AIRCRAFT ANALYSIS

JUSTIN MAWIRA

OVERVIEW OF THE TASK

- The company wants to purchase and operate airplanes for commercial and private enterprises
- Preferably low-risk aircraft

THE DATA

- The dataset holds 31 columns and 90,348 rows

- What we can know: accident severity per aircraft
- What we can't: how prone to accidents the aircraft are (accident rate)
- Why we can't: total exposure time is not provided

HOW I HANDLED THE DATA

- EDA
- Clean – case, null values etc
- Aggregate - sum, mean etc
- Create and merge new dfs
- Filter and sort values by relevant criteria
- Create visualizations

HOW I HANDLED THE DATA

- Given that total exposure time/flight hours is not declared, we cannot define low-risk aircraft in terms of accident rate

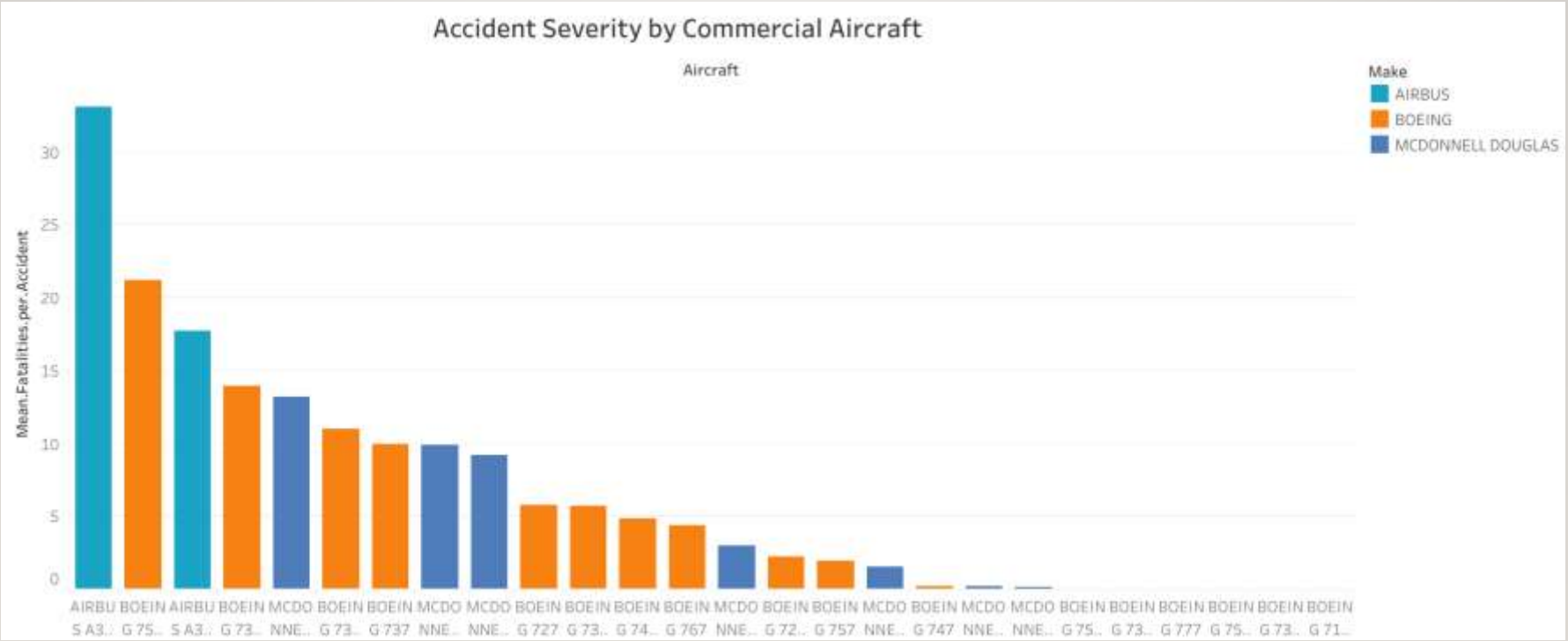
- Given this constraint, I've opted to employ accident severity as the metric for risk
- Defining accident severity as the mean fatalities per accident
- While filtering for the number of accidents, to ensure the findings are not a fluke

