



AVIATION RISK ANALYSIS: IDENTIFYING LOW-RISK AIRCRAFT FOR BUSINESS EXPANSION

Overview

Aviation Industry Safety Insights

This project analyzes aviation accident data from the NTSB to provide actionable insights for informed investment in commercial and private aviation.

Key focus areas include:

- Aircraft Attributes: Make, model, engine type, and number of engines.
- External Factors: Weather conditions.

We identified trends and risk factors linked to different aircraft types using statistical methods and data visualization.

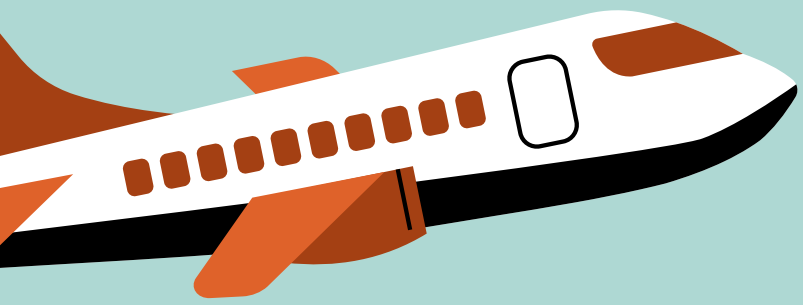


Business problem

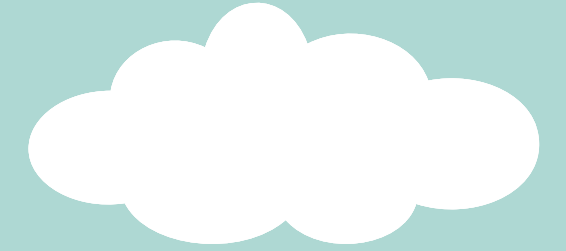
The company seeks to diversify into aviation by identifying the safest, lowest-risk aircraft for commercial and private operations, minimizing risks, and ensuring success.

Business Pain Points

- Safety: High accident risks threaten financial and reputational stability.
- Knowledge Gap: Limited expertise in assessing aircraft safety.
- Decision Support: Lack of data-driven insights for aircraft selection



Data Analysis Questions



The following questions were chosen to address the business's needs:

1. Which aircraft makes and models have the highest and lowest accident counts?
- 2, What are the patterns of accidents based on engine type and number of engines?
3. How do meteorological conditions (VMC vs. IMC) impact accident counts?
4. Which aircraft make or model is associated with the most or least severe outcomes, such as fatalities or serious injuries?

Answering these questions is critical for making informed decisions about aircraft purchases.



Data Understanding

Data Source

The dataset used for this project was sourced from Kaggle. It contains detailed information about aviation accidents, which is critical for analyzing risks associated with different aircraft types.

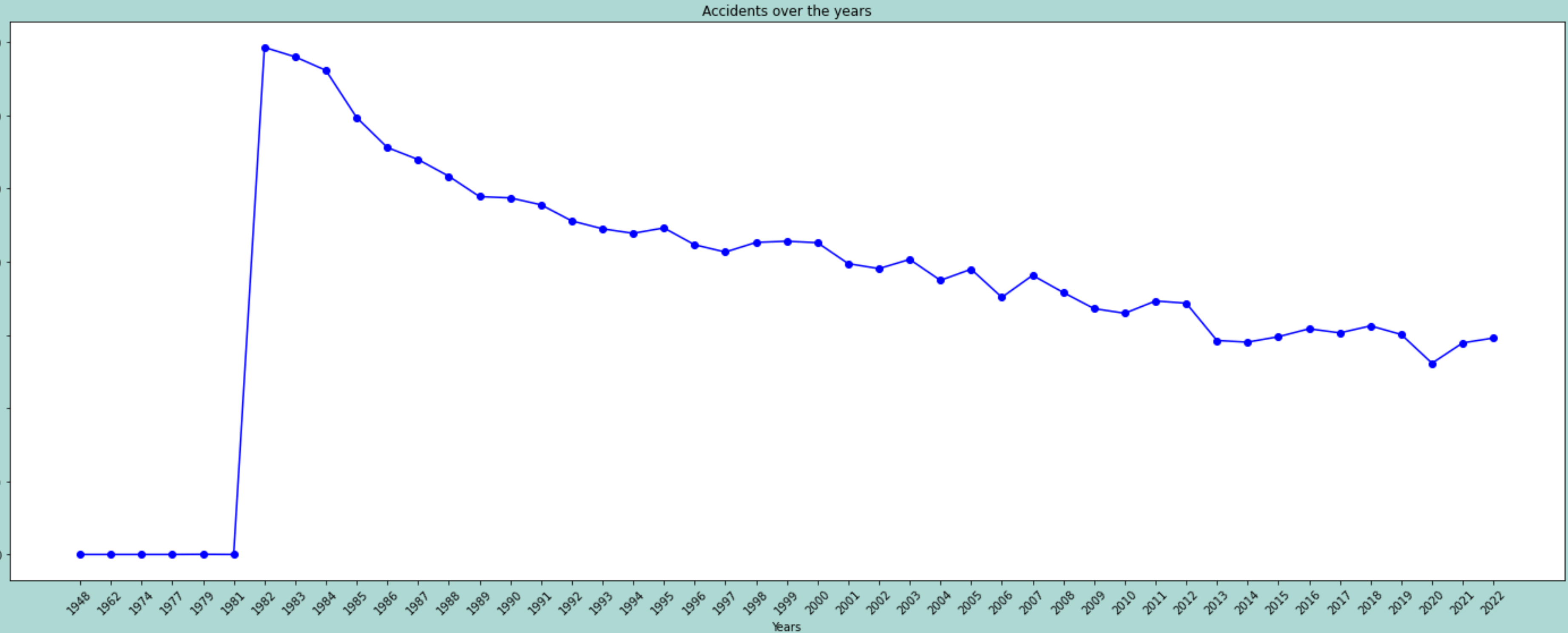
Data Representation

The data represent aviation accident records, primarily including information about:

- **Aircraft make,**
 - **Aircraft model**
 - **Engine type**
 - **Number of engines**
 - **Accident outcomes such as injuries and fatalities.**
 - **Number of fatal injuries. (Key variable in identifying high-risk aircraft)**
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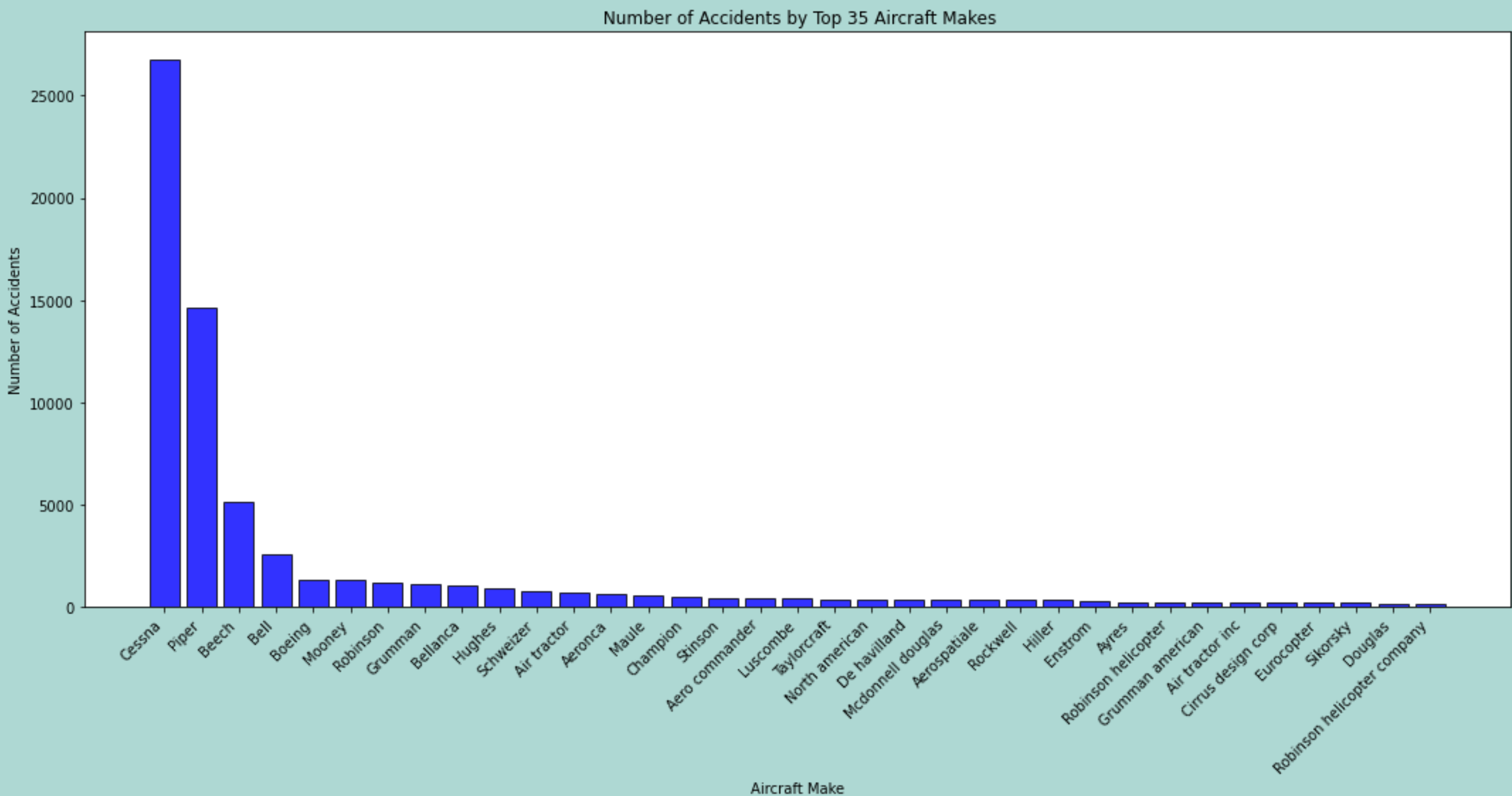
Data Analysis

To address these questions I had posed at the onset of this project, various charts and graphs were used to uncover patterns and provide actionable insights.



