

LOW RISK AIRCRAFT SELECTION USING HISTORICAL AVIATION ACCIDENT DATA

**A Data Driven Risk Assessment for Purchase of Aircrafts for
Commercial & Private Operations**

Aviation Safety and Risk Analysis

2025

This analysis is based on aviation accident records spanning 41 years (1982–2022), providing a long-term and reliable view of aircraft safety performance across different models.

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Project Objectives

- Identify aircrafts models with :
 - Low accident frequency
 - Low injury severity
 - Consistent operational safety in different types of flights
- Support low risk purchase of aircrafts
- Provide interactive dashboards for case study analysis

I focus on patterns over time rather than isolated incidents, to identify the best aircraft models to be bought.

New Aviation Division: Leveraging Aviation Accident Analysis for a Safe and Successful Purchase and Operations of Commercial and Private Air Fleet.

- ✓ Purchasing Aircrafts involves high starting capital and safety risk
- ✓ Poor uninformed aircraft choices may lead to:
 - Financial loss
 - Non-compliance with prevailing national laws for aircraft registration and operation
 - Reputational loss
 - Difficulty in financing and insurance
 - Unexpected operating costs.
- ✓ The New Aviation Division require evidence based guidance not assumptions., to be able to minimize risk when purchasing new aircrafts.

AviationData_csv

Contents of the AviationData used:

- Civil aviation accident records
- Between 1962-2023 and 1948
- Coverage:
 - U.S.A AND International waters
 - Commercial and private aircraft
- Each record represents one reported aviation accident

This dataset allows me to evaluate long term safety trends across aircraft models.

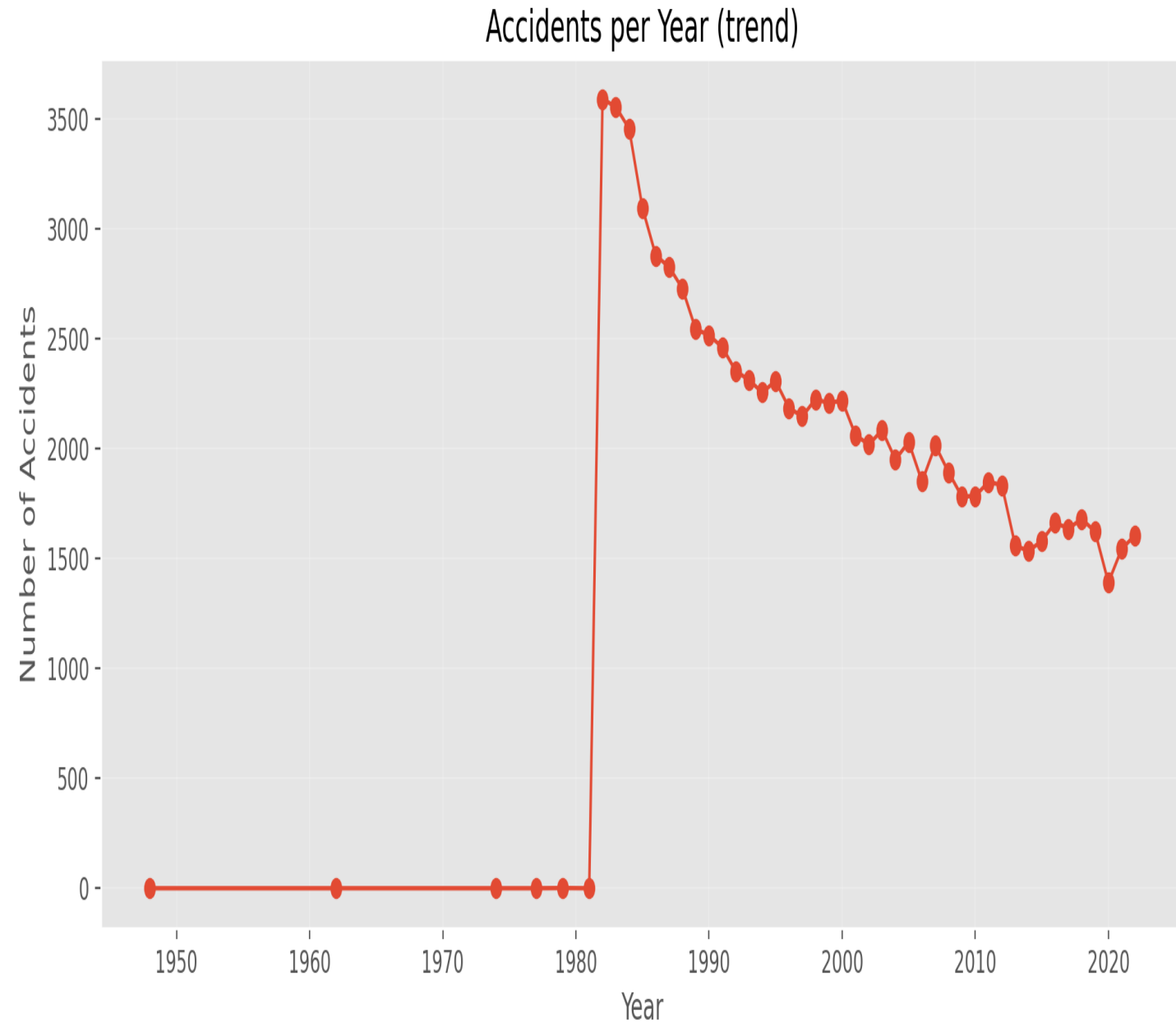
Data Manipulation(preparation)

