Aircraft Risk Analysis for Fleet Expansion

A Data-Driven Approach to Reducing Aviation Risk

By: Jessica Gichimu

Project Overview

This project supports the company’s entry into aviation by analyzing aircraft accident trends to guide low risk procurement

The analysis uses accident data from the National Transportation Safety Board (NTSB), covering the period 1962 to 2023

The goal is to identify patterns in injury severity based on aircraft type, flight phase, damage and weather conditions

Python was used for cleaning and exploring the data and Tableau was used for dashboard visualization

Business Problem and Business Stakeholders

- **Business Problem:**

Fatal aviation accidents continue to occur, despite technological progress and stricter regulations. The company requires data-backed insights to minimize future risks

- **Primary Stakeholder:**

The Head of the Aviation Division who is responsible for making strategic decisions on aircraft procurement and safety risk reduction

- **Other Key Stakeholders:**

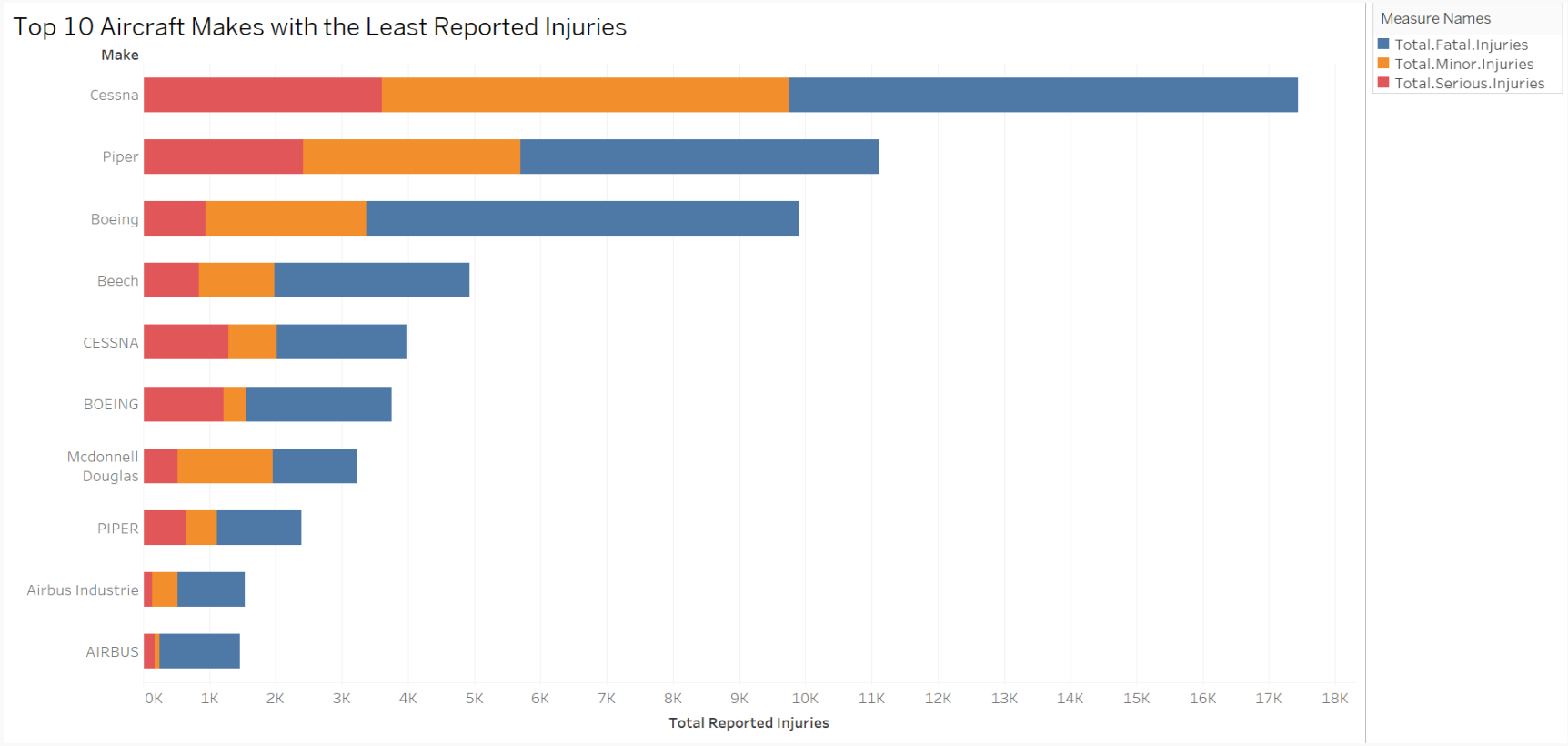
Civil aviation authorities, aircraft manufacturers, airline safety teams and aviation procurement advisors. They rely on accurate data for policy and safety improvements

Key Business Questions

1. Which aircraft types have the lowest accident rates and severities?
2. What weather conditions are associated with fatal incidents?
3. How have aviation safety trends changed over time?