The chart above shows the Trend in the count of accidents over the years, with the highest count of accidents being in 1982.

Accident counts by Aircraft make



The top 5 make with the highest count of accidents

- Cessna
- Piper
- Beech
- Bell
- Boeing

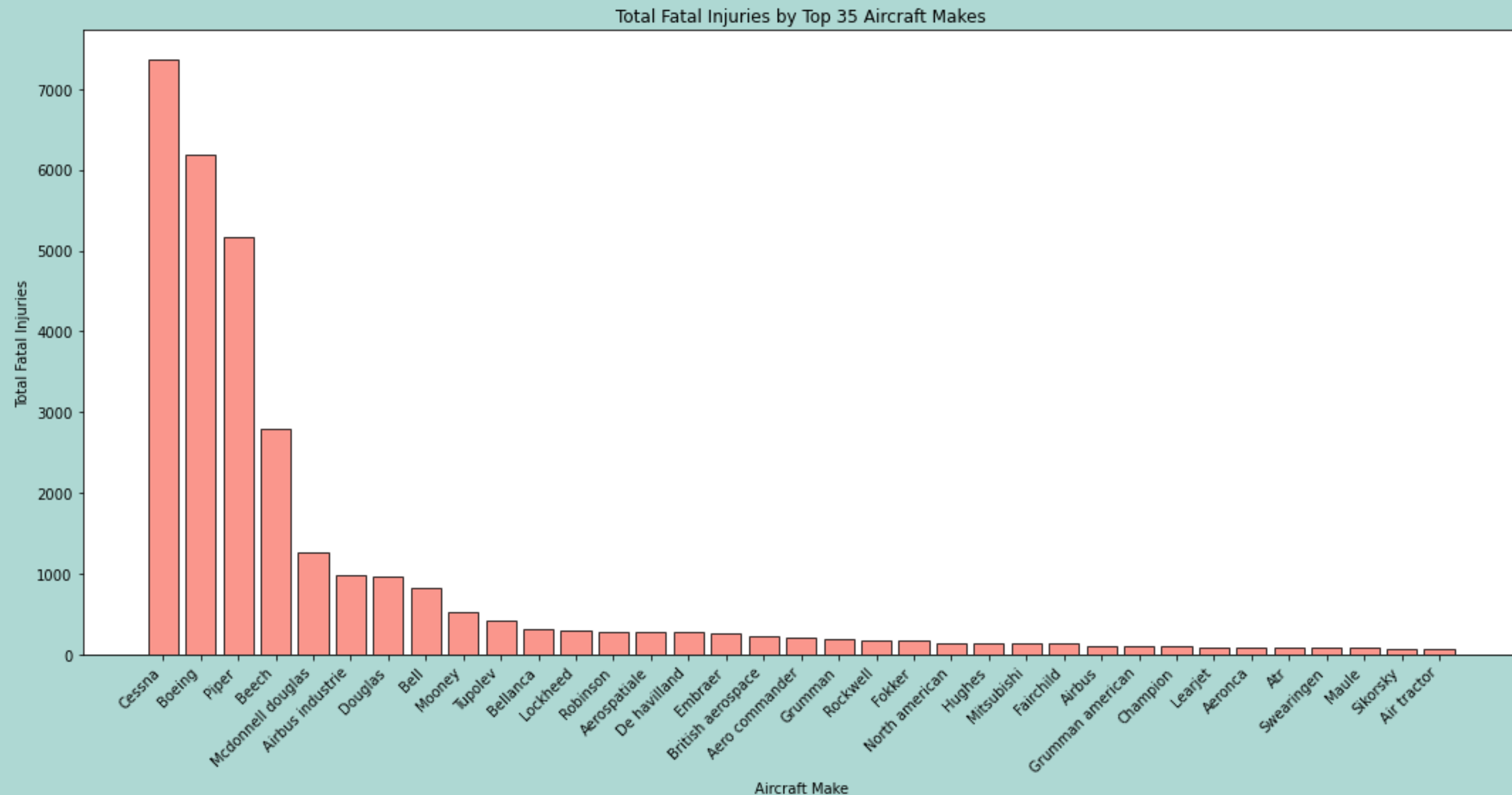




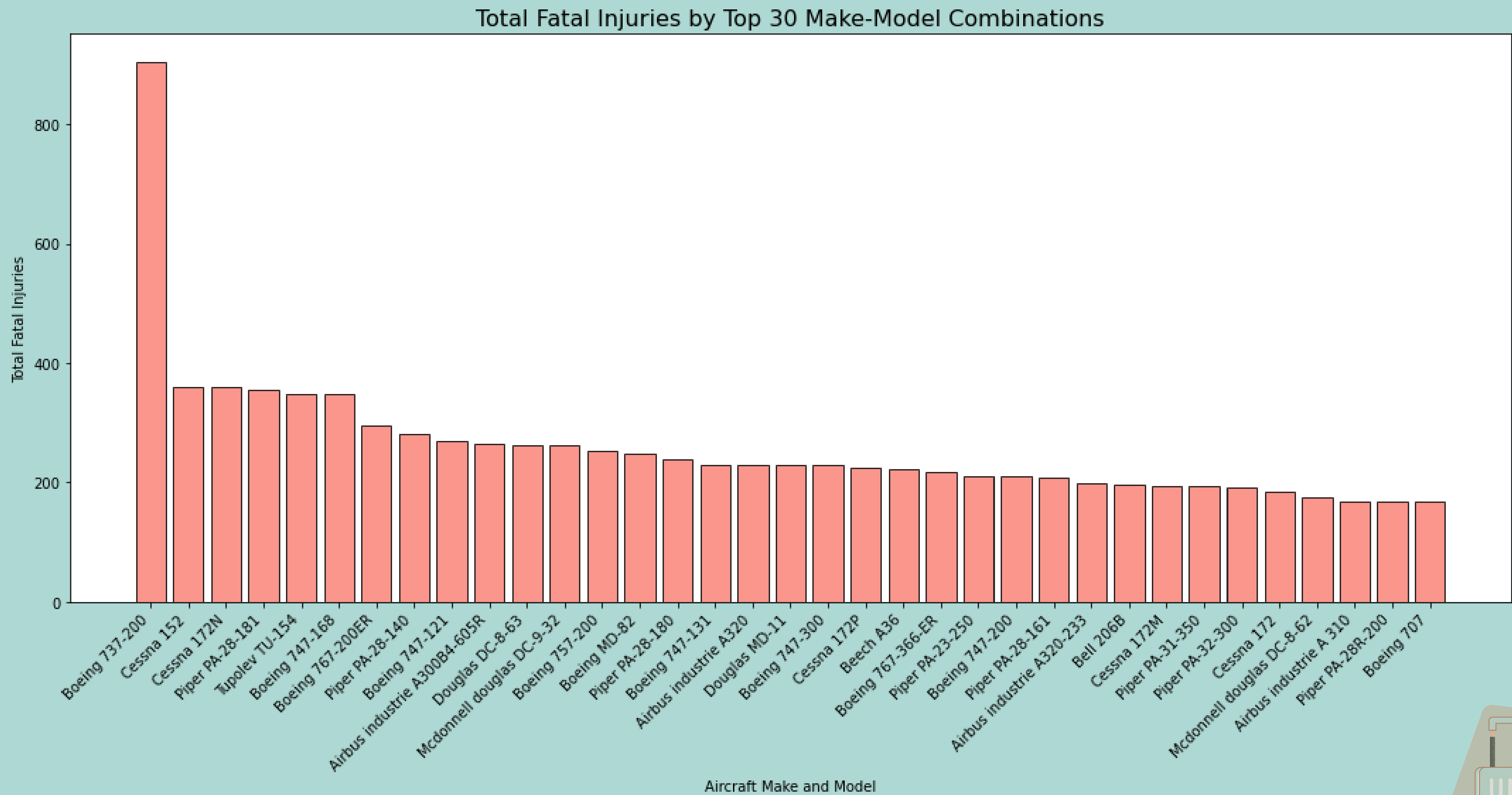
Total Fatal Injuries by Aircraft Make

The top 5 make with the highest count of Fatal injuries

Cessna
Boeing
Piper
Beech
Mcdonnell



Total Fatal injuries by make and model



NOTE : They are the makes-models to avoid at all cost



Aircraft Models to Avoid by Make since they have a high fatality count

Boeing

- 737-200, 747-168, 747-121, 747-131, 747-200, 747-300, 757-200, 767-200ER, 767-366-ER, 707

Cessna

152, 172, 172N, 172M, 172P

Piper

PA-28-140, PA-28-161, PA-28-180, PA-28-181, PA-28R-200, PA-31-350, PA-32-300, PA-23-250

Airbus Industrie

A30084-605R, A320, A320-233,A310

Tupolev

TU-154

Douglas

DC-8-63, DC-8-62, MD-11

McDonnell Douglas

DC-9-32, MD-82

Beech

A36

Bell

206B

NOTE:

They are based by the previous graph .

