Airbag Equipped General Aviation Aircraft Incidents and Accidents

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Background

- *AmSafe Developed Inflatable Restraint*
  - *Airbag folded in cover, mounted on restraint (2, 3, 4, or 5 point)*
  - *Inflator (based on automotive) inflates bag through hose*
  - *Sensor Module: Mech. Sensor / Firing Circuit / Battery*

- *Over 50,000 restraints in Service*
  - *Transport Aircraft in service 2001, now > 50 commercial airlines*
  - *GA Aircraft in service Sept 2004, now > 7,000 aircraft*

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Objectives

- *Review GA Event Statistics for first 6 years of GA airbags*
- *Provide Useful Data for Evaluating GA Safety*
- *Indicate AmSafe Airbag Performance to Date*

Note: Transport aircraft events are not included in the statistics.

There have been 3 known:

09Nov07, Airbus A340-600, Iberia Flight IB6463 runway overrun, no injuries, airbags did not deploy.

24Sept09, BAE J-41 Reg. ZS-NRM crashed during positioning flight with no passengers on board. The two pilots and flight attendant on board were injured. Airbag seats were not occupied.

13Apr10, Airbus A330, Cathay Pacific Flight CX780, emergency landing, eight had minor injuries, authorities did not respond to requests for airbag status, event would not be expected to deploy bags.

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All Events: Incidents and Accidents

- *Where does Data Come From?*
  - *Customers provide Aircraft Registration Data to AmSafe*
  - *AmSafe monitors preliminary event data at www.faa.gov*
  - *Cooperation between NTSB / AmSafe evaluates each event*

  Note: NTSB conducted Airbag Study, Report in Process
- *Incidents: Minor Damage, No Injuries*
- *Accidents: Major Damage or Injuries*
  - *May be a minor event from a crashworthiness perspective*
  - *Often no injury or minor injury*

July 2004 through August 2010 (first 6 years of GA airbags)

