Evaluation of Aircraft Safety Risks for Business Expansion

Data-Driven Insights for Aircraft Acquisition

Phase 1 Project

Introduction

- This project aims to evaluate the safety risks associated with purchasing and operating different types of aircraft for commercial and private enterprises.

- The company is expanding into the aviation industry and needs data-driven insights to guide the decision-making process on which aircraft to acquire, with a focus on minimizing potential risks.

- The primary audience for this analysis is the Head of the Aviation Division, who needs actionable insights to make informed purchasing decisions about aircraft models for the company's new venture into aviation.

Data Source

- The dataset used in this analysis contains aviation accident records from the National Transportation Safety Board (NTSB), spanning from 1962 to 2023.

- This rich dataset includes information on various aircraft types, accident severity, causes, locations, and other contributing factors.

- The primary goal is to assess the historical performance of different aircraft models by examining accident frequency, severity, and the underlying risk factors associated with each type of aircraft.

NTSB | National Transportation Safety Board | **Case Analysis and Reporting Online**

Welcome to CAROL

CAROL is NTSB's query tool for information about investigations and recommendations.

Objectives

General Objective

To identify the safest aircraft that the company can purchase through analyzing aviation accident data and provide actionable insights for good decision making.

Specific objectives

- 1. To evaluate the aviation accident data with the goal of identifying the aircraft with the highest safety records and lowest risk.

- 2. To analyze the data to understand factors contributing to accident frequency and severity.

- 3. To use Geospatial Map to visualize accident distribution and risk hotspots the US and relationship between them and specific aircraft.

Technologies used

- **Python**
  - Data cleaning and preprocessing.
  - Advanced analysis such as calculating severity scores and filtering datasets.
  - Visualization for exploratory data analysis (EDA) and quick insights using libraries like Matplotlib and Seaborn.

- **Tableau**
  - Creating interactive dashboards for decision-making.
  - Geospatial visualizations to identify accident hotspots.

# Severity Scores for top 10 Aircraft

- Private aircraft, such as the Piper-PA-28-161 and Cessna 150, tend to have lower severity scores.

- However, this is still higher than for commercial aircraft

- The overall risk of accidents is higher in private aviation due to lower pilot experience and fewer safety features.

- Therefore, the risk of investing in private plane is higher than in commercial planes
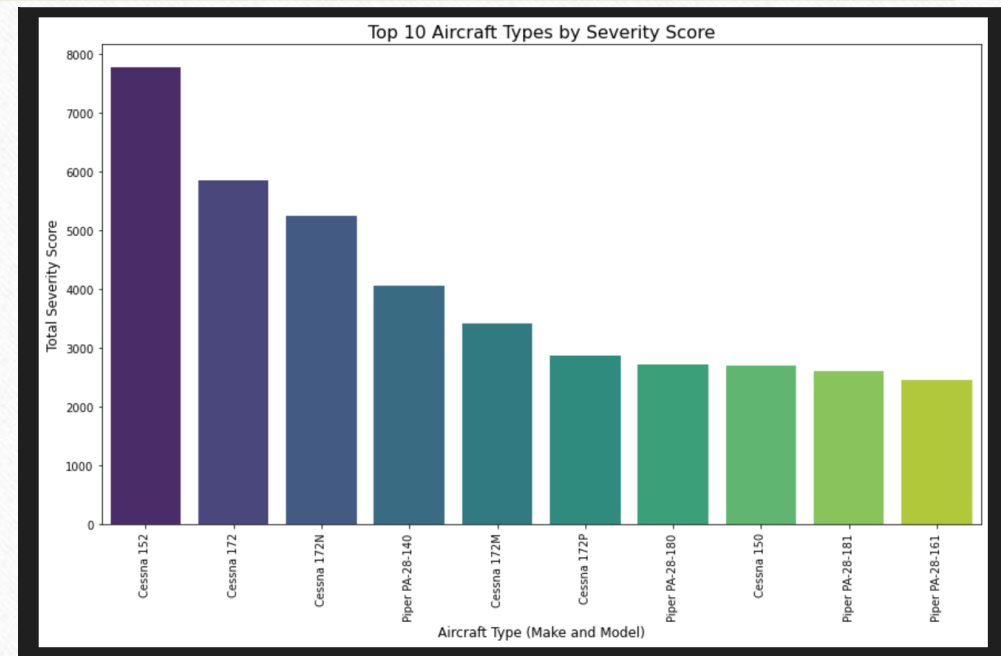
Accident Severity