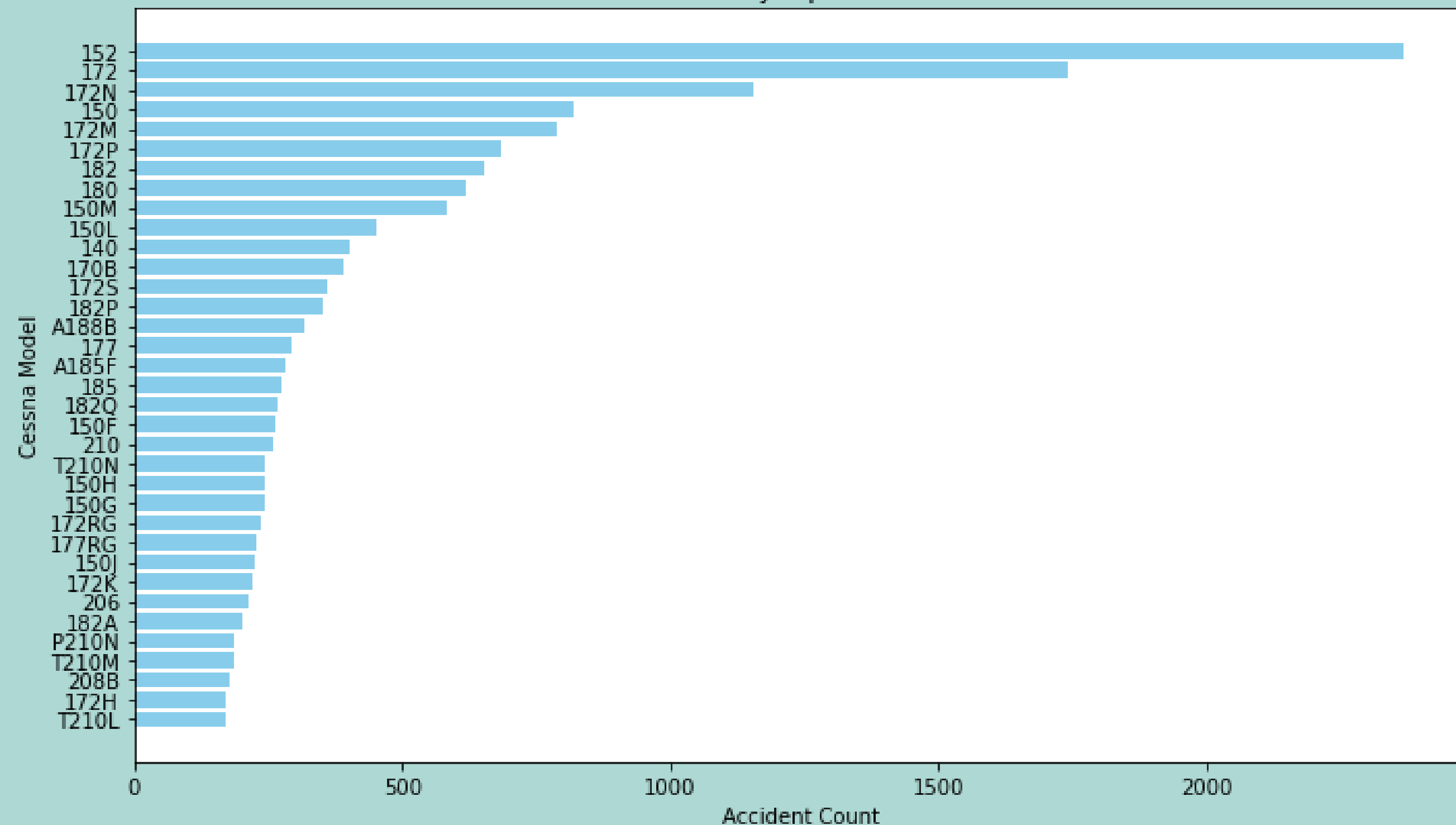




Accident counts by Popular Aircraft makes

1.Cessna

Accident Count by Top 35 Cessna Models



Models to Avoid (Higher Accident Counts)

- 152, 172, 172N, 150, 172M, 172P, 182, 180, 150M

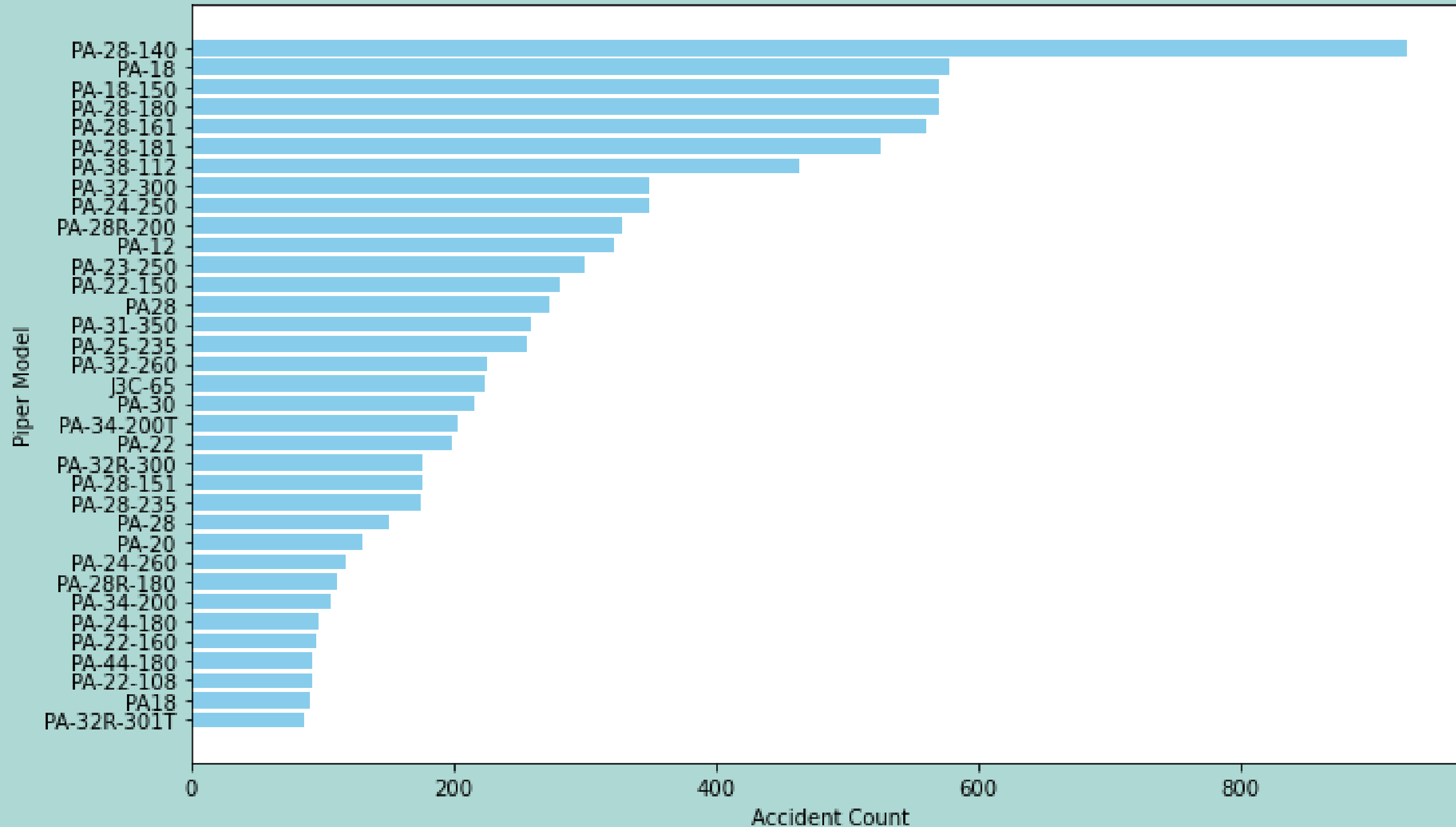
Recommended Models(Lower Accident Counts)

- T210L, 208B, P210N, 182A



2. Piper

Accident Count by Top 35 Piper Models



Models to Avoid (Higher Accident Counts)