VISUALIZATIONS

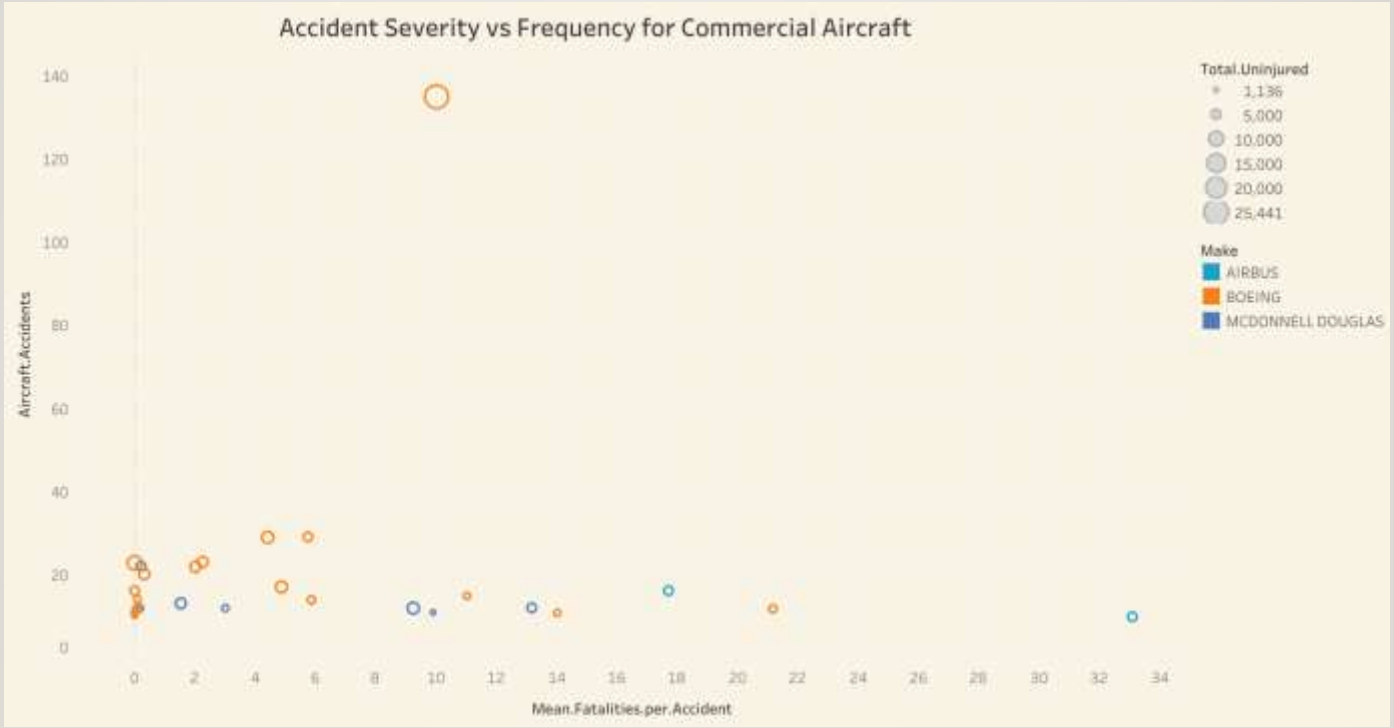
- **Accident Severity by Commercial Aircraft**
- **Accident Severity vs Frequency for Commercial Aircraft**
- **Yearly Trend of Total Fatalities by Commercial Aircraft**

- **Accident Severity vs Frequency for Private Aircraft**
- **Private Aircraft with Minimum Severity across >=20 Accidents**