- Weather conditions are the dominant factor influencing accident severity, with a clear correlation to severe weather events causing higher-risk incidents.

- The correction among Engine type, broad-phase of flight and weather condition is also very low.

Correlation Heatmap of Factors Contributing to Accident Severity for Top 10 Aircraft Models
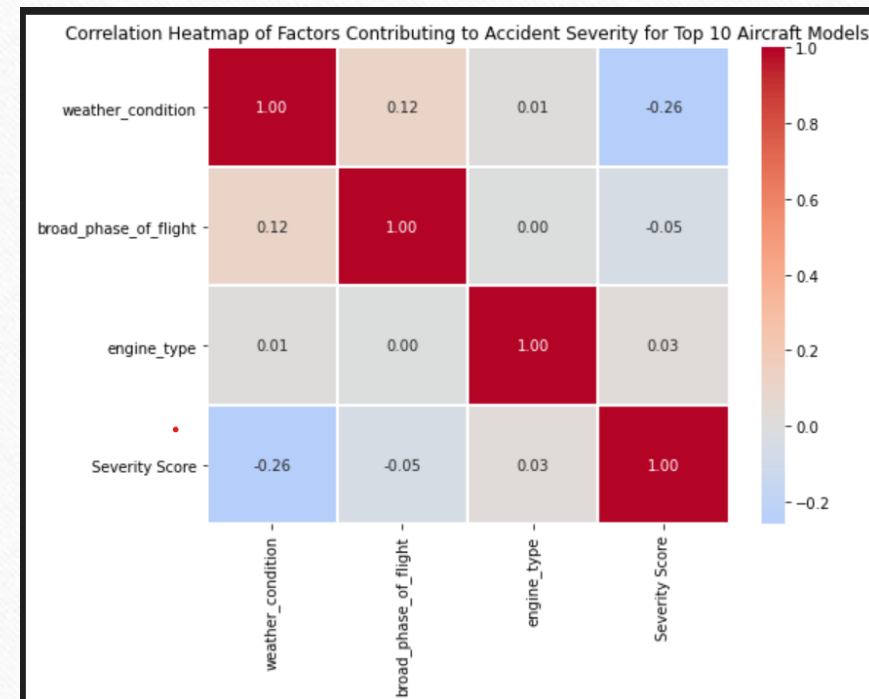
Broad phase of Flight vs Severity Score

- Understanding the broad phases of flight is essential for aviation professionals to ensure safety, efficiency, and compliance throughout the entire flight journey.

- Based on the above, most accidents happen during landing, followed by cruise and then takeoff. Very few accidents happen when a plane is standing and when taxiing to the Runway