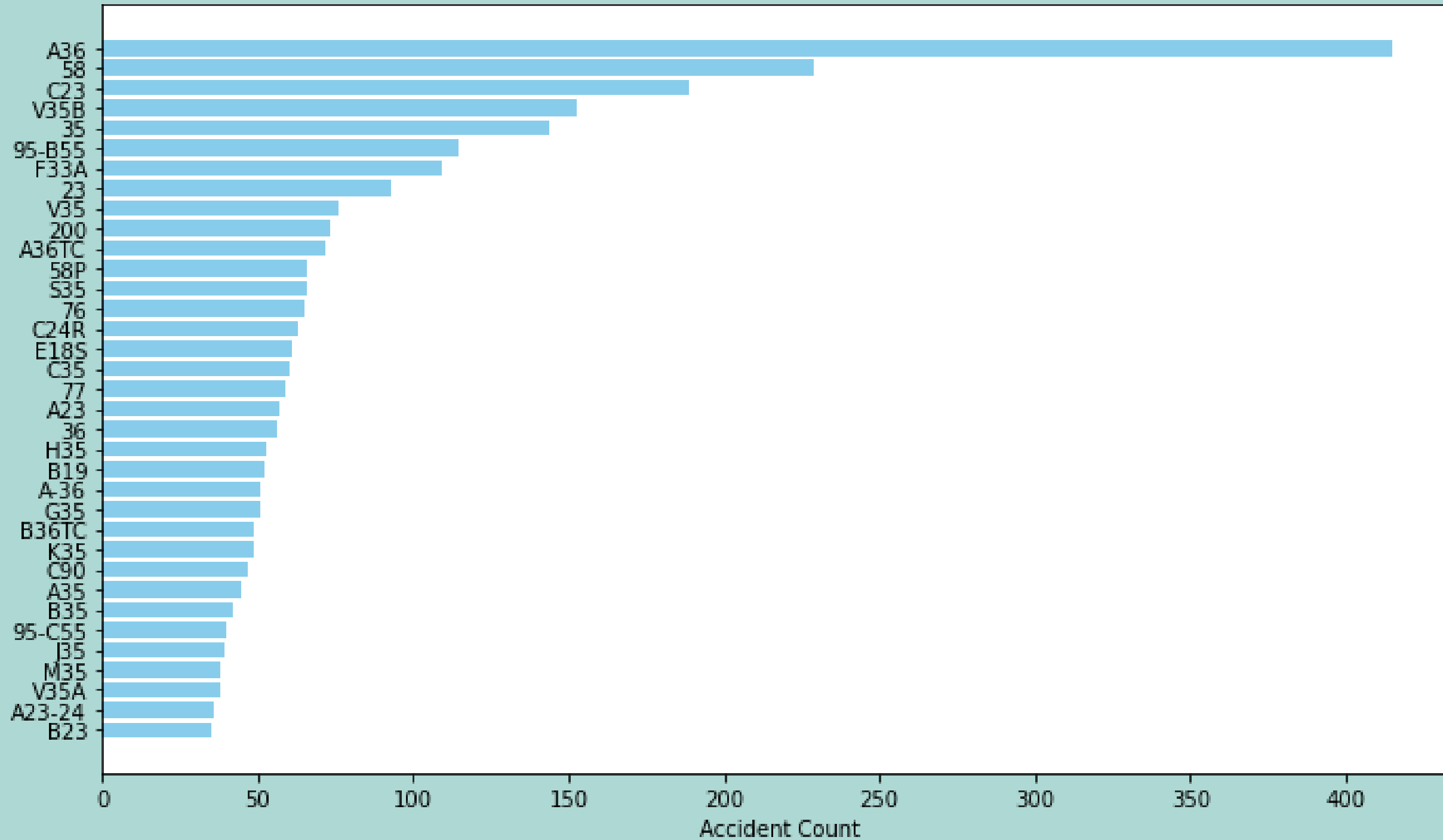
- PA-28-140, PA-18, PA-18-150, PA-28-180, PA-28-161, PA-28-181, PA-38-112

Recommended Models(Lower Accident Counts)

- PA-22-108, PA-32R-301T

3.Beech

Accident Count by Top 35 Beech Models



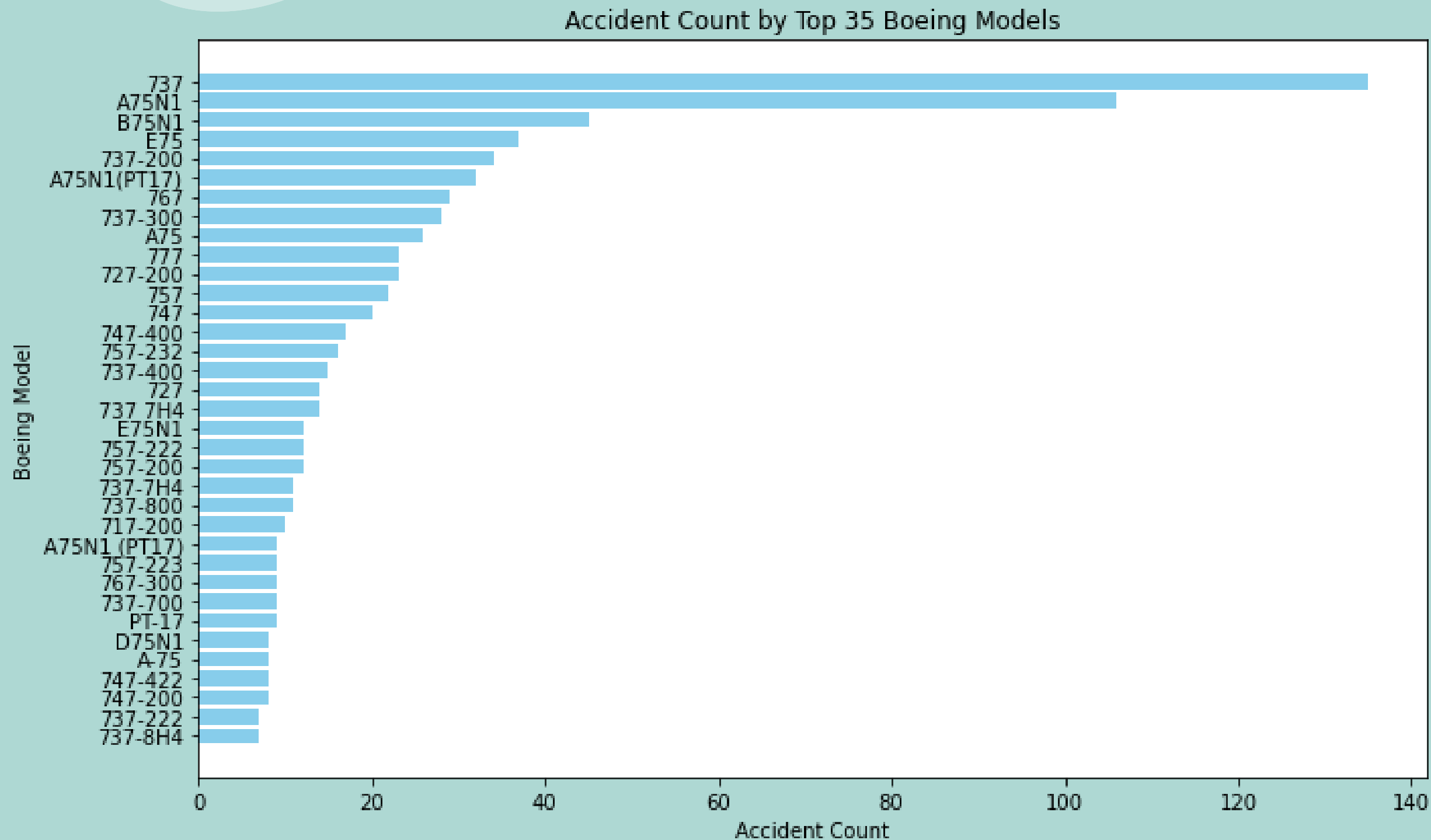
Models to Avoid (Higher Accident Counts)

- A36, 58, C23, V35B, 35, 95-B55, F33A

Recommended Models(Lower Accident Counts)

- A23-24 , 95-C55

4. Boeing



Models to Avoid (Higher Accident Counts)

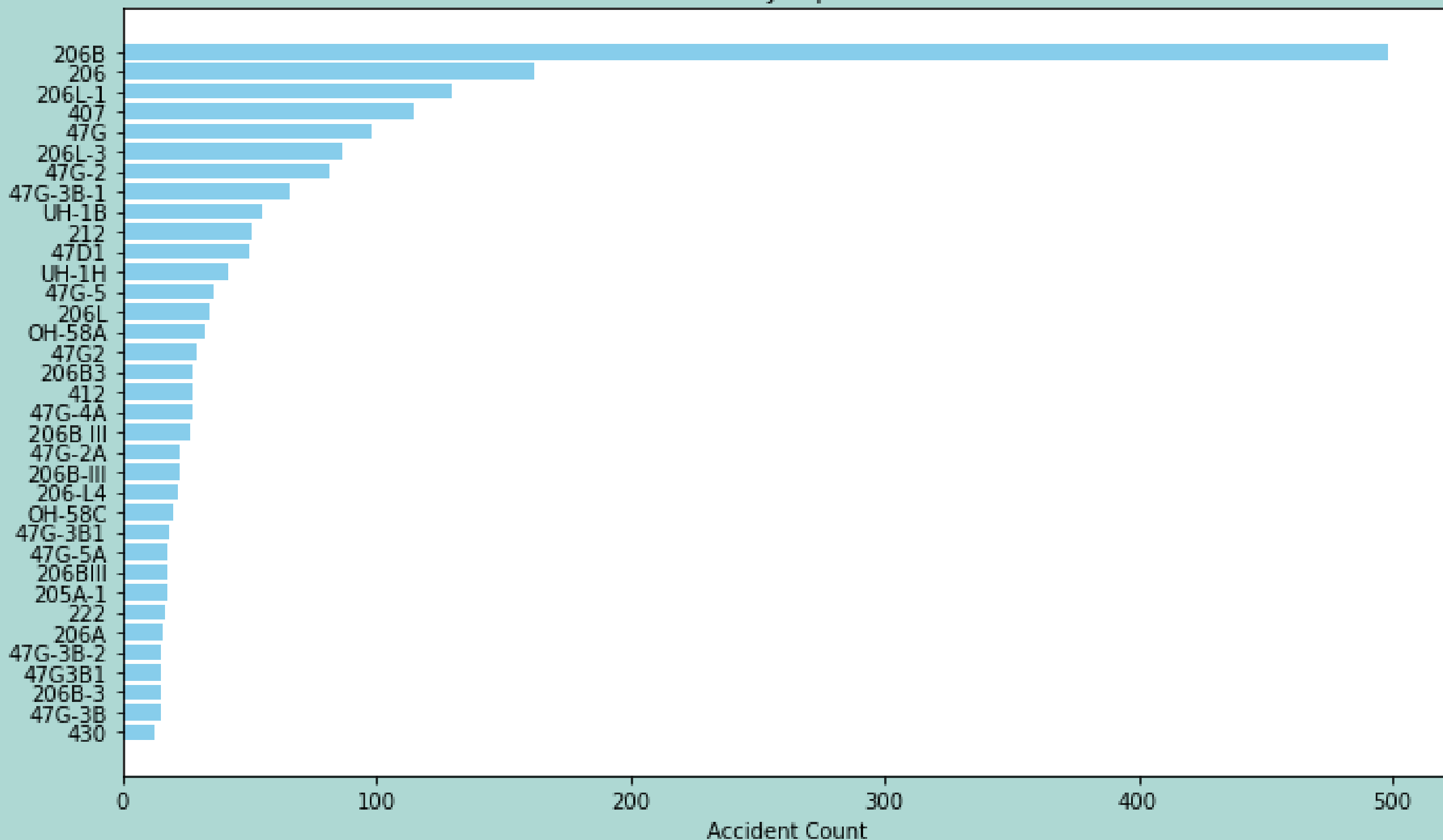
737, A75N1, B75N1, E75, 737-200, A75N1(PT17)