Incidents	*n= 62 (30%)*
Accidents	*n=147 (68%)*
N/A (foreign)	*n= 4 (2%)*

Total = 213

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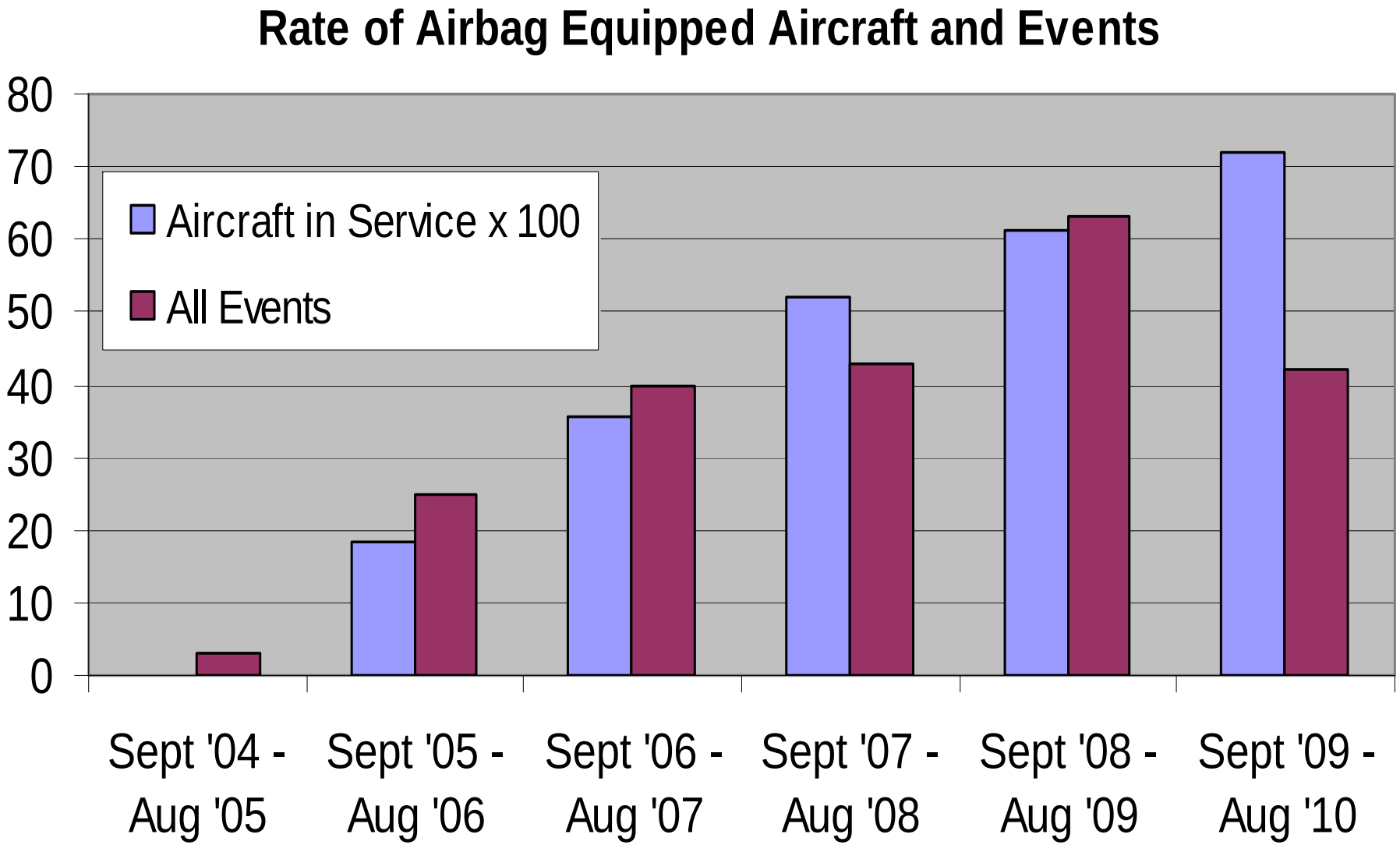
Rate of Airbag Introduction vs. Events