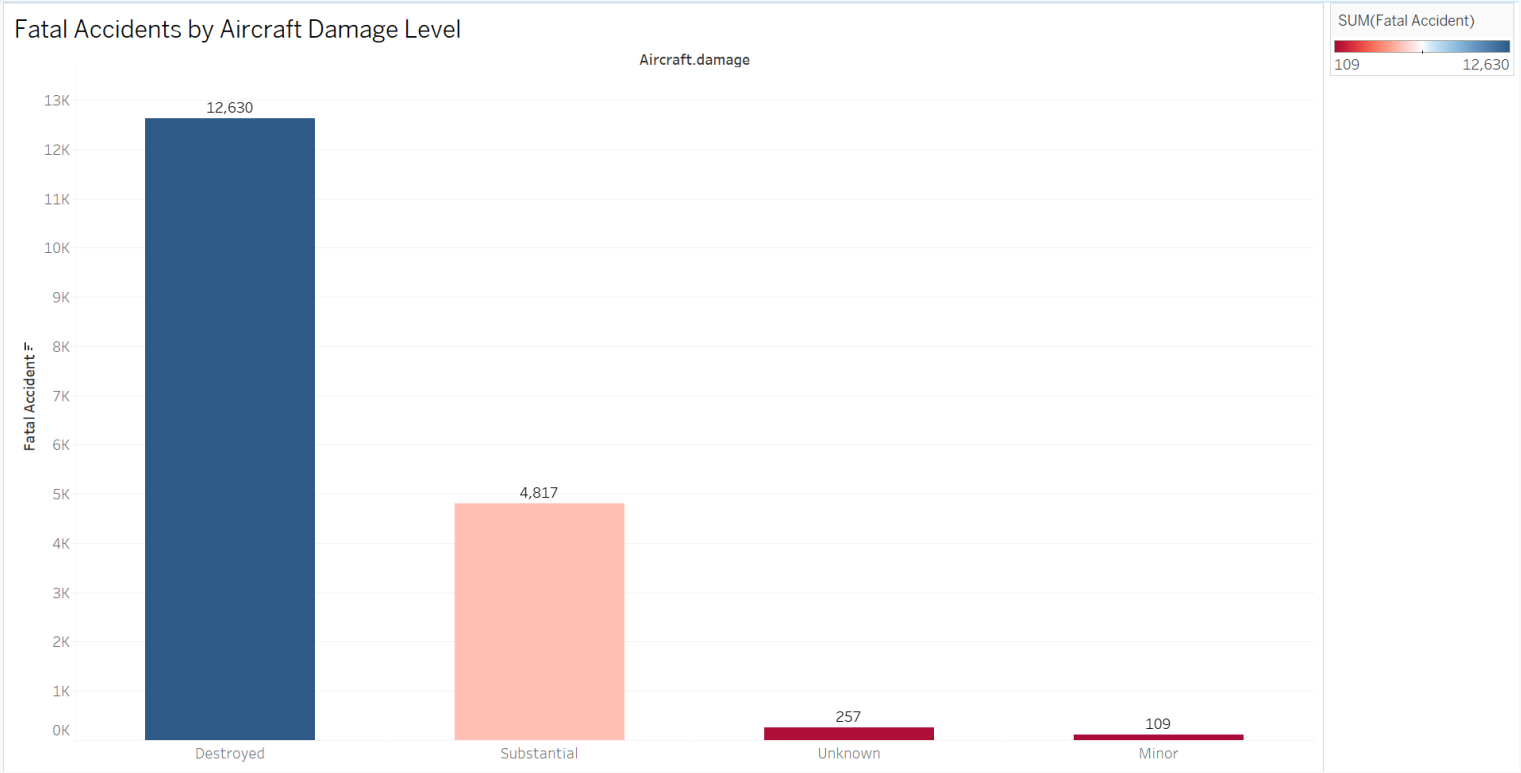
Tableau Dashboard Overview

- The dashboard was developed in Tableau Public using five worksheets and one interactive dashboard
- Each chart answers a specific business question on aircraft safety, fatality rates or risk patterns.
- Visuals include bar charts using a contrasting color scheme
- Dashboard features include filters, labels, legends and tooltips to improve user navigation and data exploration.