Recommended Models(Lower Accident Counts)

747-422

5. Bell

Accident Count by Top 35 Bell Models



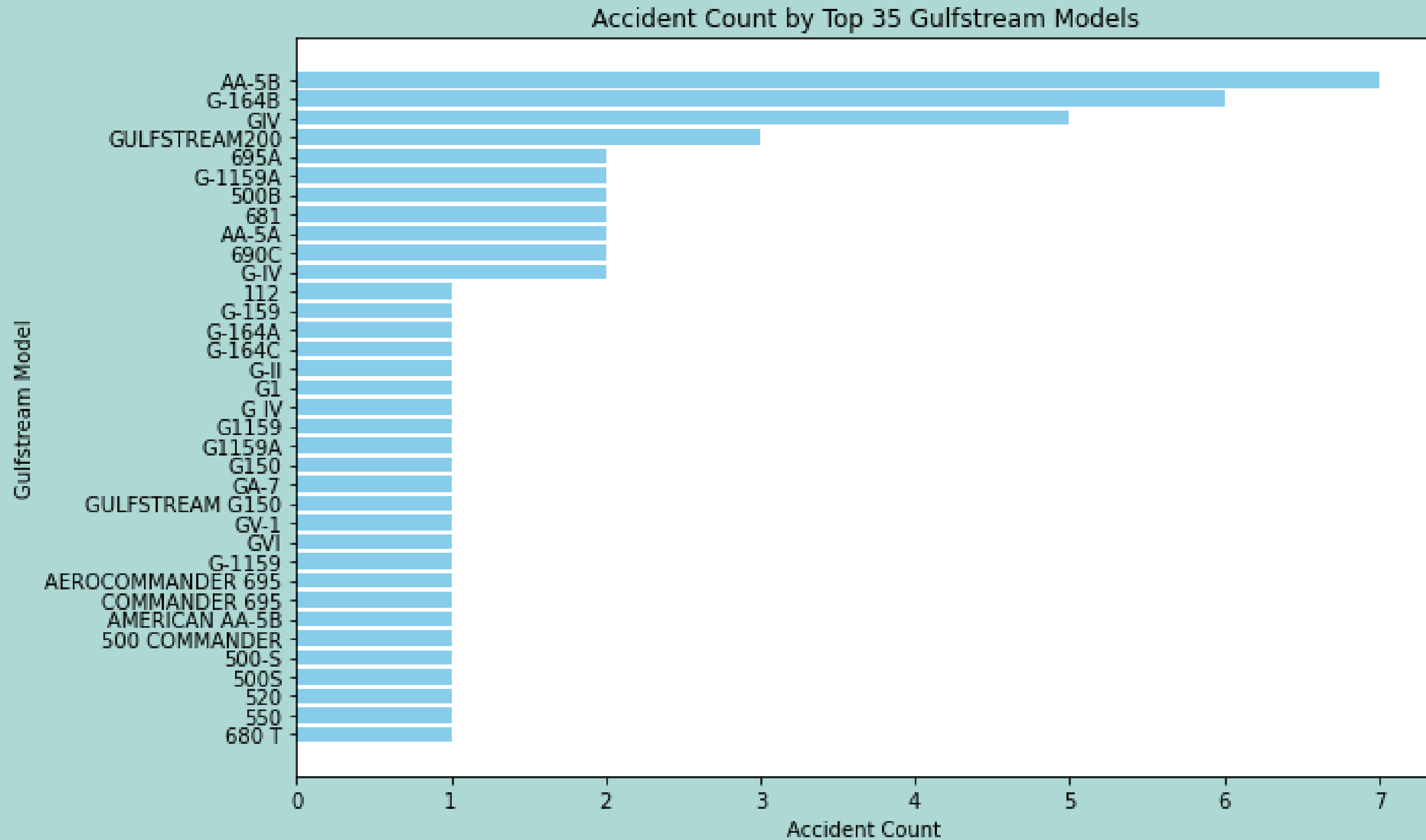
Models to Avoid (Higher Accident Counts)

- 206B, 206, 206L-1, 407, 47G, 206L-3

Recommended Models(Lower Accident Counts)

- 430, 222

6. Gulfstream

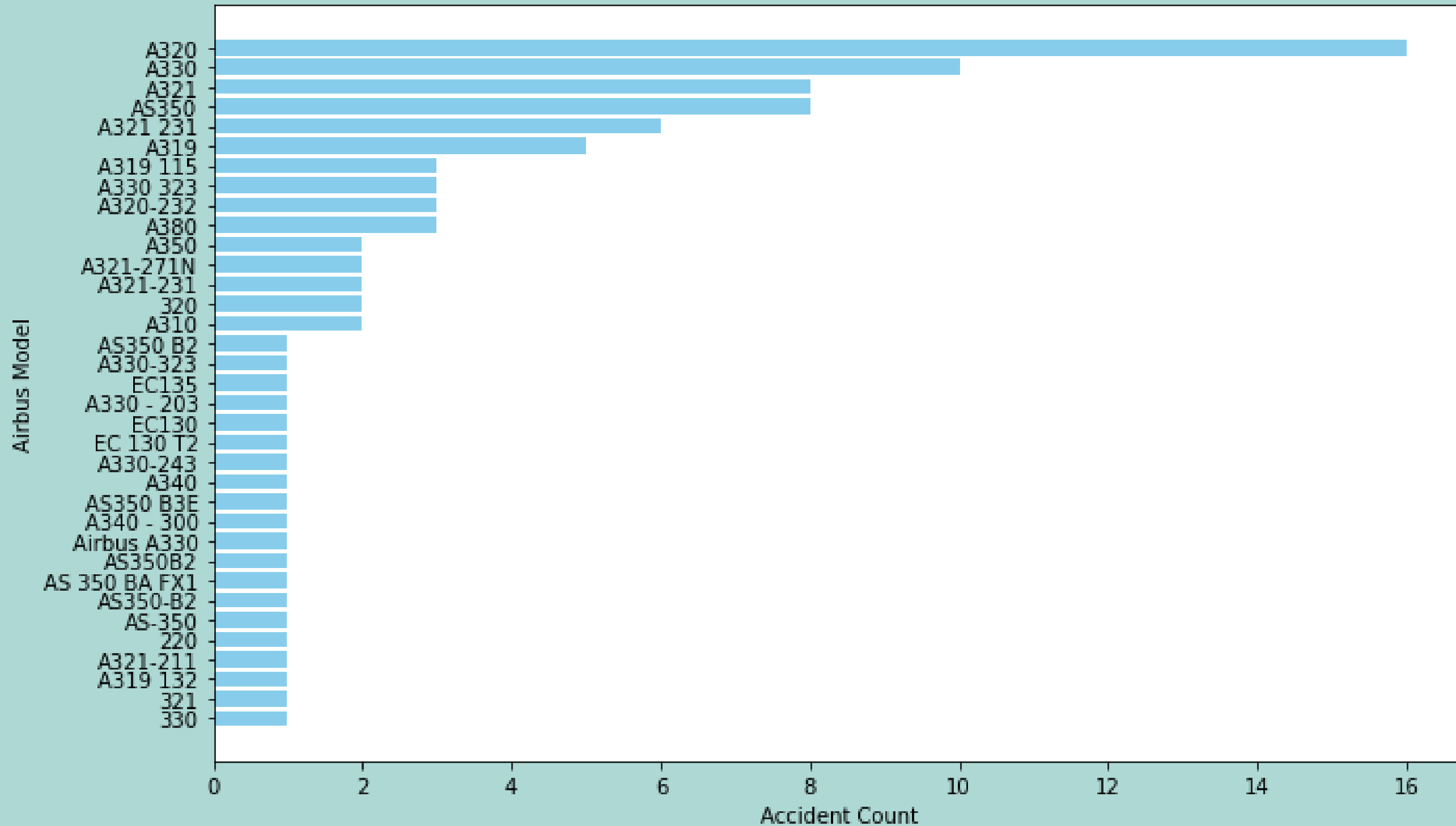


Recommended Models(Lower Accident Counts)