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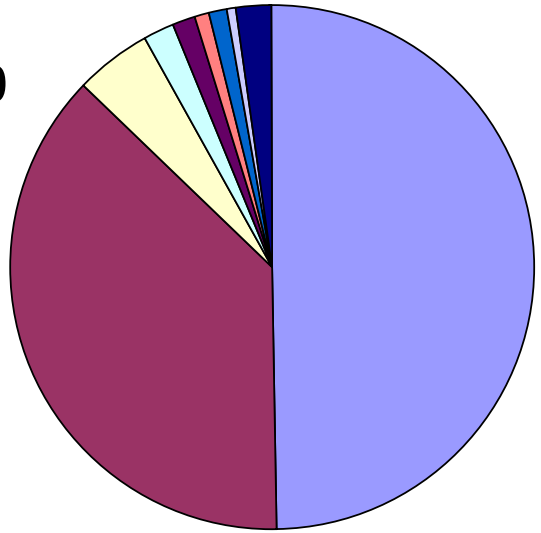
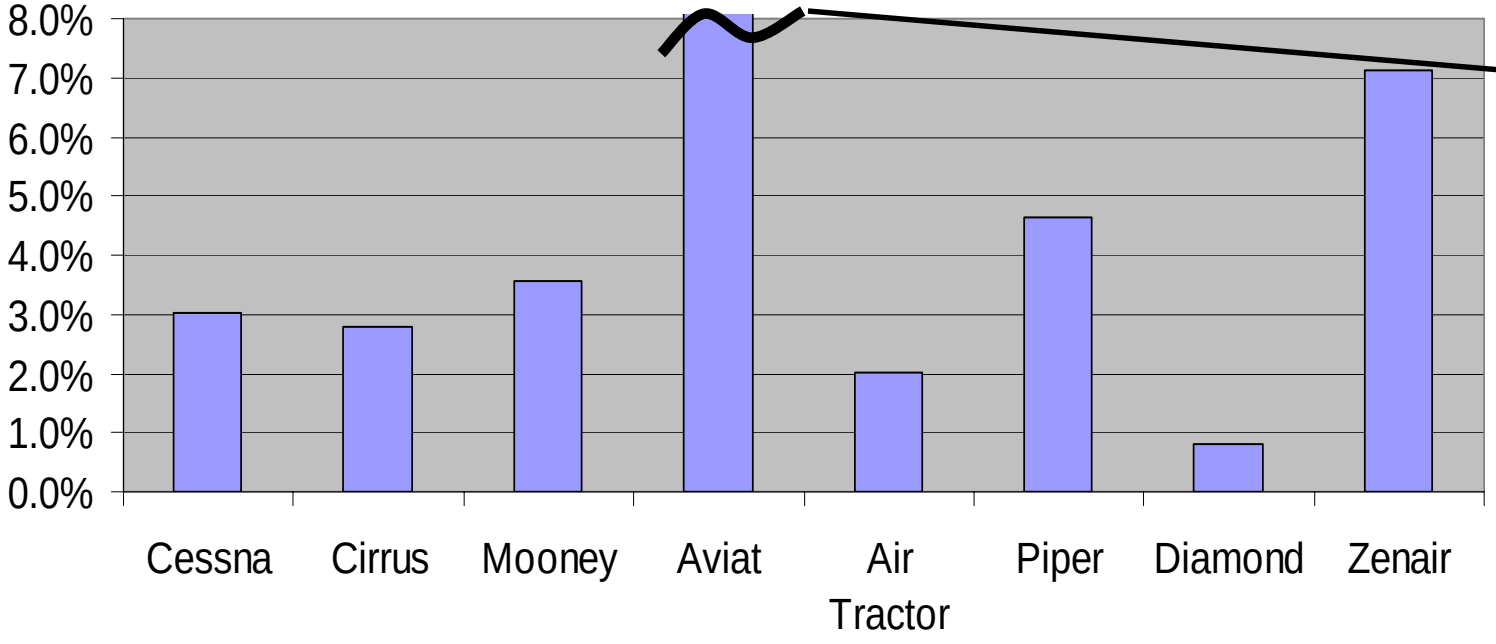
Aircraft Types All Events

Incidents and Accidents Sept '04 to Aug '10
n=213

- Cessna n=106
- Cirrus n=80
- Mooney n=10
- Aviat n=4
- Air Tractor n=3
- Piper n=2
- Diamond n=2
- Zenair n=1
- unknown n=5



Event per Aircraft in Service



Aviat: 50%

(4 of 8 Aircraft)