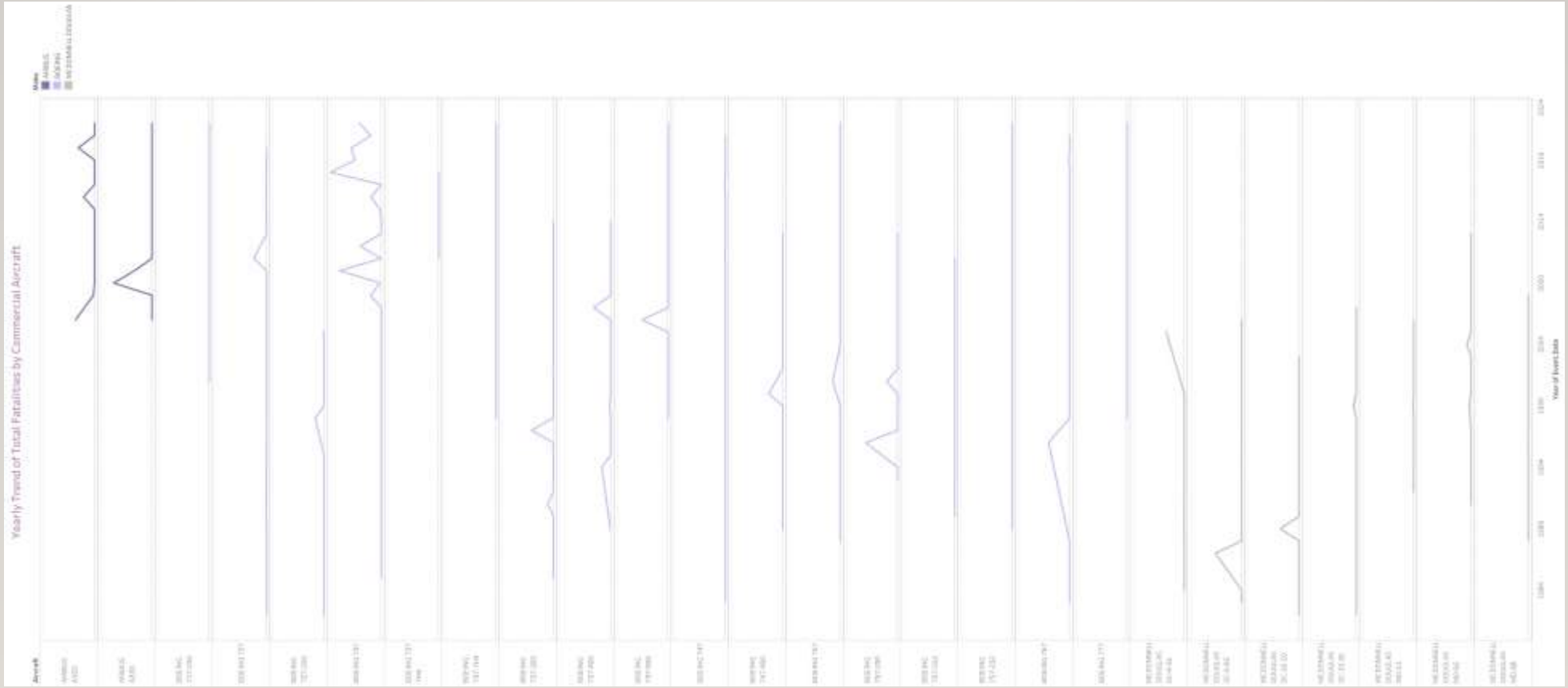
COMMERCIAL


Accident Severity by Commercial Aircraft
Aircraft
Make
AIRBUS
BOEING
MCDONNELL DOUGLAS
Mean.Fatalities.per.Accident
30
25
20
15
10
5
0
AIRBU S A3..
BOEIN G 75..
AIRBU S A3..
BOEIN G 73..
MCDO NNE..
BOEIN G 73..
BOEIN G 737
MCDO NNE..
MCDO NNE..
BOEIN G 727
BOEIN G 73..
BOEIN G 74..
BOEIN G 767
MCDO NNE..
BOEIN G 72..
BOEIN G 757
MCDO NNE..
BOEIN G 747
MCDO NNE..
MCDO NNE..
BOEIN G 75..
BOEIN G 73..
BOEIN G 777
BOEIN G 75..
BOEIN G 73..
BOEIN G 71..