Broad_phase_of_flight VS Severity Score

Broad Phase Of Flight
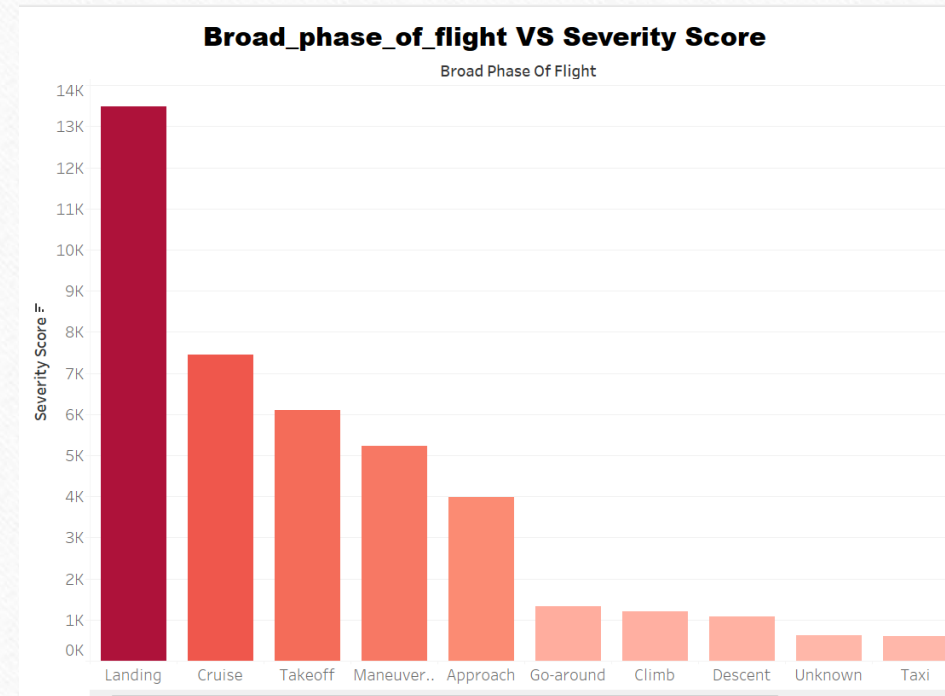
Severity Score vs purpose of flight

- Analyzing severity scores in relation to the purpose of the flight was important in identifying patterns and risks associated with different flight activities.

- Personal and instructor flights had the highest severity score while ferry and executive/corporate flights had the lowest score

Severity Score vs Purpose of Flight
Purpose Of Flight
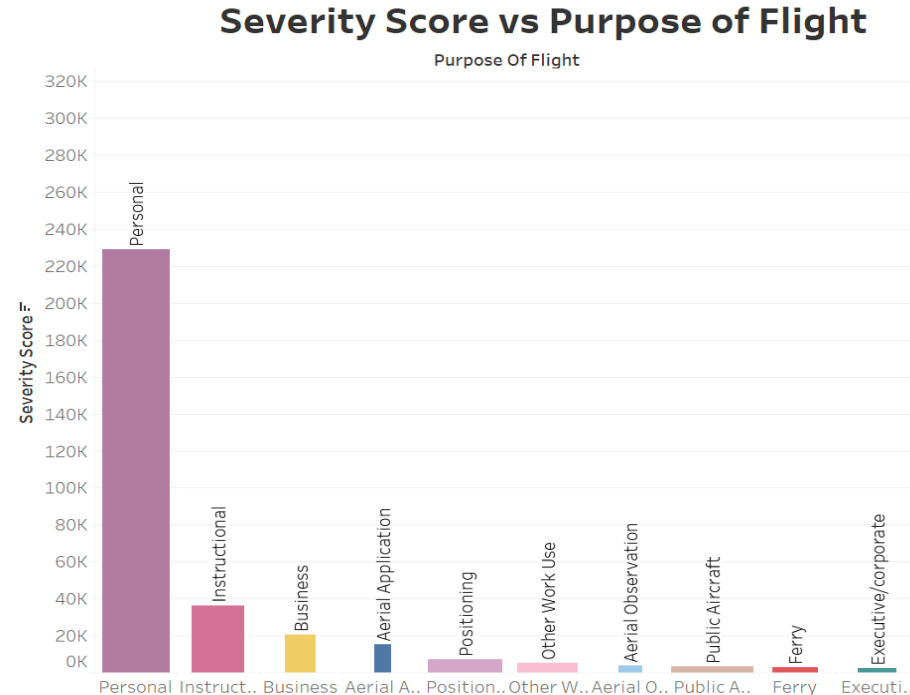
Severity Scores VS US States

- California has the highest severity scores, followed by Florida and Texas, suggesting these states have higher accident rates compared to others.