- 550, 680T, 500S

7. Airbus

Accident Count by Top 35 Airbus Models

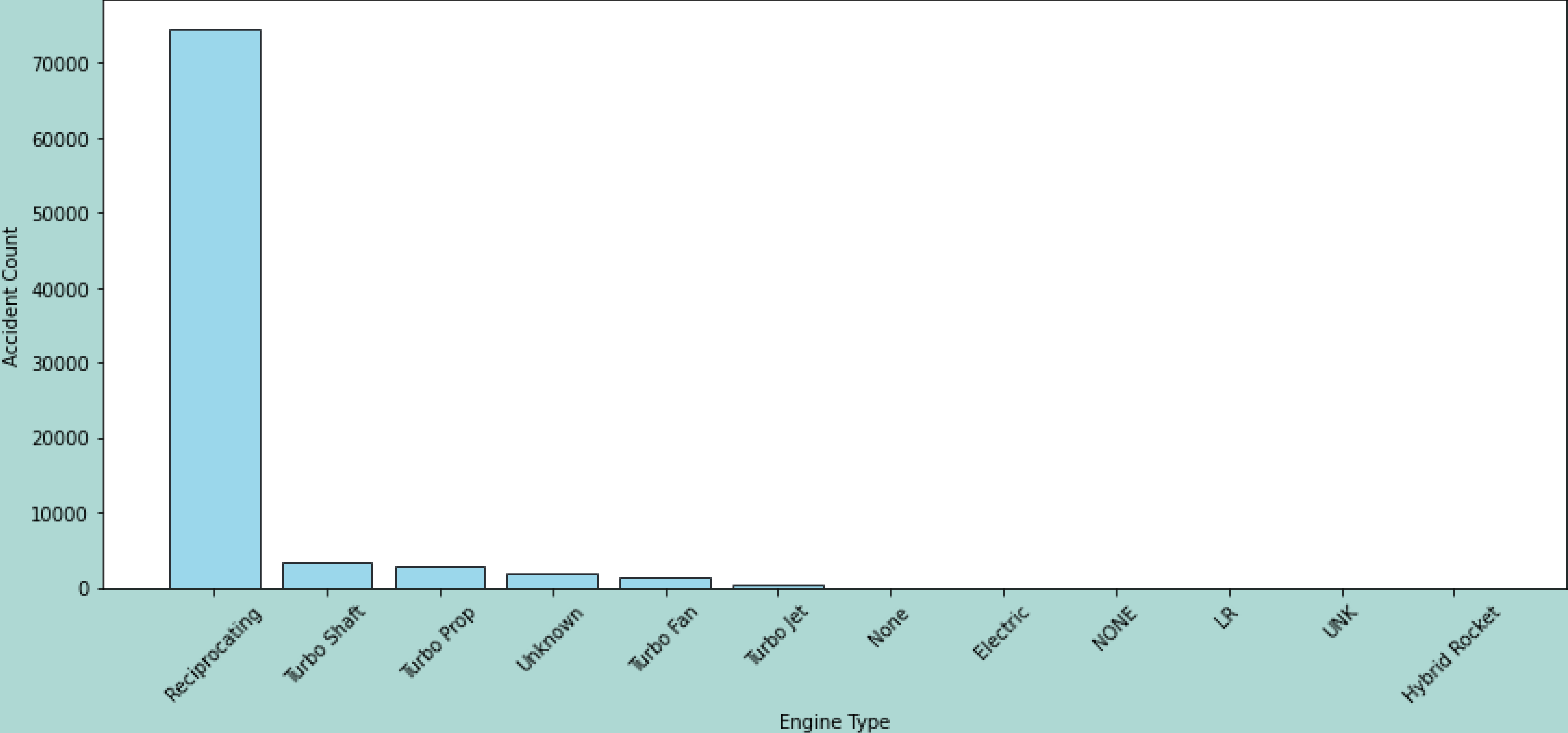


Recommended Models(Lower Accident Counts)

- 330, 321, A319-132, A321-211, AS-350

Count of accidents by engine type

Count of Accidents by Engine Type



Insights from the Bar Chart: Engine Types and Accident Counts

Key Finding: Aircraft equipped with **Reciprocating engines** have the highest count of accidents compared to other engine types.

Focus on Major Engine Types in Commercial Aviation Airplanes

Reciprocating Engines (Most have one engine)

It has the highest accident count and it is Suitable for short-range flights and light aircraft.
Most of them have one engine.

Turbo Shaft Engines (1-2 engines)

Typically found in helicopters. Exhibits a moderate level of accident occurrences.

Turbo Prop Engines (1-3 engines)

Used in smaller regional airliners and smaller commuter aircraft.

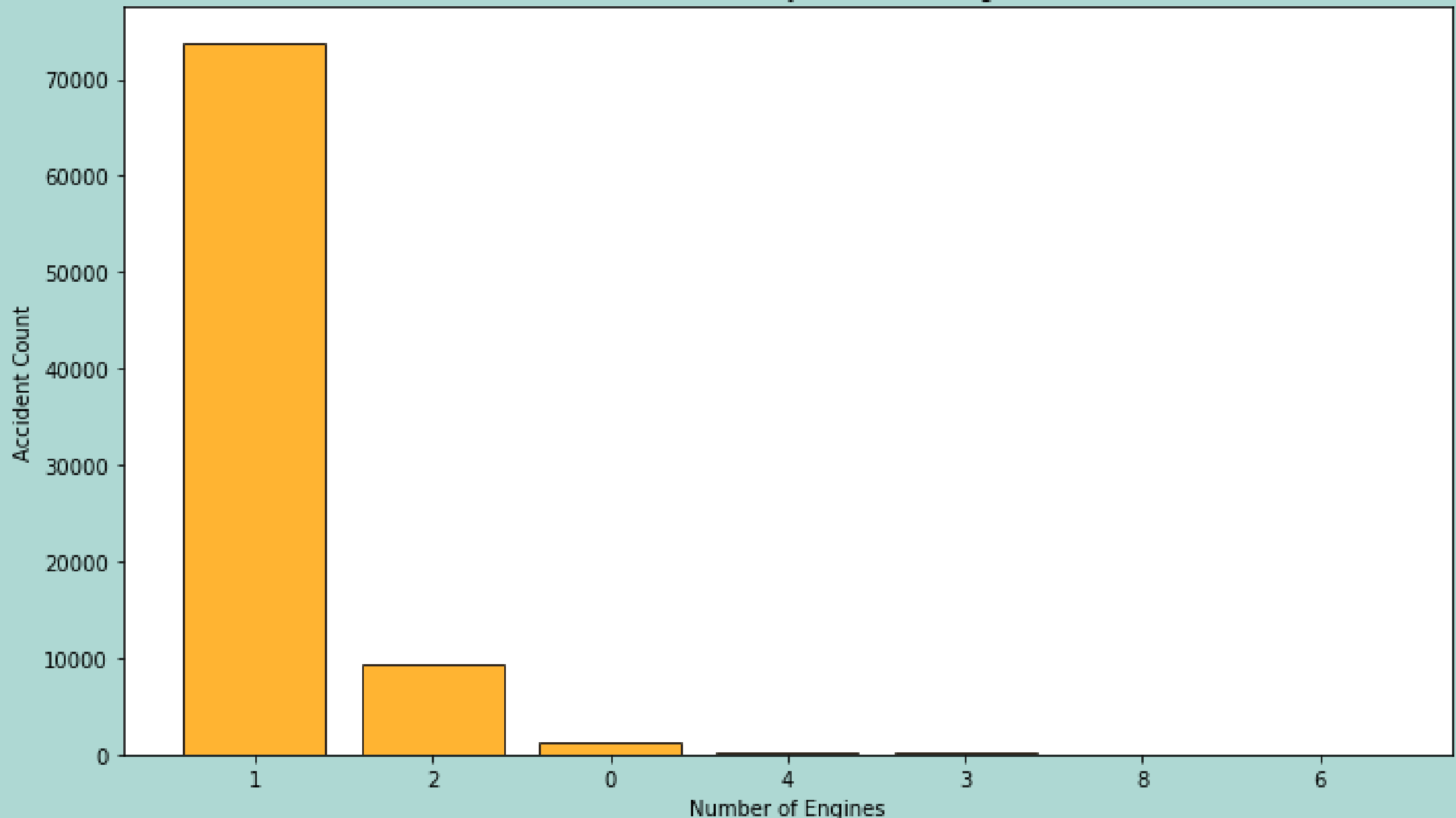
Turbo Fan Engines (2-4 engines)

Found in large commercial jets and business jets. It demonstrates a relatively low accident rate, reflecting advanced safety standards making it ideal for commercial aviation.