How the data was prepared:

- **Remove incomplete or irrelevant fields**
- **Standardized column names**
- **Converted date for trend analysis**
- **Created safety indicators:**
 - **Accident frequency per year**
 - **Fatality rate**
 - **Severity rate**

The safety indicators ensures results are reliable and comparable across aircraft models.

Accidents Trends Over Time



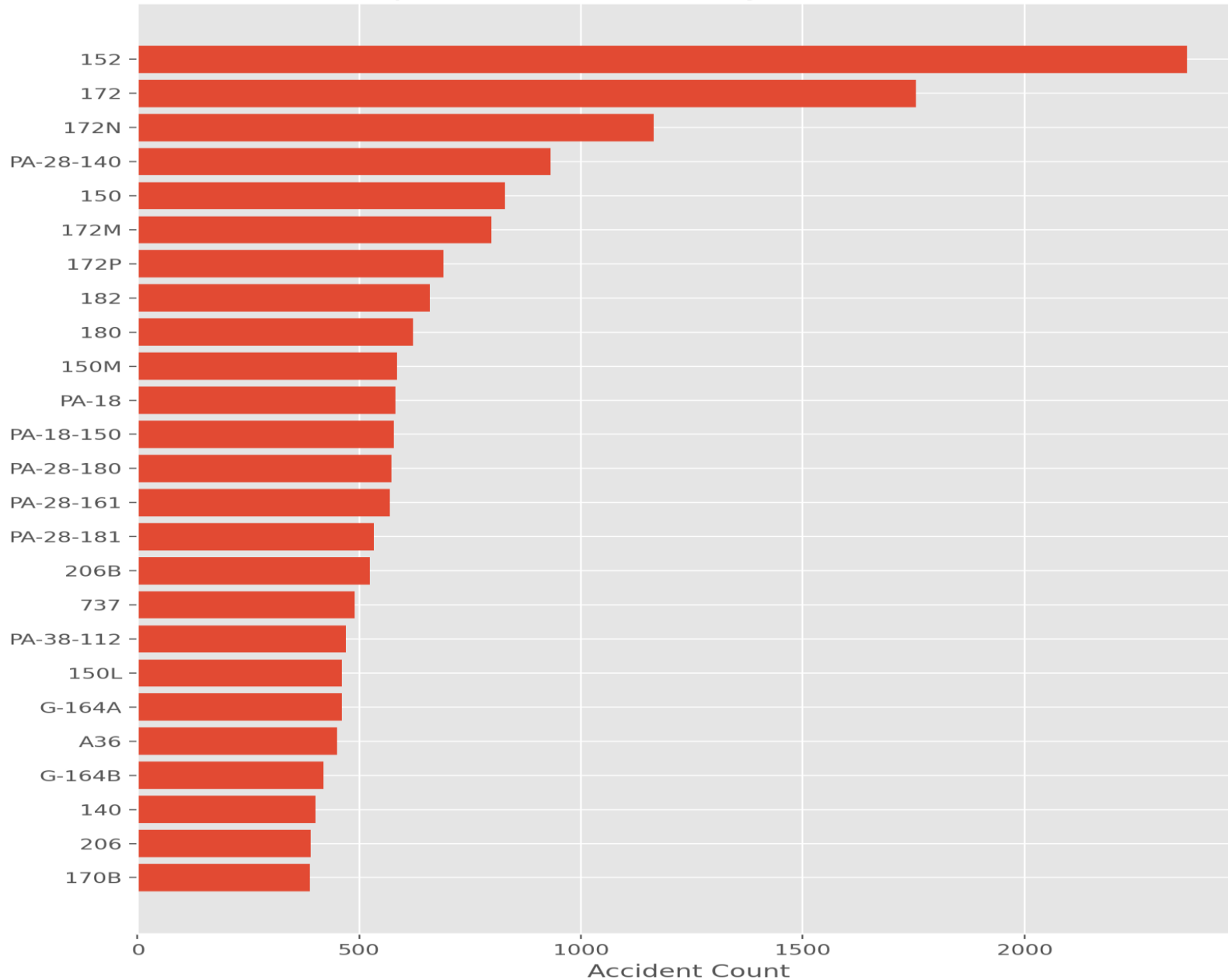
