Aviation Accident Analysis: Data-Driven Recommendations for Safer Aircraft Purchases

National Transportation Safety Board Data (1962–2023)

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26/ 09/ 2024

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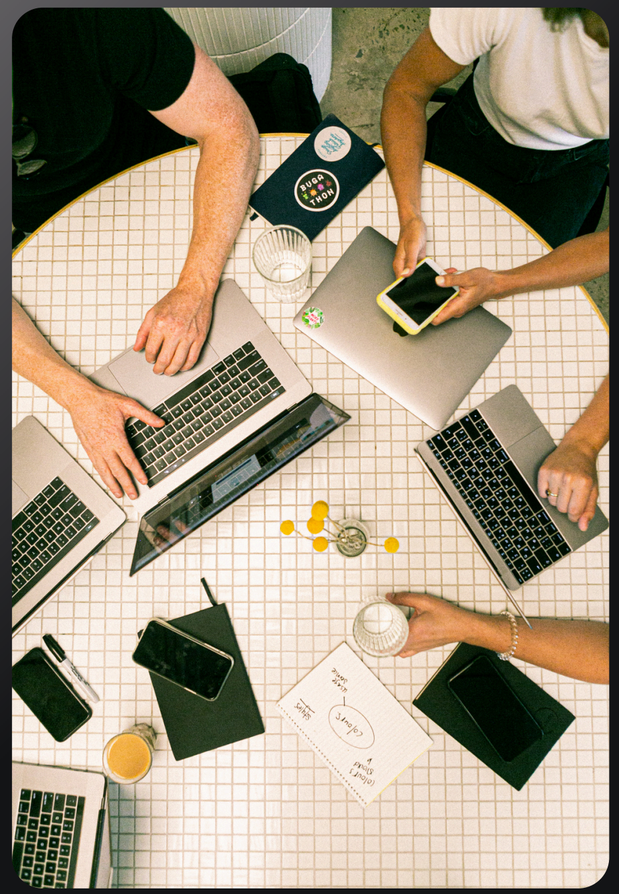
“Champions keep playing until they get it right”

“Technique and ability alone do not get you to the top; it is the willpower that is most important”

Overview

-> Goal: Analyze aviation accident data to identify which aircraft types and manufacturers have the lowest accident risk.
-> Data: NTSB accident data from 1962–2023.
-> Outcome: Three business recommendations supported by data and visualizations.



Business Problem

- Our company needs to reduce the risk of accidents by making informed decisions about which aircraft to purchase.
- Understanding accident trends will help avoid high-risk aircraft and improve fleet safety.

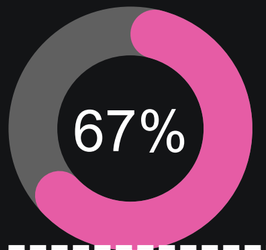
Business Problem

What we Aim to answer...

1. Which aircraft models have the lowest accident rates?
2. What external factors (e.g., weather) contribute to accidents?
3. How can we mitigate risk in future purchases?

Reviewing the Data

Data Source: National Transportation Safety Board (NTSB)
Timeframe: 1962–2023a



Key Variables

- Accident date
- Aircraft type
- Manufacturer
- Weather conditions
- Fatalities
- Injuries
- Damage costs

01 Reviewing The Data

Key Variables

- Accident Date: Helps track trends over time, revealing periods with higher accident risks, like specific seasons.
- Aircraft Type: Identifies which types of aircraft (e.g., small planes vs. commercial jets) are more accident-prone.
- Manufacturer: Provides insights into which manufacturers have better or worse safety records.
- Weather Conditions: Shows the role adverse weather plays in accidents, helping evaluate aircraft performance in difficult conditions.