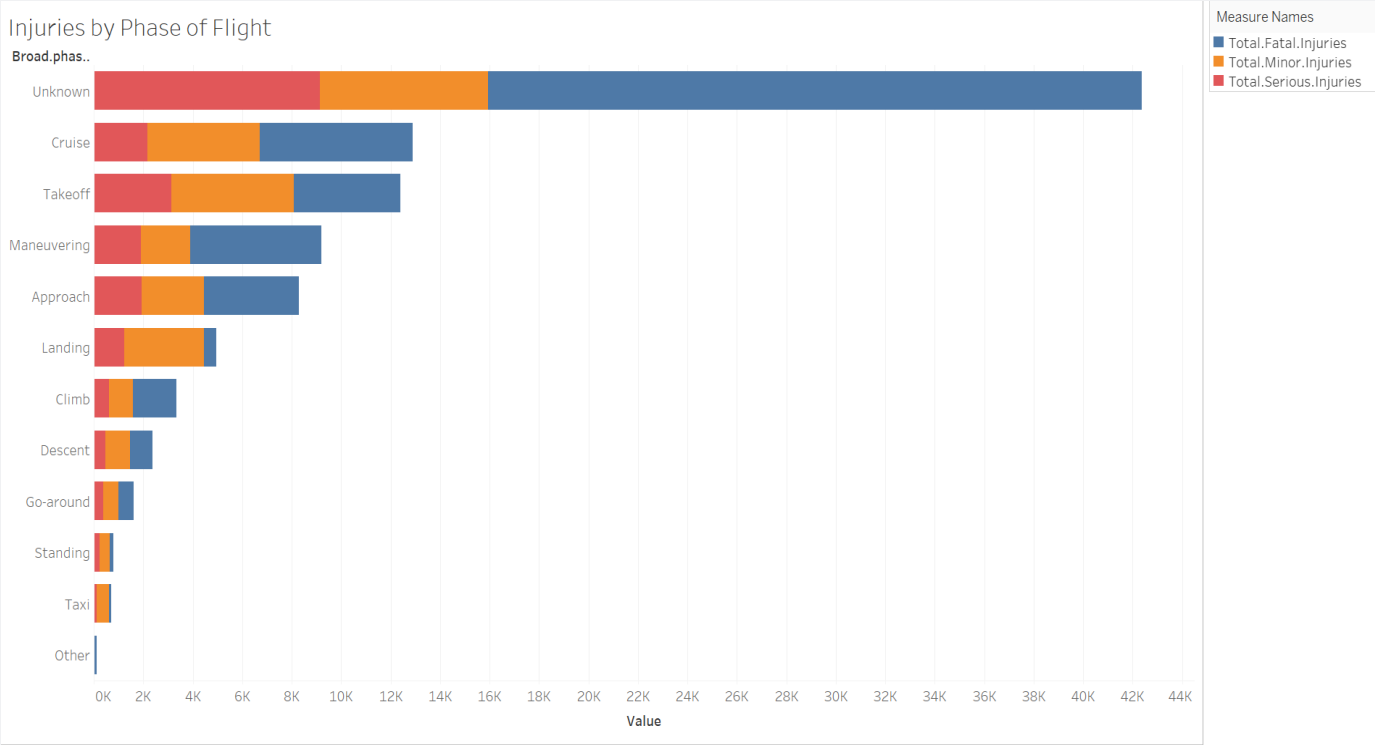
Insight 1: Safer Aircraft Types

Airbus and McDonnell Douglas have the lowest reported injuries, while Cessna and Piper report the highest. This insight supports safer aircraft selection for fleet expansion.



Insight 2 : Damage Level vs Fatalities

- Destroyed aircraft had the highest fatality counts
- Greater damage levels are strongly linked to fatal outcomes
- Highlights the importance of aircraft resilience and pre-flight safety checks



Insight 3 – Injuries by Flight Phase

- The findings show that Unknown and Cruise phases recorded the highest injuries

- Many injuries occur mid-flight or when flight phase is unclear

- Supports targeted safety planning and improved data documentation

Summary of Key Findings

- Airbus and McDonnell Douglas show the lowest injury rates among aircraft makes

- Fatalities are most common in flights that experienced destroyed aircraft damage

- Unknown, Cruise and Takeoff are the most dangerous flight phases. The frequency of accidents has declined over time. However, certain years saw an increase in fatalities.

- Visual Meteorological Conditions (VMC) had the highest number of fatal accidents, likely due to more frequent flights.

- There are records that have missing values, limiting some analyses and showing the need for better documentation.

These insights support the company in selecting safer aircraft and shows conditions that may need targeted safety measures.

Recommendations and Conclusions

Recommendations

1. Prioritize aircraft with strong historical safety records like Airbus models for initial procurement

2. Standardize safety protocols across all weather conditions, including VMC, not just adverse weather

3. Enhance pilot training for high-risk flight phases such as cruise and approach

4. Collaborate with regulators and industry players to improve data completeness

Conclusions

This project shows how aviation accident data can guide safer aircraft procurement and operational decisions. By identifying high-risk flight conditions, safer aircraft types and the patterns behind serious accidents, stakeholders are then able to take proactive safety measures.

The interactive dashboard built in Tableau simplifies complex insights into clear visuals, making them accessible to both technical and non-technical users.

This analysis serves as a practical, data-driven foundation for strategic decisions in aviation fleet expansion.

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