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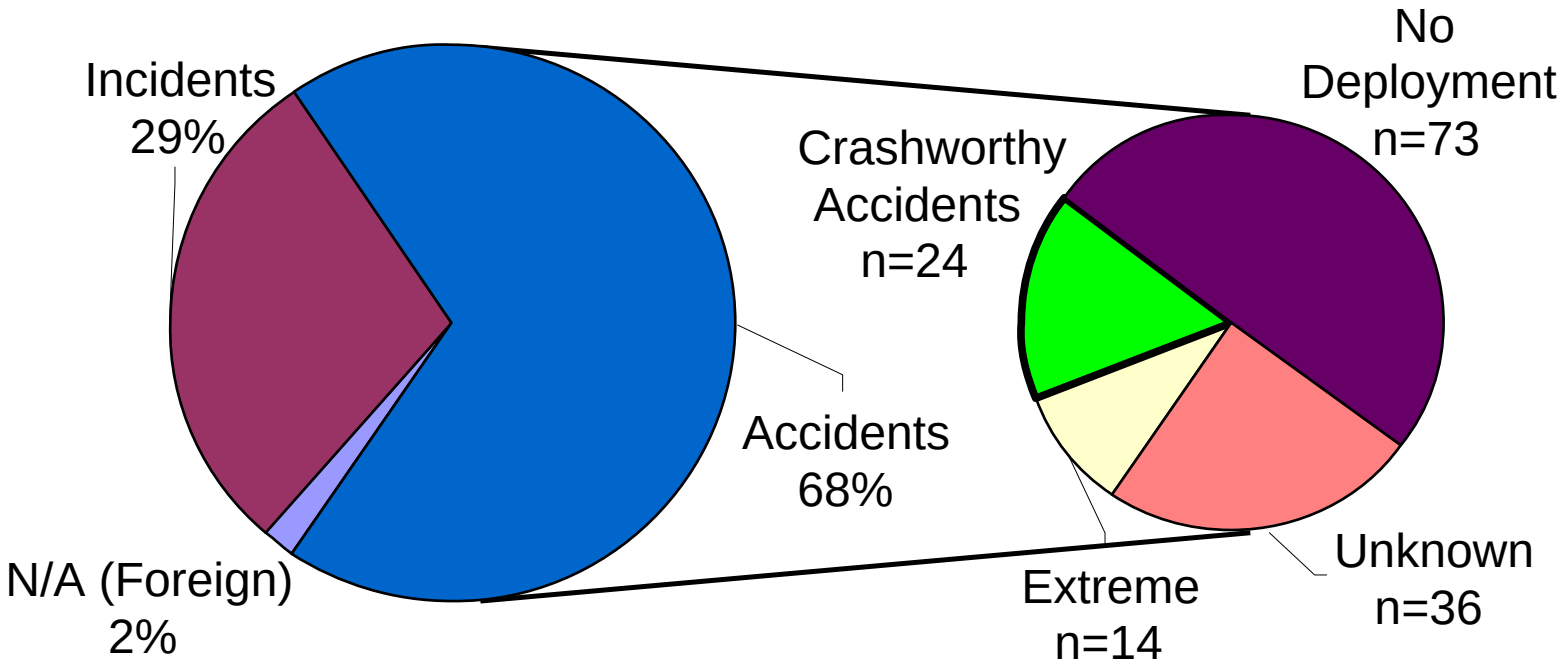
Accidents of Interest for Crashworthiness

- *Extreme: Aircraft was completely destroyed on impact or fire, evaluation of the airbag / occupant survivability not possible*
- *Crashworthy Accidents: Airbags Deployed, Survivability evaluated*



- *Unknown: Accidents occurred before or after the NTSB study period*

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No Deployment Accidents

- No Significant Longitudinal Impact
  - Rotational does not contribute
  - Forward component of impact vector is critical
  - Threshold requires BOTH: Impact Force > ~ 4 G
    Velocity Change > ~ 0.25 G/s

  What does that mean?
  FAR 23.562 GA 26G pulse onset 520 G/s or total ΔV = 1.3 G/s
  Airbag will deploy ~ 30 ms into the 100ms crash pulse

- Accident Investigations to date…
  - Indicate Sensor Threshold is appropriate
  - Bags have deployed when required
  - Bags have not inadvertently deployed