02 Reviewing The Data

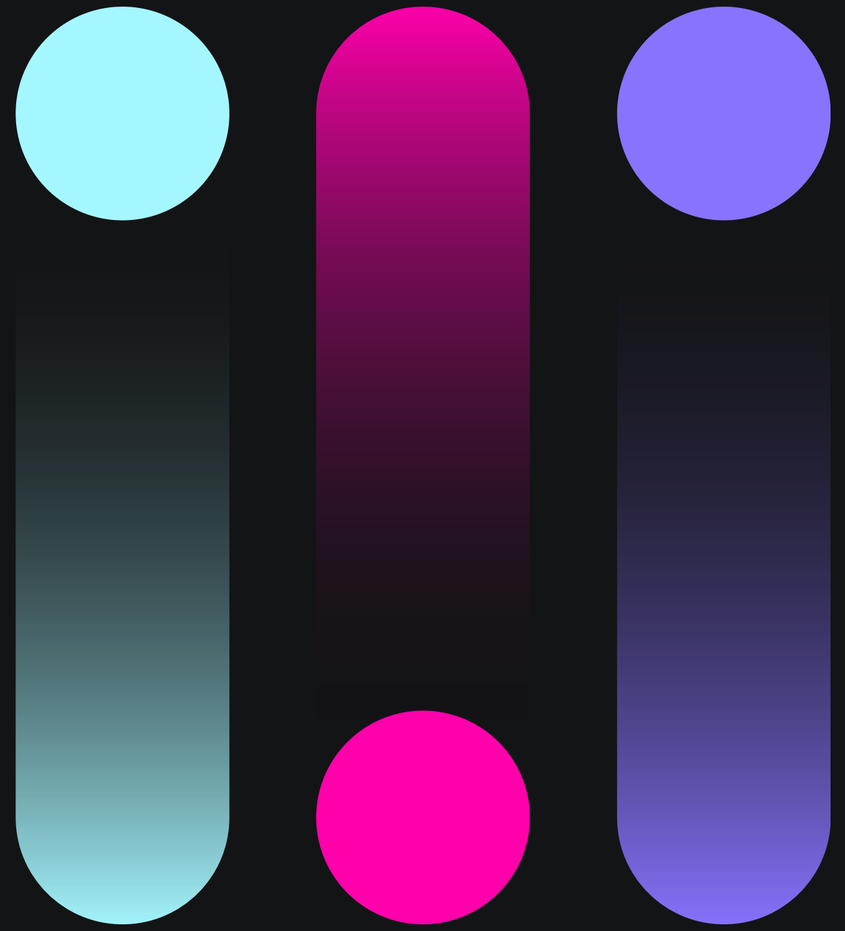
Key Variables

- Fatalities: Measures accident severity based on the human cost.
- Injuries: Similar to fatalities, assessing how often accidents cause injuries highlights risks.
- Damage Costs: Financial impact of accidents, helping evaluate aircraft based on the cost of damage from incidents.

