✈ There were 22,775 wildlife strikes → 26% caused damage to the aircraft!



## INTRODUCTION

- ✈ General aviation industry:
  - ✈ 446,000 aircraft worldwide;
    - ✈ 211,000 in the U.S.
  - ✈ Supports \$219 billion in total economic output and 1.1 million jobs in the U.S.;
  - ✈ Flies approximately 25 million flight hours (U.S.);
  - ✈ Flies to more than 5,000 public airports;
  - ✈ Primary training ground for most commercial airline pilots.



## INTRODUCTION

- ✈ Previous studies have addressed the safety management of wildlife by airport operators;
- ✈ However, little has been done to target the GA community, especially aviators!
- ✈ This pilot study investigated if a safety training module could enhance the Part 141 pilots' ADM processes to mitigate the risk of bird strikes. Data were collected to answer the following research questions:
  - ✈ RQ1 - Is there a statistically-significant difference in pre-and posttests scores between and within the control and experimental groups?
  - ✈ RQ2 - From the participants' perspective, how do 14 CFR Part 141 GA pilots manage to fly safely, given the threat of aircraft accidents due to birds?

## METHODOLOGY

✈ Pretest Posttest Experimental Design →

RANDOM ASSIGNMENT	GROUP 1	PRETEST	TREATMENT	POSTTEST
	GROUP 2	PRETEST	NO TREATMENT	POSTTEST

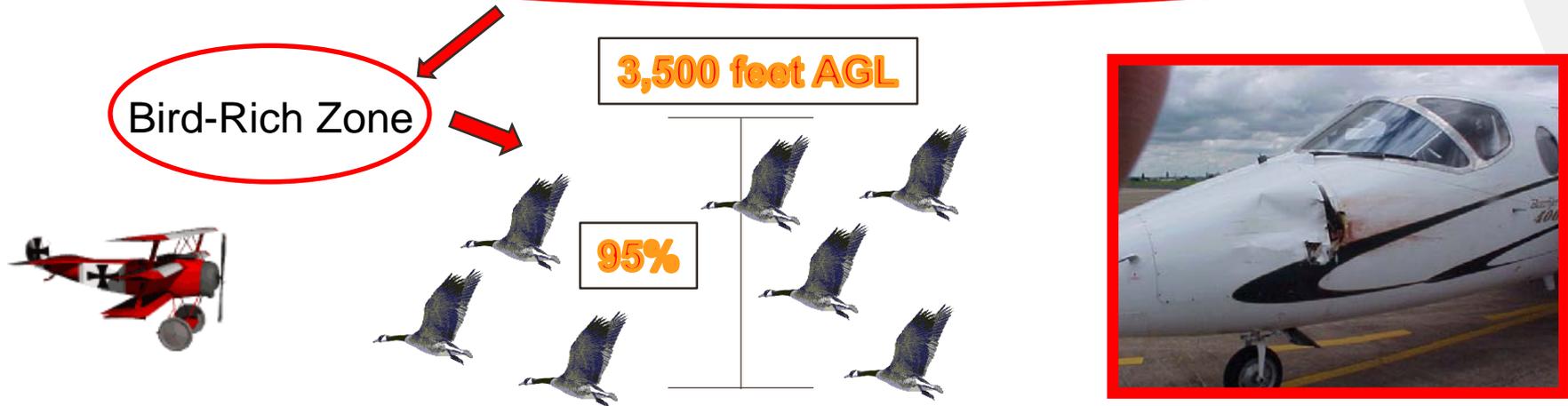
✈ Procedures:

- ✈ 1. Initial orientation, random assignment to the control and experimental groups, and Pretest;
- ✈ 2. Safety training →
- ✈ 3. Posttest; and
- ✈ 4. Follow-up survey questionnaire.

### Workshop Outline

1) <b><u>Workshop Introduction</u></b> <ol style="list-style-type: none"> <li>a) Introductions</li> <li>b) Overview and objectives of the workshop</li> </ol>
2) <b><u>Safety Management Systems and Aeronautical Decision-Making</u></b> <ol style="list-style-type: none"> <li>a) Safety Risk Management             <ol style="list-style-type: none"> <li>i) Hazard identification</li> <li>ii) Safety risk assessment and mitigation</li> </ol> </li> <li>b) Safety Promotion             <ol style="list-style-type: none"> <li>i) Safety culture</li> <li>ii) Safety training and communication</li> <li>iii) Break</li> </ol> </li> </ol>
3) <b><u>Bird Hazard to Aviation</u></b> <ol style="list-style-type: none"> <li>a) Brief overview             <ol style="list-style-type: none"> <li>i) Information derived from the analysis of bird strikes in the U.S.</li> <li>ii) Bird hazard data acquisition</li> <li>iii) Kinetic energy</li> <li>iv) Planning a safer flight in regards to bird hazards</li> <li>v) Pilots' actions to mitigate the risk of bird strikes</li> <li>vi) Aircraft accident due to bird strikes – a case study</li> </ol> </li> </ol>
4) <b><u>Workshop Conclusion</u></b> <ol style="list-style-type: none"> <li>a) Workshop recap</li> <li>b) Discussion and final questions</li> </ol>

# Safety Training Protocol



# Findings – Demographics Assessment

## Summary of Pilots' Flight Hours Information

	<b>Flight Hours</b>				
	<b>N</b>	<b>Min.</b>	<b>Max.</b>	<b>Mean</b>	<b>Std. Dev.</b>
<b>Control Group (CG)</b>	9	15	345	187.78	115.66
<b>Experimental Group (EG)</b>	8	17	247	97.13	88.06

## Summary of Pilots' Flight Certificates and Ratings

<b>Flight Certificates &amp; Ratings</b>	<b>Control Group</b>	<b>Experimental Group</b>
Private / Instrument / Commercial / Single & Multiengine	1	0
Private / Instrument / Commercial Single & Multiengine / Certified Flight Instructor	1	2
Private	2	2
Private / Instrument	3	0
Student	2	4

✈ RQ1. Is there a statistically-significant difference in pre-and posttests scores between and within the control and experimental groups?