- North and South Dakota have the lowest accident severity, indicating a lower risk for operations in these states.

Severity Scores vs US States
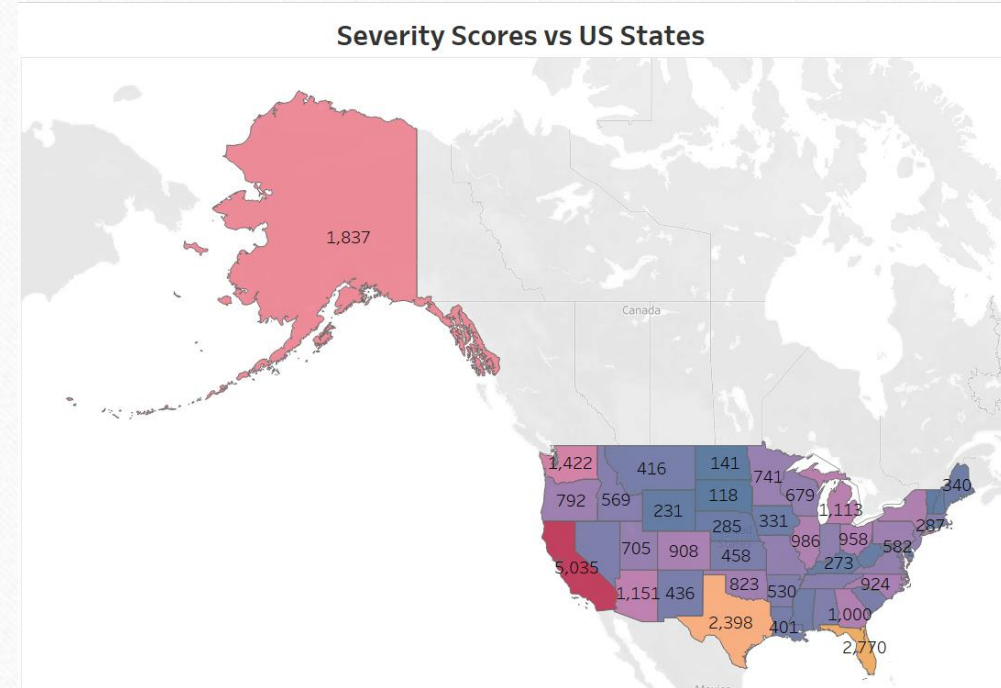
Recommendations

- **Prioritize Commercial Aircraft Over Private Aircraft:** Commercial aircraft generally exhibit a lower risk of accidents compared to private aircraft. Investing in commercial aircraft would align with the company's goal of minimizing risk and enhancing safety for the new aviation venture.

- **Invest in Aircraft Resilient to Extreme Weather:** Weather conditions are the leading cause of aviation accidents. The company should consider aircraft that are designed to withstand extreme weather, such as those equipped with better de-icing and weather detection systems.

- **Focus on Landing Infrastructure and Safety Protocols:** The landing phase of flight is where most accidents occur. The company should invest in improving airport infrastructure and implement robust safety protocols for landing procedures. This will reduce the overall risk during this critical phase of flight

- **Invest in North and south Dakota:** These best place to start the company since very few accidents happen there

Next Steps

The following next steps should be taken to operationalize these findings:

1. **Aircraft Review:** The company should review various commercial aircraft models that meet safety and weather-resilience criteria.

2. **Weather Resilience Investment:** Identify and prioritize aircraft that have been proven to perform well in adverse weather conditions.

3. **Landing Infrastructure:** Conduct a feasibility study on improving landing infrastructure, focusing on critical accident hotspots, particularly in states like California and Florida.

Thank You

For any further questions or clarifications, please feel free to contact me.

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