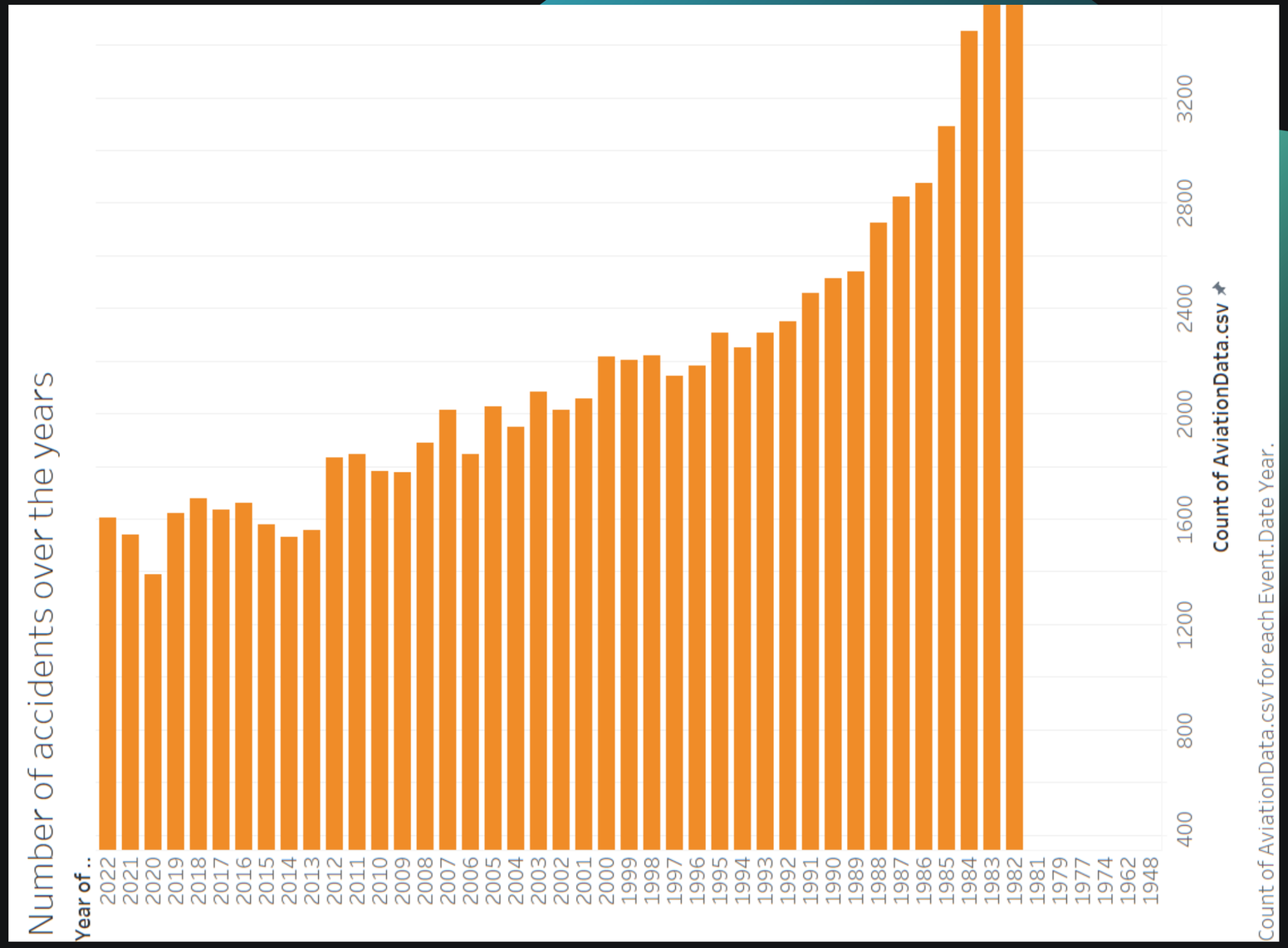
Understanding the Data Challenges

The analysis of aviation accident data faces two key challenges related to missing data:

1. Missing Weather Data.
2. Missing Data on Older Aircraft Models.



Accident Trends Over Time



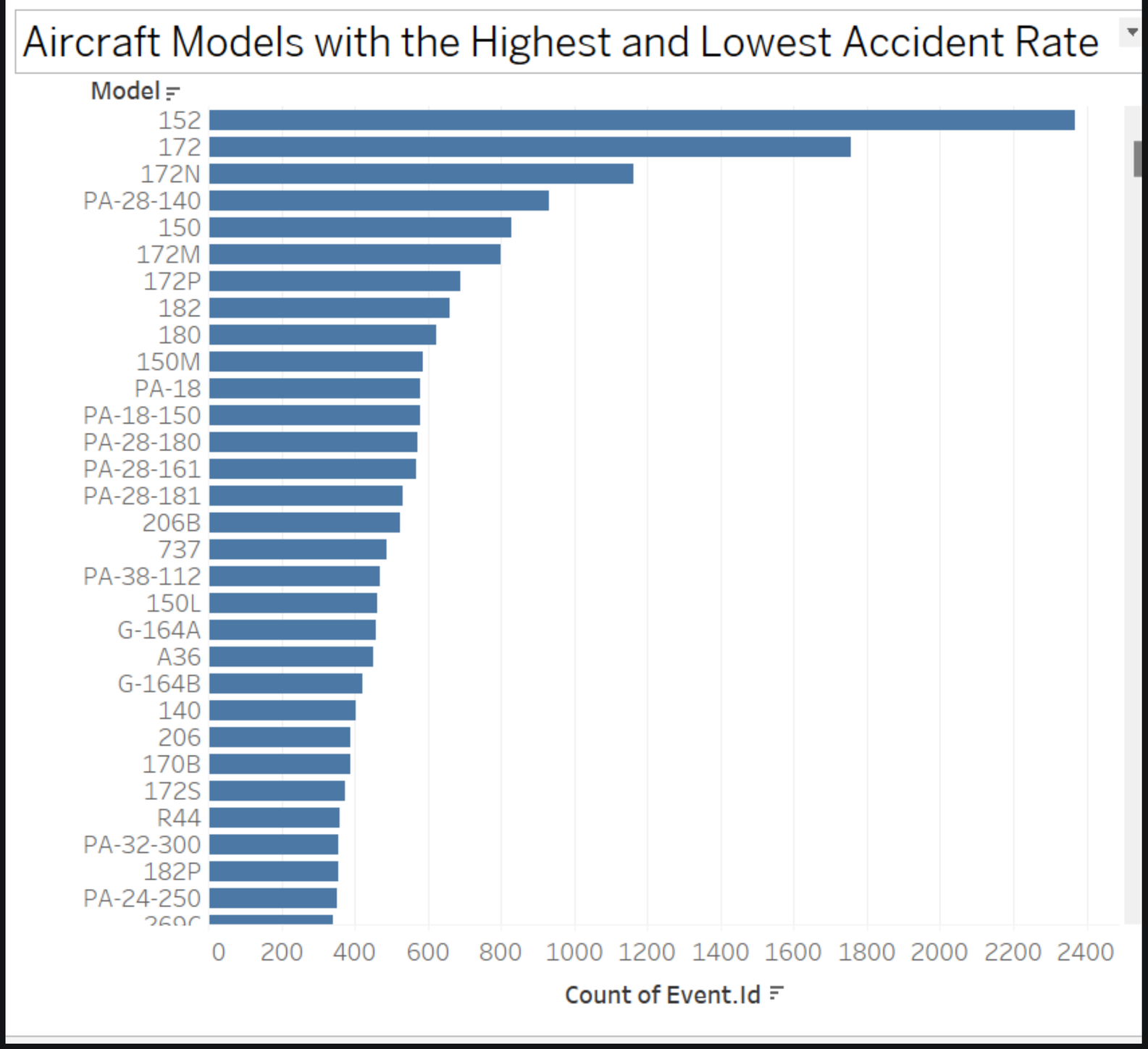
- Accidents have steadily declined over time, suggesting that safety has improved. However, there are spikes that need further investigation.

Top 10 Aircraft Manufacturers by Accident Count

- Certain manufacturers show a significantly higher accident count.
- Key Insight: Cessna and Piper consistently have the highest number of accidents.

- Implication: Purchasing decisions should carefully consider aircraft from these manufacturers due to higher accident rates.

Visualization: Bar chart showing top models with the most accidents.