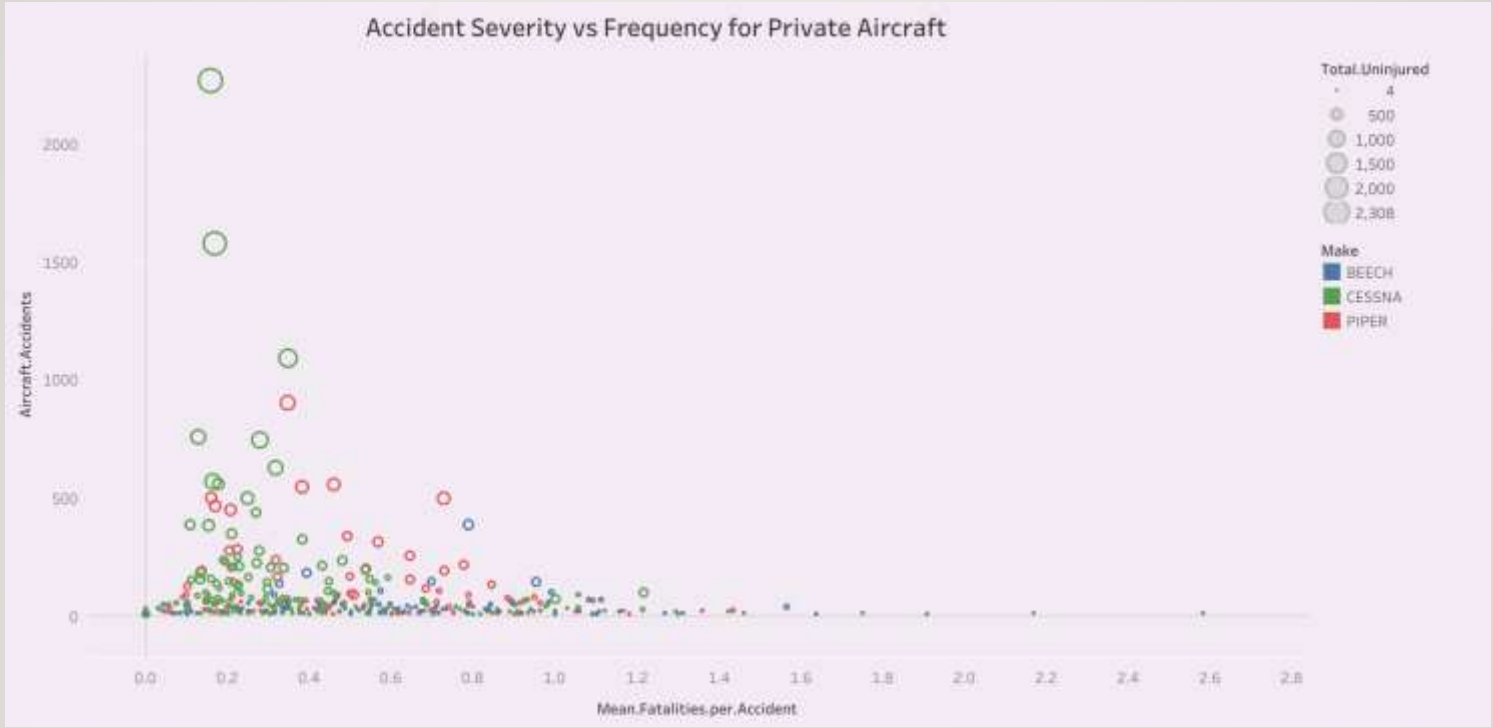
COMMERCIAL


Accident Severity vs Frequency for Commercial Aircraft
Aircraft.Accidents
Mean.Fatalities.per.Accident
Total.Uninjured
1,136
5,000
10,000
15,000
20,000
25,441
Make
AIRBUS
BOEING
MCDONNELL DOUGLAS