Count of Accidents by number of engines

Count of Accidents by Number of Engines



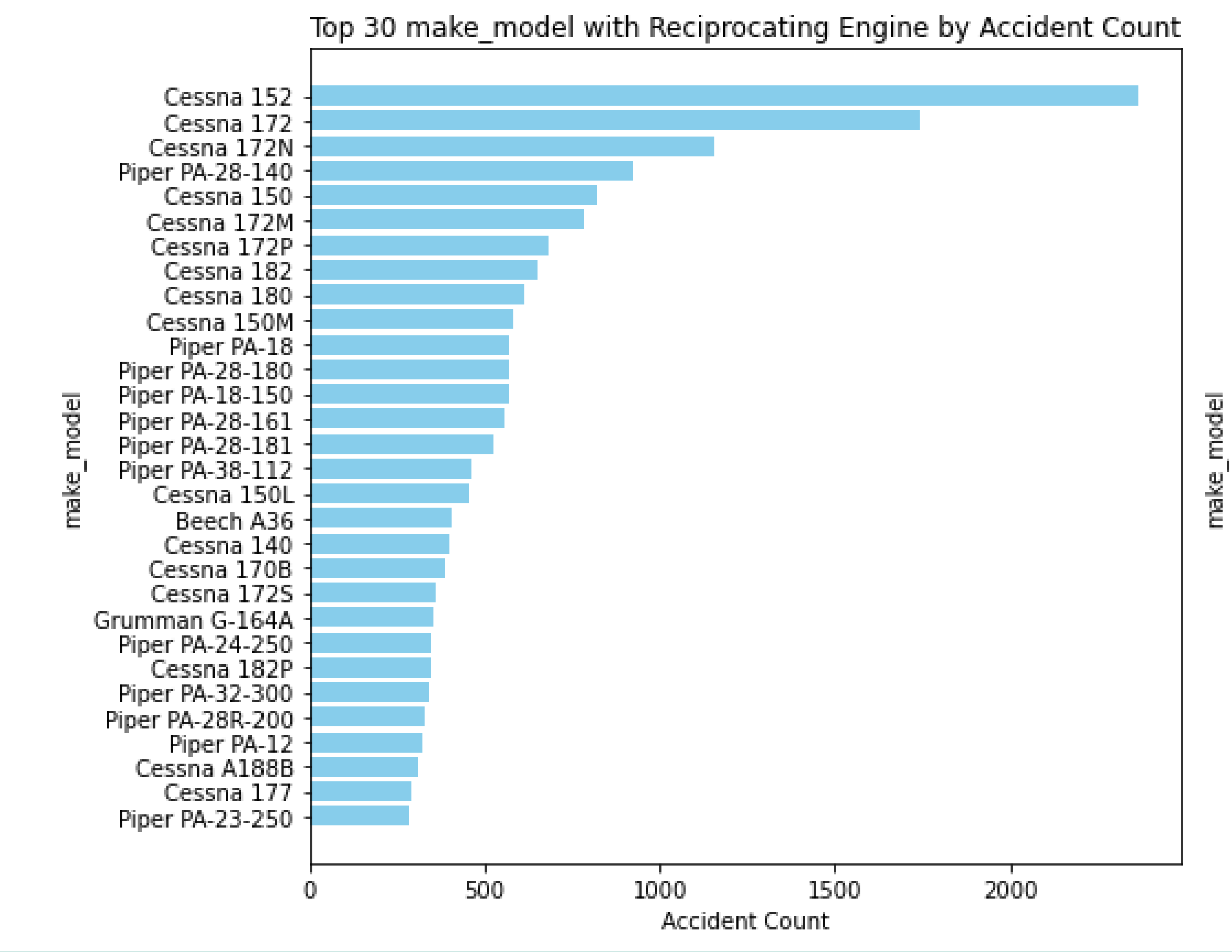
Recommendation

I recommend the company to purchase fewer models that have one engine only due to their high count of accidents.



Recommended Aircraft by Engine Type Based on Lowest Accident Counts

1.RECIPROCATING



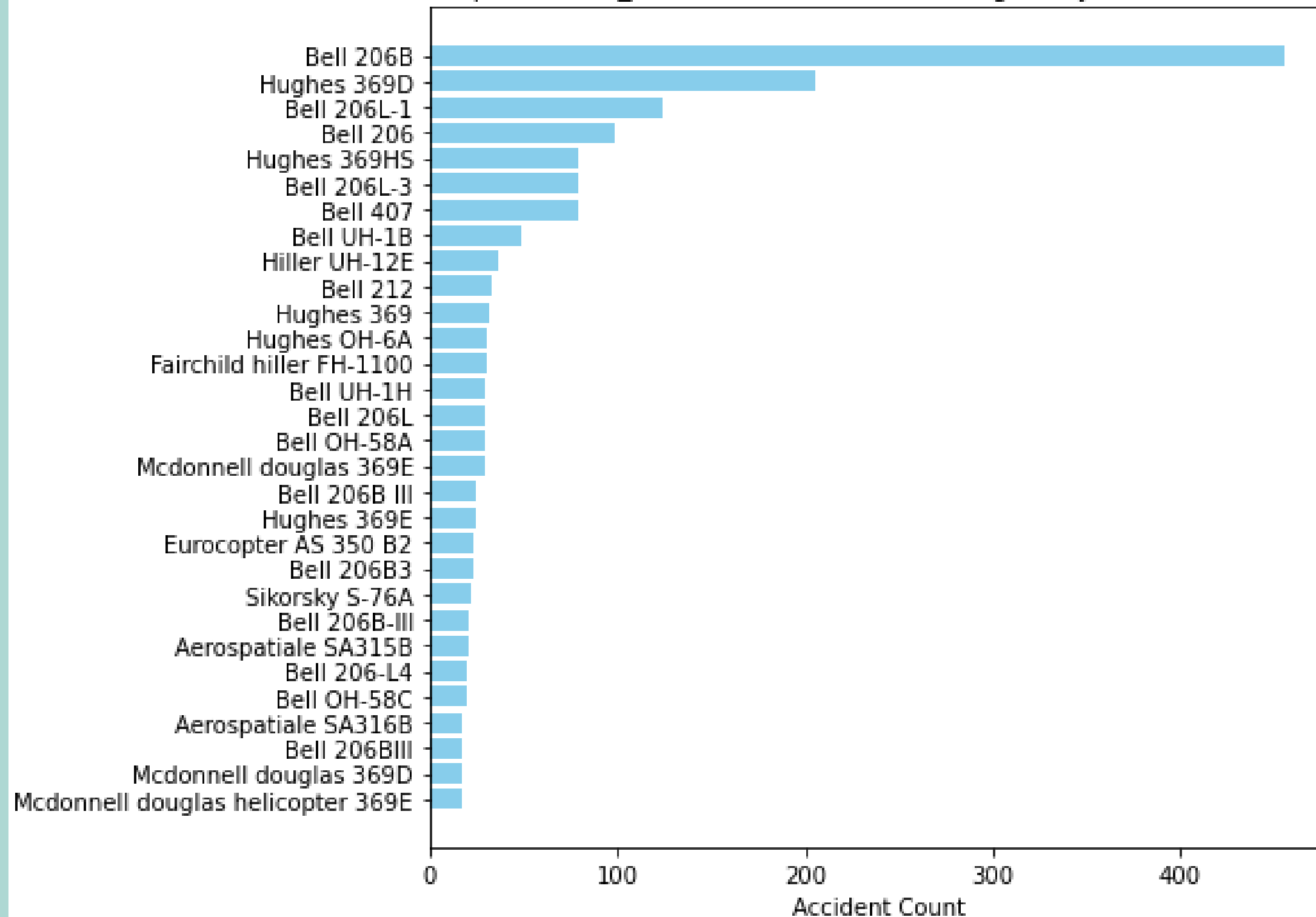
Recommended Make-Models(Lower Accident Counts)

- Piper PA-23-250
- Cessna 177
- Piper PA-32-300



2. Turbo Shaft

Top 30 make_model with Turbo Shaft Engine by Accident Count

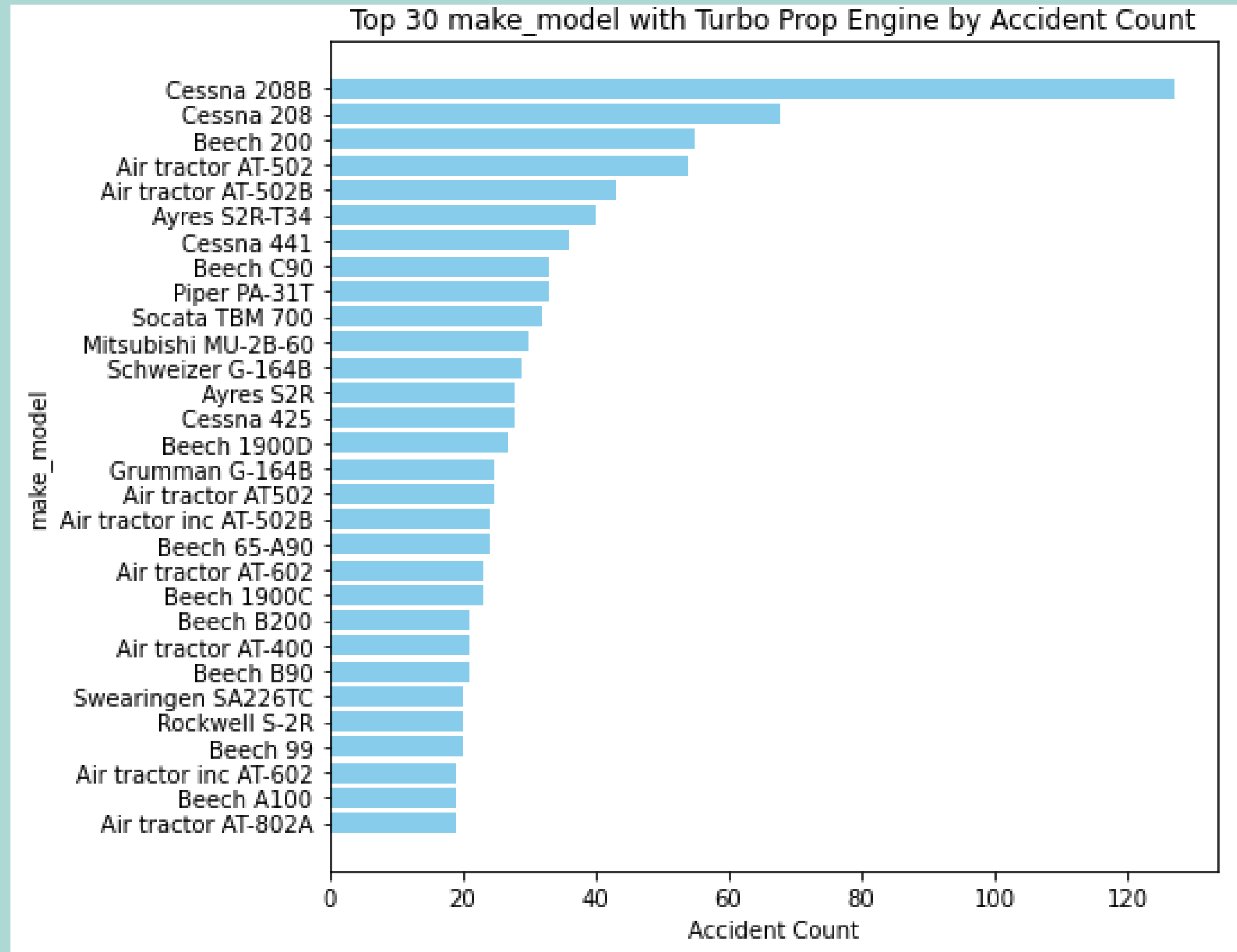


Recommended Make-Models(Lower Accident Counts)