- Interesting non-deployments for discussion…

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Impact Threshold Examples

No Deployment, No Debilitating Injuries…..Below Threshold

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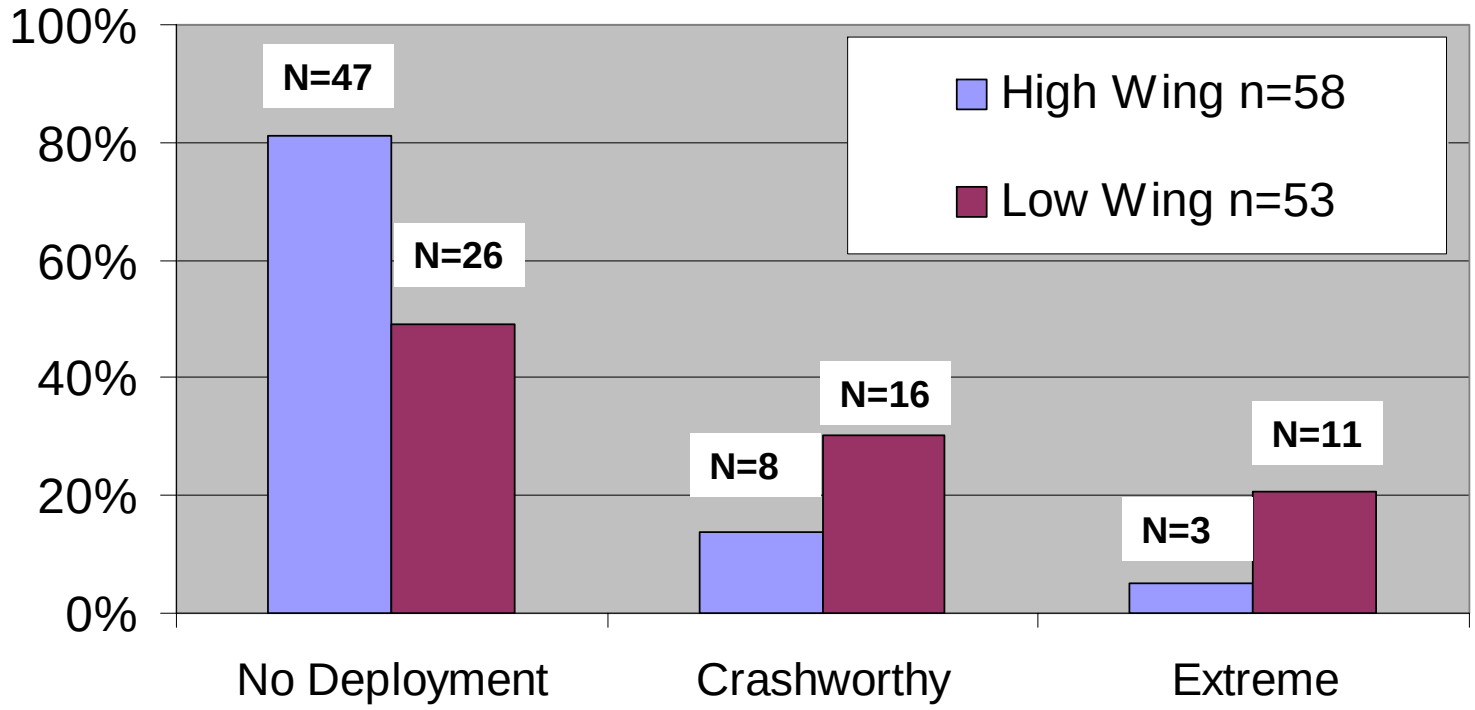
Accident Characterization

Severity of accident related to Aircraft Type

5% of High Wing were Extreme as compared to 21% of Low Wing

High Wing:	*Cessna 172: 38*	***Low Wing:***	*Cirrus SR22: 38*
Total = 58	*182: 13*	*Total = 53*	*SR20: 7*
	206: 4		*Mooney M20: 4*
	Aviat Husky: 3		*Air Tractor: 2*
			Diamond DA40: 1
			Piper PA-28: 1

Accident Distribution Sept '04 to Aug '10
High Wing vs Low Wing Aircraft Type



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Deployment with No / Minor Injury