✈ The researchers investigated the data using the Mann-Whitney U test;

✈ The control group pretest scores (mean rank 8.61) did not differ significantly from the experimental group pretest scores (mean rank = 9.44) prior to the safety training!

$$U = 39.00, z = 0.290, p > 0.05, r = 0.08$$

✈ However, after the safety training the experimental group posttest scores (mean rank = 11.5) were statistically significantly higher than control group posttest scores for the experimental group (mean rank = 4.00)!

$$U = 56.00, z = 3.270, p < 0.05, r = 0.84$$

✈ The researchers further investigated the data using the **Wilcoxon signed-rank test**;

- ✈ A Wilcoxon signed-rank test determined that there was a median increase in the posttest scores of the control group (Median = 52) when compared to the control group pretest scores (Median = 36), but this difference was not statistically significant!

$$z = 0.742, p > 0.05$$

- ✈ The Wilcoxon signed-rank test showed a statistically significant increase in the **posttest scores** of the participants of the **experimental group** (Median = 72) when compared to their pretest scores (Median = 46)!

$$z = 2.521, p < 0.05, r = 0.89$$

## ✈ RQ2. From the pilots' perspectives, how do CFR Part 141 pilots manage to fly safely given the threat of aircraft accidents due to birds?

- ✈ “Wildlife safety management is not really emphasized during flight training. There are other safety management areas that are more heavily emphasized, such as SRM, ADM, and SOPs. Wildlife safety management is not well understood and so it isn't taught unless it is encountered directly”;
- ✈ “To be honest, I have never been really told anything about mitigation strategies”;
- ✈ “Practically no wildlife mitigation techniques as they usually fly out of the way before they become an issue”.
- ✈ “Very little is spent on educating how to find information on wildlife strikes and what to do to avoid and mitigate the risk associated with wildlife strikes”.

# Findings – RQ2

- ✦ “I really have minimal knowledge on this. A CFI or two when I was a flight student told me to dive if on a collision course with birds. If you are including other wildlife, I have been taught to go around if something is on the runway, but I really have little to no experience with this, and as a CFI I would like to have some knowledge to pass onto my students. This test made me realize how much about this I do not know”;
- ✦ “There is little discussion about bird strikes. The main thing that is gone over what to do if there is a strike. Very little is spent on educating how to find information on wildlife strikes and what to do to avoid and mitigate the risk associated with wildlife strikes”;
- ✦ “I really have minimal knowledge on this. A CFI or two when I was a flight student told me to dive if on a collision course with birds. If you are including other wildlife, I have been taught to go around if something is on the runway, but I really have little to no experience with this, and as a CFI I would like to have some knowledge to pass onto my students. This test made me realize how much about this I do not know”.

# Findings – RQ2

- ✈ Three primary themes emerged from the analysis of the qualitative data;
  - ✈ Poor familiarity with the ADM processes applicable to the safety management of birds by pilots;
  - ✈ Misperception of the safety culture key elements - underlying practices and values that promote a high level of risk awareness and aviation safety;
  - ✈ The topic “bird hazard” is barely covered during the ground and/or safety training of Part 141 GA pilots!



# Limitations

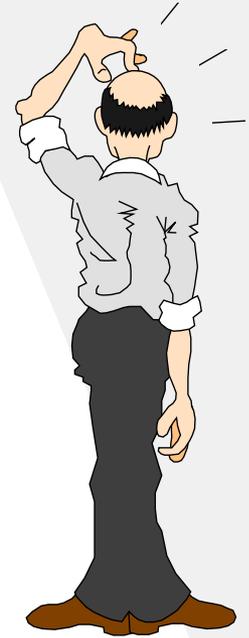
- ✈ Small sample size → restricts the generalizability of the findings;
- ✈ Small amount of flight hours by participants;
- ✈ Validity and reliability of the questions used during the pretest, posttest, and follow-up survey questionnaire.



- ✈ A future study should be completed using a similar methodology, but including GA pilots with a greater range of flight hours!
- ✈ The participants' responses to the open-ended questions suggested they had received little instruction and guidance during their ground and flight training regarding the safety management of wildlife hazards;
- ✈ Clearly, further research needs to be completed to gain additional understanding of this discrepancy.

- ✈️ Providing Part 141 **GA** pilots, through specific safety training, with the knowledge and skills to mitigate the risk of bird strikes could:
  - ✈️ Reduce the number of human fatalities and injuries due to bird strikes;
  - ✈️ Reduce direct and indirect costs associated with damaging strikes;
  - ✈️ Increase the quality and quantity of wildlife strike reports by pilots; and
  - ✈️ Support the sustainable growth of the U.S. aviation industry.

# Questions





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**Thank you!**

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