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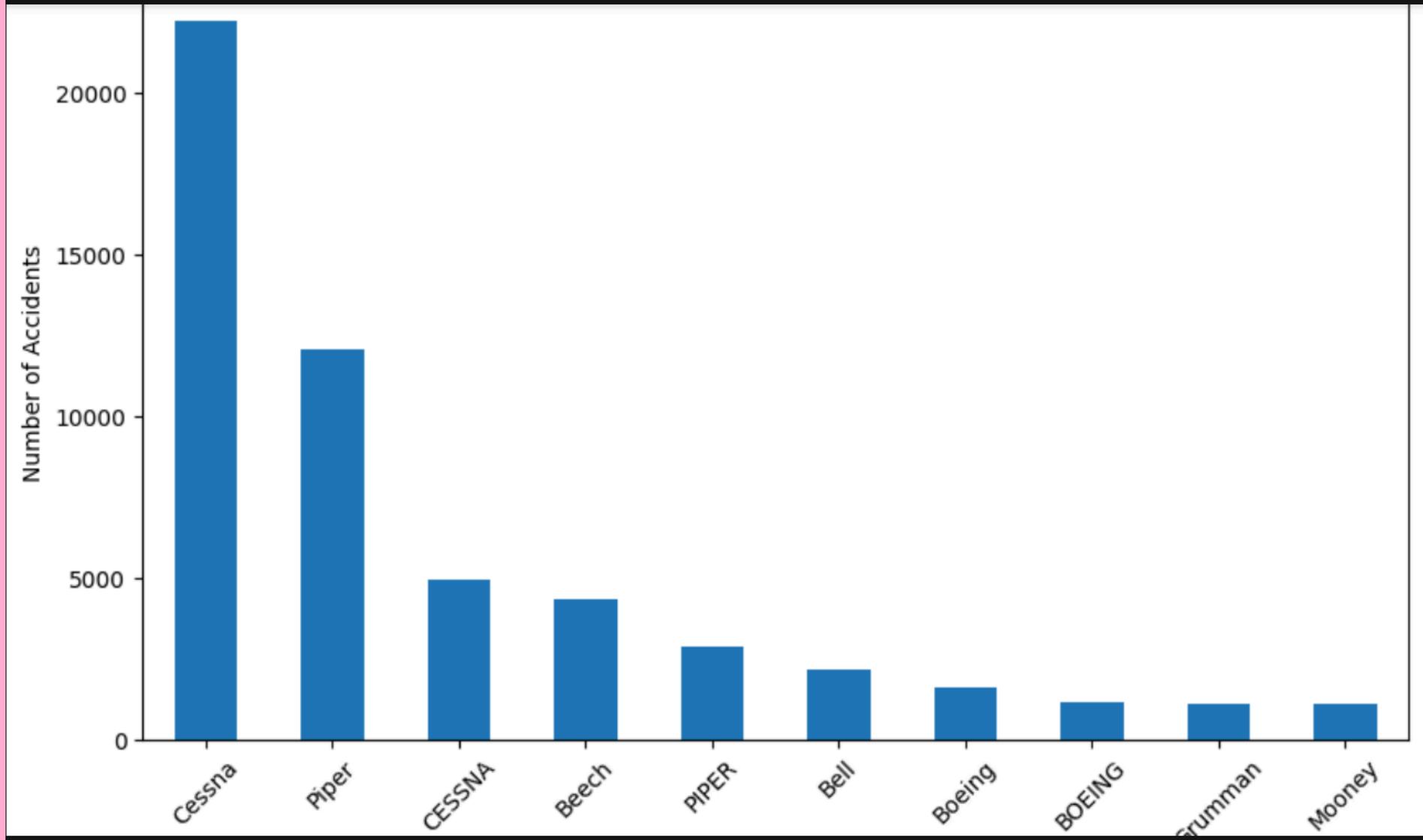


Accident Severity by Aircraft Type

Key Insight: Accident severity differs significantly across aircraft types, an important factor when making purchasing decisions.

-> Injury.Severity

- Non-Fatal 67357
- Fatal(1) 6167
- Fatal 5262
- Fatal(2) 3711
- Incident 2219
- Fatal(80) 1
- Fatal(217) 1
- Fatal(169) 1
- Fatal(88) 1
- Fatal(189) 1