Cessna

Piper

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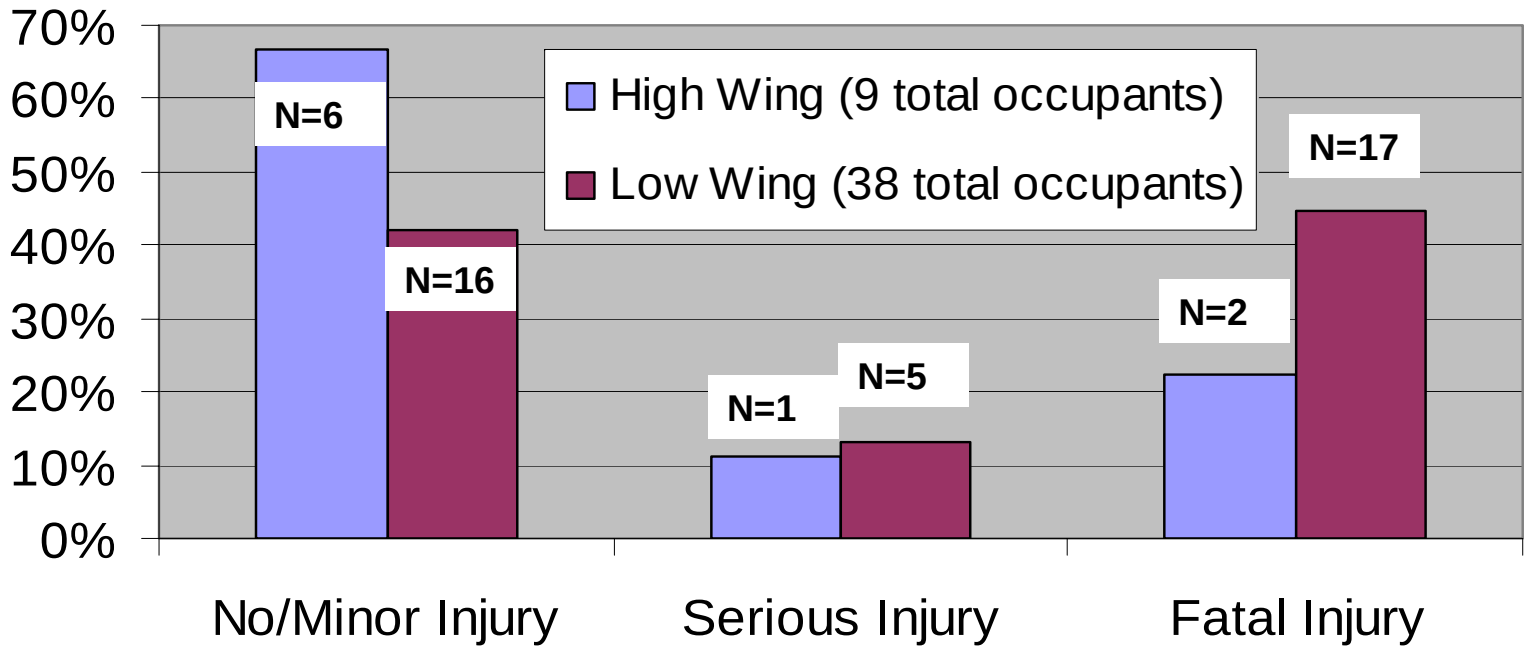
Occupant and Injury Distribution

- *The 24 Accidents designated "Crashworthy"*
  (Serious Accident with Airbag Deployment, but not Extreme):
  - *47 Total Occupants*
- *Injuries: No/Minor 22 (47%) Serious 6 (13%) Fatal 19 (40%)*
- *Total Occupants by Aircraft Type: High Wing 9 (19%)*
  Low Wing 38 (81%)



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Deployment with No / Minor Injury

Cirrus

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Deployment with Serious Injury

Impacts with Large Vertical Component

Will the bags deploy in vertical impact?

Yes, if there is also a significant longitudinal component.

Aircraft descended with Ballistic Recovery Systems (BRS) parachute

- *Airbag may or may not deploy*

Airbags deployed in the example shown below

- *Trees indicate vertical descent*
- *Aircraft pitch at impact is the critical factor*

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Conclusions and Discussion Points

- *Roughly 3% of fielded aircraft experienced event*
- *Comparison to NTSB 2005 data is roughly comparable*
  - *7.2 Accidents per 100k FH is ~3.6% probability aircraft will be involved in an accident in 500 FH*
- *Events with airbag equipped GA aircraft now common*
  - *> 7,000 aircraft in field, > 50 accidents a year*
  - *Monitoring?, Investigation?, Other Issues?*
- *Approximately 1/3 of Accidents Severe enough for Deployment*
  - *2/3 of these may benefit from airbag*
- *Current Sensor appears to have appropriate threshold*
- *Belt mounted system appears to have appropriate interface to occupant*

Note: NTSB Airbag Safety Study: Board Review Meeting Jan. 11, 2011 Open to Public, No Participation

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Thank You For Your Time!

Special Thanks for Their Contribution:

- *NTSB*
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- *AmSafe staff*
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