Key Observations: Accident Trends

- Accident reporting increased significantly after 1980
- Overall trends shows:
 - Improved safety standards
 - Better reporting practices
- Modern aviation operates under stricter safety controls

Here I have interpreted the historical risk

Accident Frequency by Aircraft Model

Top 25 Aircraft Models by Accident Count



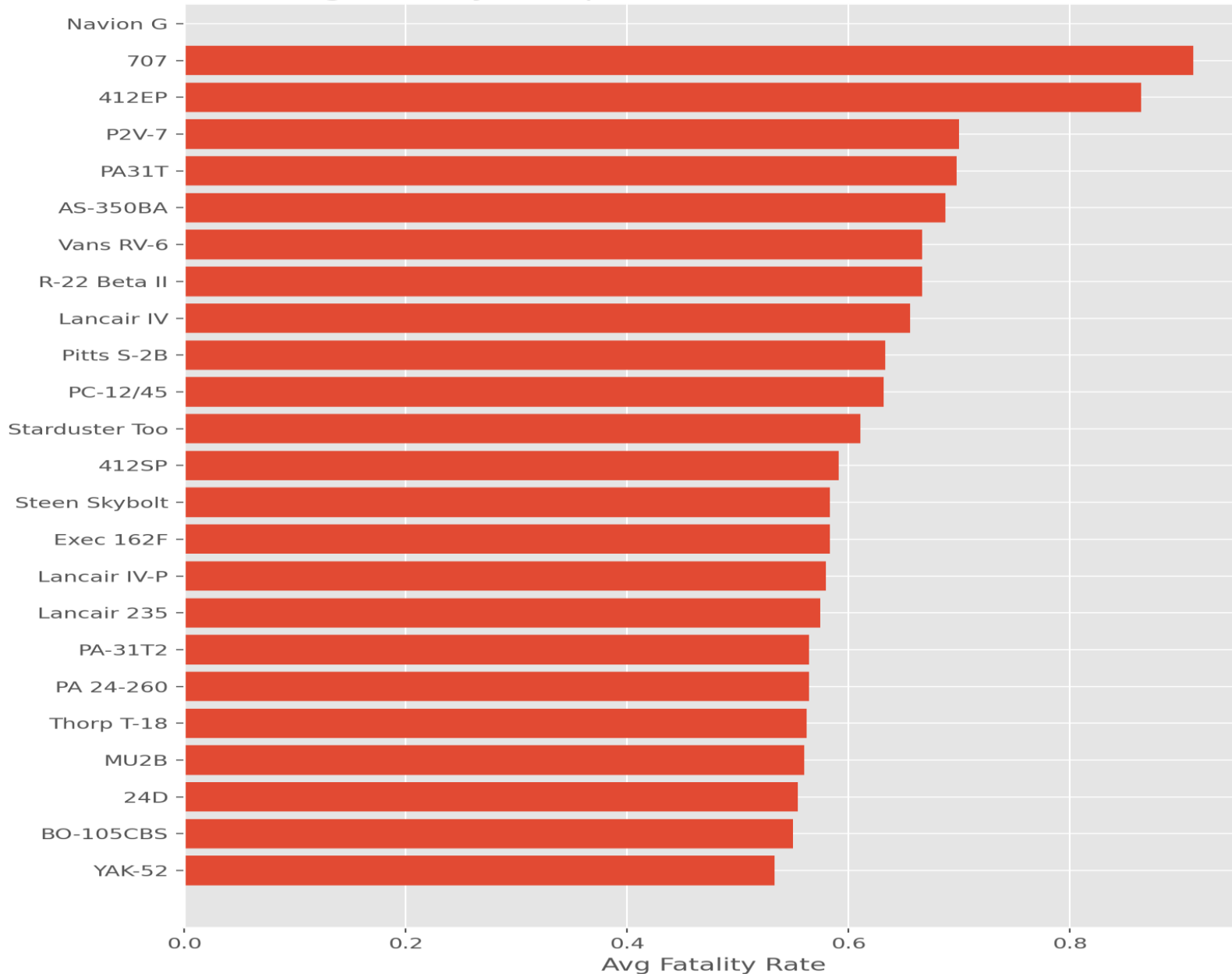
What I Observed:

- Some aircraft models appear more frequently in
- Higher frequency often reflects:
 - Greater usage
 - Longer operational history
- High frequency alone does not imply high risk

The fact that some aircrafts are used more often than other models makes it important to analyse severity of accidents to make informed decision on the risk.

Injury Severity Matters More than Frequency of Accidents

Average Fatality Rate per Model (models with ≥ 5 accidents)



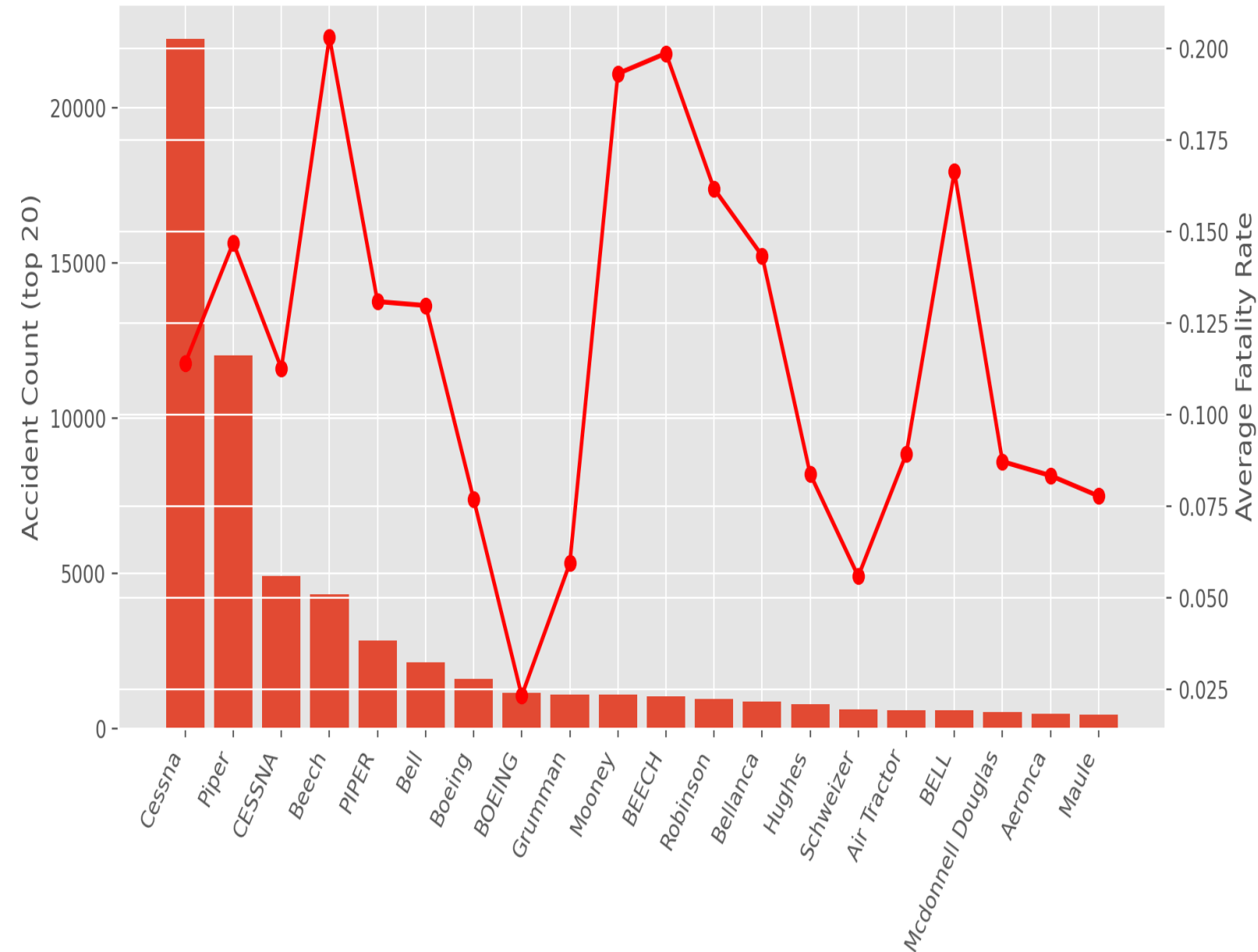
Why Severity was prioritized

- Not all accident result in serious harm
- I evaluated:
 - Fatal injuries
 - Serious injuries
 - Minor injuries
- Developed a severity score to compare impact

Low risk aircrafts are those with lower injury outcomes when the accidents occurred

Low Risk Aircrafts Models

Top 20 Manufacturers: Accident Count and Avg Fatality Rate



Low Risk Aircraft Models Identified

- Selected models show:
 - Multiple recorded accidents
 - Zero to Near zero fatalities
 - Consistently low severity scores
- These models demonstrate strong safety performance

The displayed models show safer investment options based on historical evidence.

Interactive Dashboard for the New Aviation Division

To support deeper exploration of the findings, an interactive dashboard has been developed in Tableau.

This dashboard will allow the New Aviation Division to:

- Explore accidents trend over time
- Compare aircraft models by risk and severity
- Filter results by aircraft type and operational factors

Access the live dashboard here:

<https://public.tableau.com/app/profile/brian.chairo/viz/New-Aviation-LowRisk-AircraftPurchase-Project-InteractiveDashboard/LowRiskAircraftDashboard>