- McDonnell Douglas Helicopter 369E
- Bell 206BIII
- Sikorsky S-76A



3. Turbo Prop



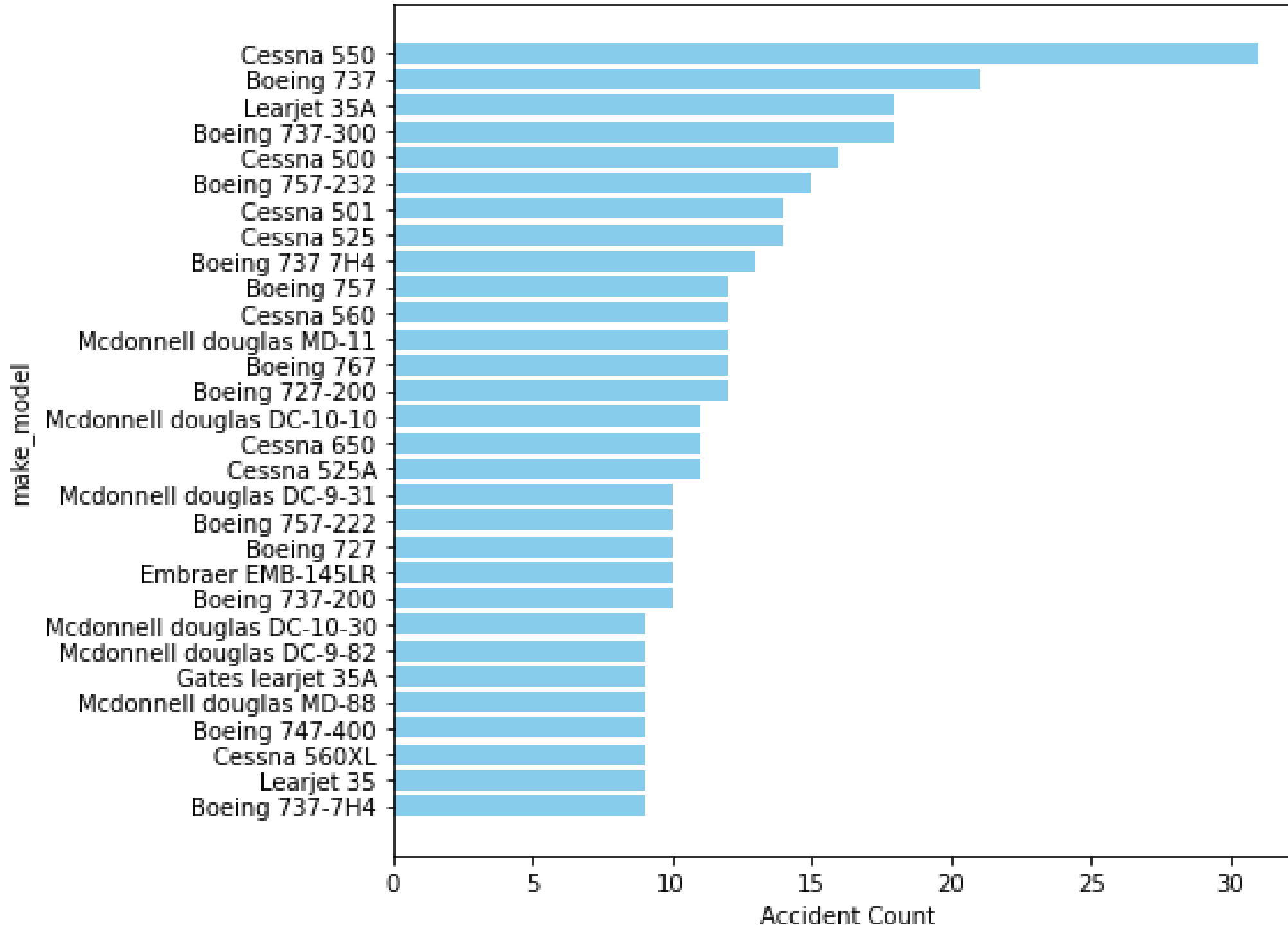
Recommended Make-Models(Lower Accident Counts)

- Beech 99
- Cessna 425



4. Turbo Fan

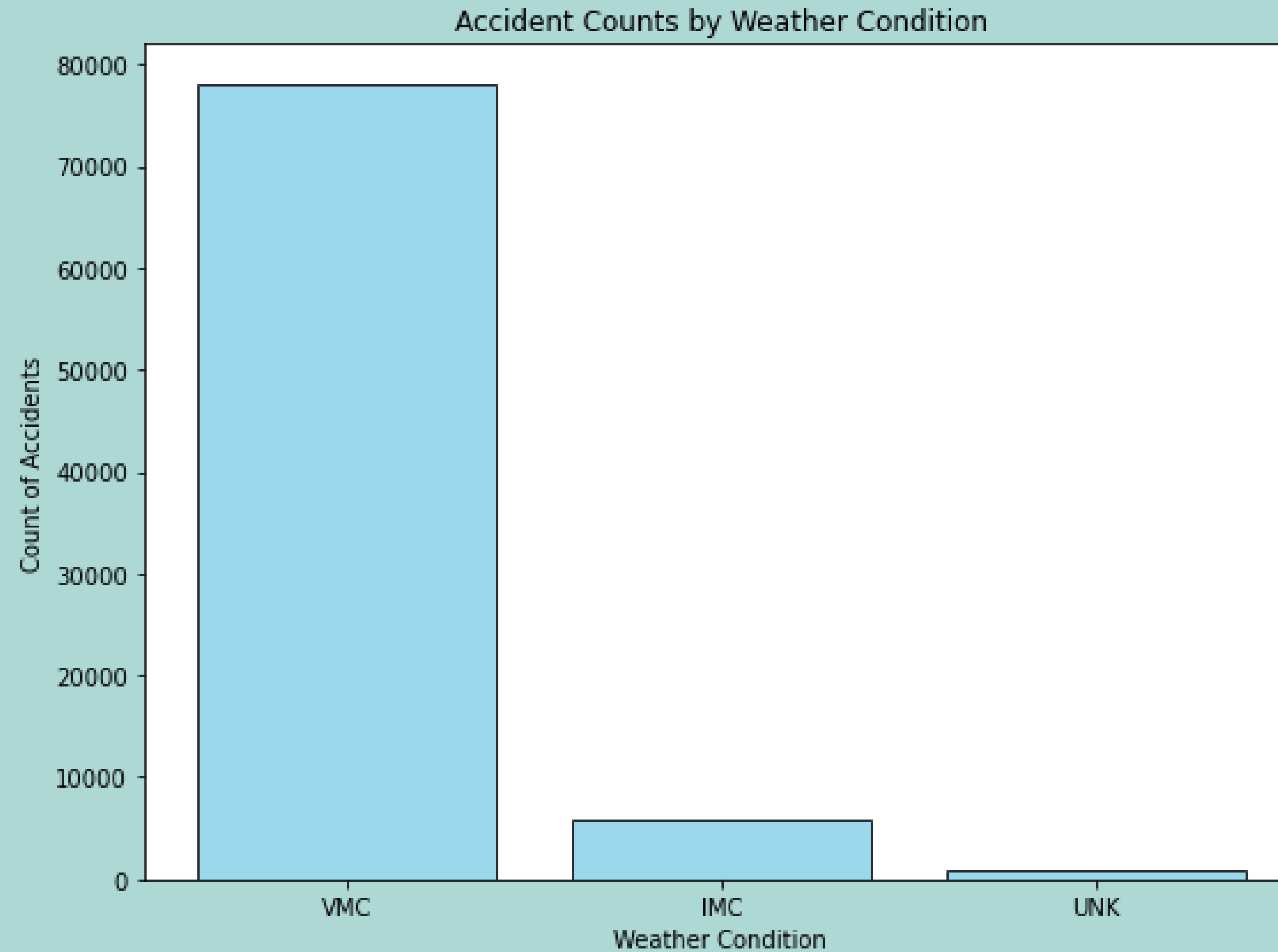
Top 30 make_model with Turbo Fan Engine by Accident Count



Recommended Make-Models(Lower Accident Counts)

- Cessna 560XL
- Boeing 737-7H4
- Boeing 747-400
- McDonnell Douglas DC-9-82
- McDonnell Douglas DC-10-30
- Boeing 757-222
- Cessna 525A
- Boeing 767

Accident counts based on weather conditions






Aircraft Weather Conditions: VMC vs. IMC

VMC (Visual Meteorological Conditions)

- Conditions where pilots can operate the aircraft by visual reference to the ground and environment.
- Number of accidents under VMC: 78,114
- Most accidents occur under VMC, likely due to its prevalence in general aviation operations.

IMC (Instrument Meteorological Conditions)

- Conditions requiring pilots to rely on instruments due to low visibility or adverse weather.
 - Number of accidents under IMC: 5,712
 - Fewer accidents compared to VMC, but often more severe due to limited visibility and operational complexity.
- 

Conclusion

Recommendations

Based on the analysis conducted:

The recommended popular aircraft models and makes are still operational in various airlines and should be considered by the company as the first purchase.

In summary, the following factors have been considered for choosing the right aircraft:

- **Focus on Low-prone accident Aircraft.**
- **Engine Type and Configuration.**
- **Operational Planning** - The company should develop operational strategies that favor Instrument Meteorological Conditions (IMC), as these conditions have significantly fewer accidents compared to Visual Meteorological Conditions (VMC).

THANK YOU!



For any questions or comments

Please feel free to reach out

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