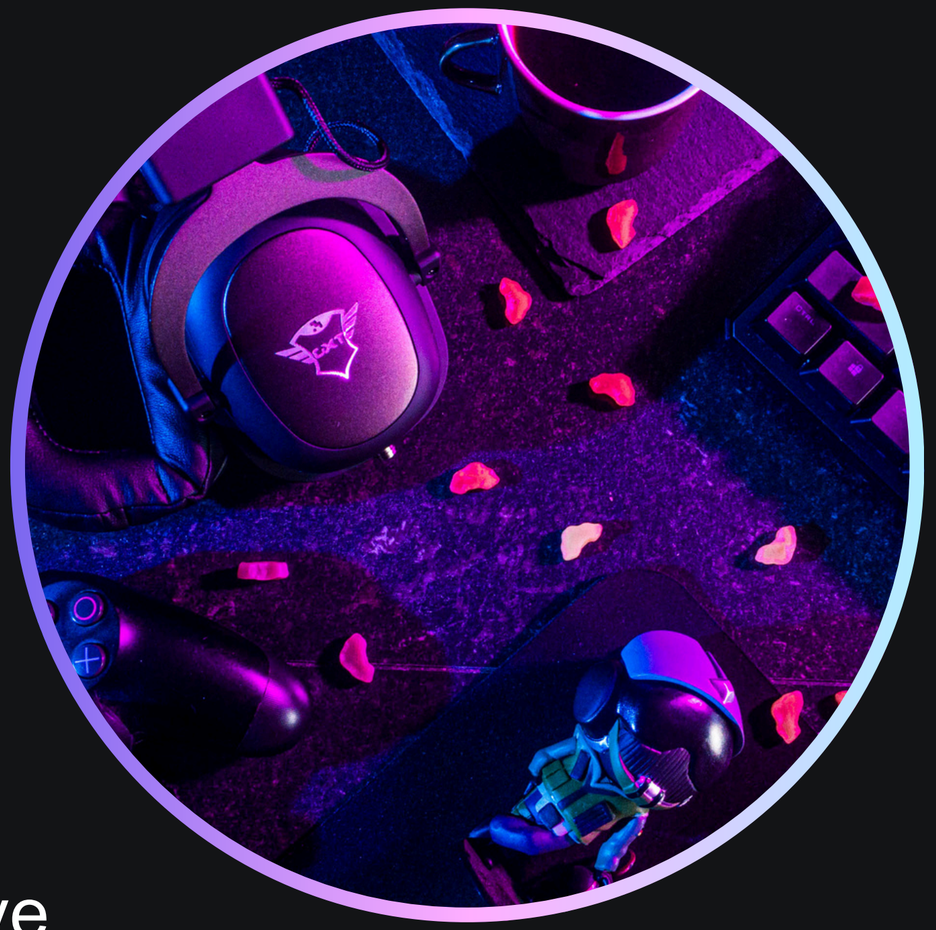
Reccommendations

1. Avoid purchasing aircraft from manufacturers with consistently high accident rates.
2. Prioritize purchasing newer aircraft models (less than 20 years old).
3. Evaluate operational environments carefully and avoid purchasing aircraft for use in high-risk weather conditions.

Next Steps

- Phase 2: Conduct a deeper analysis focusing on specific aircraft models from high-risk manufacturers.
- Expand Data Sources: Incorporate operational cost data and maintenance records to provide a more comprehensive risk assessments.
- Dashboard Development: Create an interactive dashboard to assist with ongoing risk monitoring and strategic decision-making.

Suggested Aircraft Models for Safety



- Airbus A350: Noted for advanced safety features and low incident rates.
- Boeing 787 Dreamliner: Incorporates cutting-edge technology with a strong safety history.
- Embraer E-Jet Series: Recognized for effective safety measures and efficient performance.

Tools Used

-> Python & Jupyter Notebook

- Purpose: Data cleaning, manipulation, and analysis.
- Libraries Used:
- pandas: For data cleaning and manipulation (handling missing values, filtering data, grouping).
- numpy: For numerical computations and array operations.
- matplotlib & seaborn: For creating detailed and customized visualizations to uncover insights.

-> Tableau

- Purpose: For creating an interactive dashboard that allows stakeholders to explore the data visually.
- Usage: Visualization of accident trends, severity analysis, and aircraft manufacturer comparisons.

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Any
questions