What this means to the New Aviation Division

- Data supports:
 - Reduced operational risk
 - Better capital allocation
 - Informed aircraft acquisition
- Transforms purchasing decisions from intuition to insight

This approach aligns safely with financial sustainability.

Limitations & Considerations

Important Considerations

- **Accident data does not include:**
 - Total flight hours per model
 - Maintenance records
- **Result should compliment**
 - Manufacturers guidance
 - Regulatory assessments
 - Operational requirements

This analysis informs decisions it however does not replace due diligence

Recommendations

Strategic:

- Prioritize aircraft with:
 - Low injury severity
 - Stable historical performance
- Avoid decision based on anecdotal safety perception
- Integrate severity based metrics into procurement policy for the New Aviation Division
- Use dashboard during:
 - Purchase planning
 - Continuous risk reassessment reviews
- Update analysis as new data becomes available

This framework is subject to evolve alongside the New Aviation Division

Conclusion

Final Takeaway

- Historical safety data provides powerful insights
- Low risk aircraft can be identified objectively
- Data driven purchases reduces uncertainty and risk

This risk analysis demonstrates how analytics can directly support strategic investment decisions.

Indicative Low Risk Aircraft Models

- The following models demonstrate:
 - Repeated historical operation
 - Very low fatality rates
 - Low injury severity scores
 - Sufficient accidents report to support confidence in results.

Shortlisted Aircrafts:

- ✓ **A300/ A300-600**
- ✓ **A320-214**
- ✓ **737-300 / 737-800**
- ✓ **DC-10-40**
- ✓ **ATR-72**
- ✓ **DHC-2 MK. I (120A)**