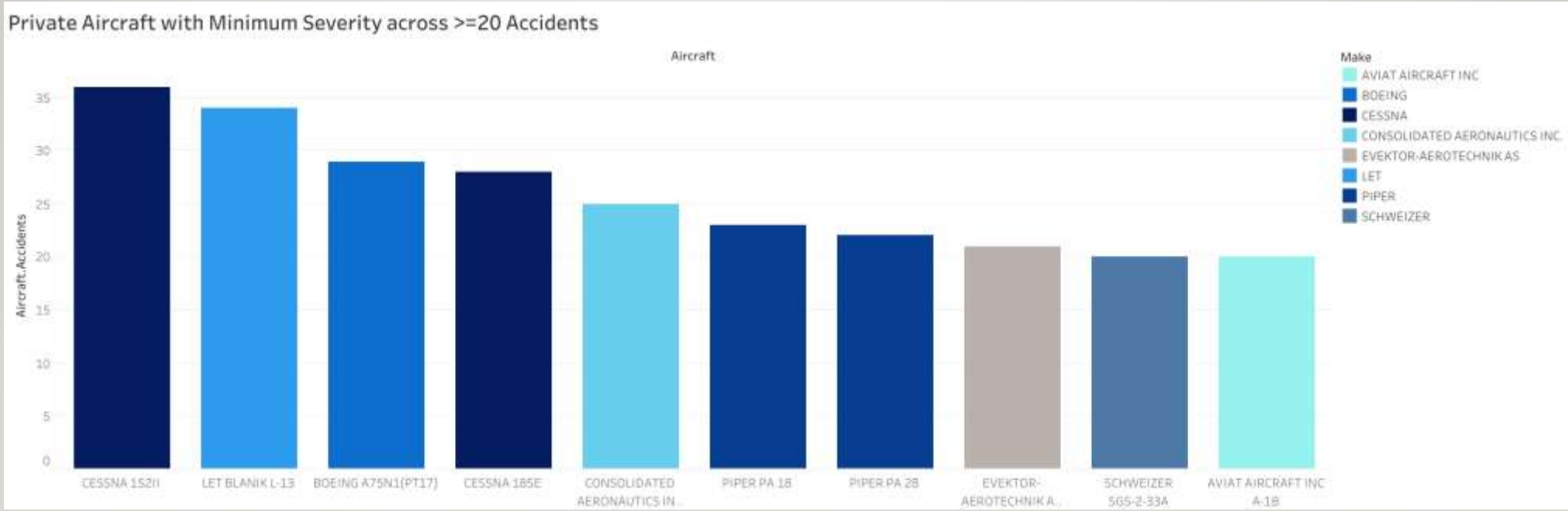
COMMERCIAL



PRIVATE


Accident Severity vs Frequency for Private Aircraft
Total.Uninjured
4
500
1,000
1,500
2,000
2,308
Make
BEECH
CESSNA
PIPER
Aircraft.Accidents
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
Mean.Fatalities.per.Accident

PRIVATE


Private Aircraft with Minimum Severity across >=20 Accidents
Aircraft
Aircraft.Accidents
35
30
25
20
15
10
5
0
CESSNA 152II
LET BLANIK L-13
BOEING A75N1(PT17)
CESSNA 185E
CONSOLIDATED AERONAUTICS IN...
PIPER PA 18
PIPER PA 28
EVEKTOR-AEROTECHNIK A...
SCHWEIZER SGS-2-33A
AVIAT AIRCRAFT INC A-1B
Make
AVIAT AIRCRAFT INC
BOEING
CESSNA
CONSOLIDATED AERONAUTICS INC.
EVEKTOR-AEROTECHNIK AS
LET
PIPER
SCHWEIZER

FINDINGS: COMMERCIAL AIRCRAFT

- Of the 26 commercially relevant aircraft with substantial accident history(10>=), the BOEING 777 exhibits the strongest safety performance in terms of accident severity
- The BOEING 777 has the highest accident count(23) among commercial aircraft with zero fatalities

- the top 5 safety performers, in terms of accident severity, are all BOEING aircraft

FINDINGS: COMMERCIAL AIRCRAFT

- The BOEING 737 is the outlier in this dataset, both in sheer number of total fatalities and the fact it's fatalities have been on the rise in recent years
- the BOEING 737 also has several times more accidents(135) than the rest

Perhaps it has more recorded flight hours than the rest. It could be an exposure bias(perhaps it flew more than the rest), or it might just be more prone to accidents

- From 1985 – 2008 it had 0 fatalities. Since 2008 there's been a spike, with fatalities reaching 249 in 2010, 301 in 2018 and 132 in 2022

RECOMMENDATIONS: COMMERCIAL AIRCRAFT

- **Prioritize the BOEING models, specifically the 777**
- **Treat high accident frequency as an operations issue, not just an airframe issue**
- **Nonetheless, exercise additional due diligence eg. machine and training requirements (to minimize crashes)**
- **Seek total exposure time data for each aircraft**

FINDINGS: PRIVATE AIRCRAFT

- 694 private planes with a minimum accident count(10)
- Of the 694, cessna, piper and beech are the most frequently occurring Make's (416 collectively)

- 45 had zero fatalities
- Of the 45, cessna and piper account for 15 combined. They are the Make's with the lowest accident severity

FINDINGS: PRIVATE AIRCRAFT

- After ranking the 45 based on accident count, the CESSNA 152II exhibits the strongest safety performance in terms of accident severity
- It has the highest accident count with zero fatalities (36)

- 2 of the top 5 among the 45 are CESSNA

FINDINGS: PRIVATE AIRCRAFT

- CESSNA 152 is very much an outlier in terms of accident count, but still scores low on accident severity
- It has the highest accident count(2270), with a mean fatalities per accident of 0.158
- could be exposure bias, or is more prone to accidents

RECOMMENDATIONS: PRIVATE AIRCRAFT

- **Prioritize the CESSNA and PIPER models, specifically the CESSNA 152II**
- **Match aircraft safety performance to pilot experience**
- **Budget for repairs as the frequency of accidents is much higher than commercial aircraft**
- **Seek total exposure time data for each aircraft**

QUESTIONS?

- I'll happily take your questions now