Title: Aviation Accident Analysis: Business Insights & Recommendations

Understanding Safety Trends & Risk Factors

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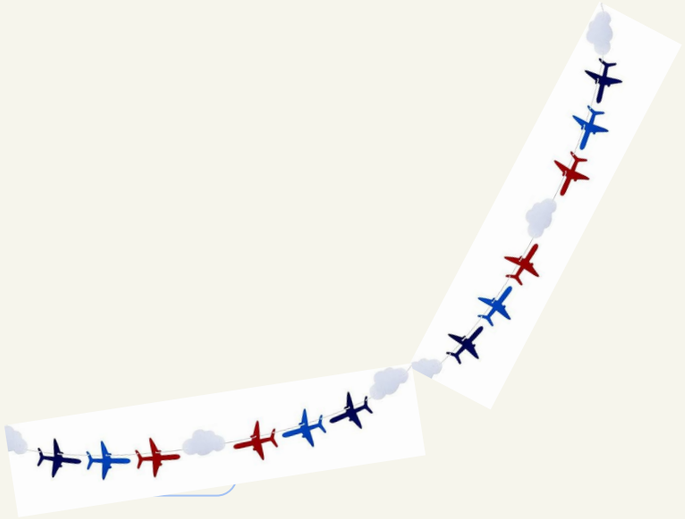
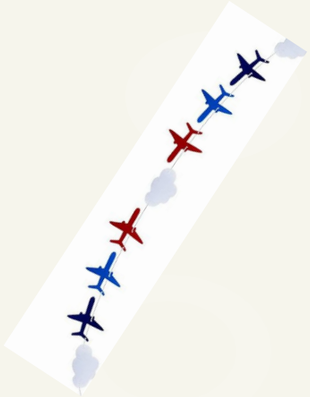


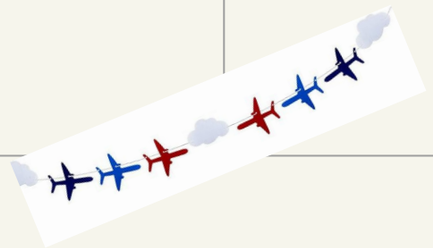
Overview

- This project conducts an in-depth analysis of aviation accident data to identify safety risks and provide recommendations for minimizing operational hazards.
- Importance of aviation safety in business operations is to ensure safe operations which are critical for reducing financial losses, regulatory penalties, and reputational damage while enhancing passenger confidence.

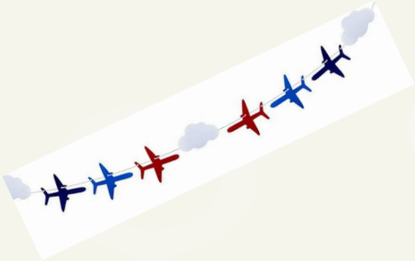


Objectives

1. Identify the safest aircraft models
2. Analyze the purpose of flights involved in accidents
3. Examine time-based trends in accident occurrences
4. Determine key factors leading to accidents
5. Assess accident severity by aircraft make
6. Conduct geographic analysis of accident locations
7. Provide data-driven recommendations for safer aviation



Business Understanding



- Business Problem: Enhancing aviation safety through data-driven decision-making
- Target Audience: Airlines, aviation regulators, aircraft manufacturers, airport authorities

Key Questions

✈️ **Which aircraft models have the highest and lowest accident rates?**

✈️ **What geographic patterns can be identified in accident occurrences?**

✈️ **How do accident trends vary by flight purpose (commercial vs. private)?**

✈️ **What time-based patterns exist in aviation accidents?**

✈️ **What are the main causes of aviation accidents?**

✈️ **How severe are accidents across different aircraft makes?**

✈️ **How can businesses implement effective risk mitigation strategies?**

Data Understanding and cleaning

- The data had 31 columns and 88,889 rows
- The data types included objects and integers

Handling Missing Values

- Categorical columns with missing values were filled with **'unknown'**.
- Latitude & Longitude were converted to numeric, with missing values filled with **0**.
- Columns handled (Location, Country, Airport Name, Injury Severity, Aircraft Damage, Aircraft Category, Registration Number, Make, Model, Engine Type, Purpose of Flight, Weather Condition, Broad Phase of Flight.)

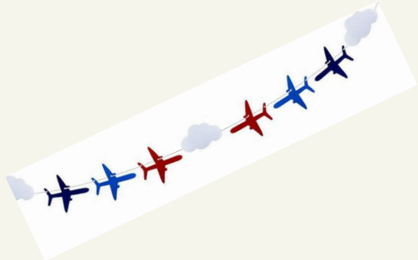
Standardizing Data

- All text data converted to **lowercase** for consistency.
- Categorical data converted to **category type** to optimize memory usage.

Data source

Data was obtained from kaggle

https://www.kaggle.com/datasets/khsamaha/aviation-accident-database-synopses



Data Understanding and cleaning

4. Removing Unwanted Columns

- Irrelevant columns dropped to focus on key attributes.
- Removed columns:
    - Event Id, Accident Number, Publication Date, Amateur Built, FAR Description, Air Carrier, Schedule, Report Status, Airport Code.

5. Final Dataset Summary:

- **Original Dataset Shape:** (before cleaning)
- **Cleaned Dataset Shape:** (after handling missing values, standardization, outlier removal, and column selection)
- Combined the numerical and categorical data using concatination process for analysis
- The cleaned data was saved as .csv files and renamed df_final.csv

DATA CLEANING PYTHON LIBRARIES USED

Data Analysis and trends

Analysis Area	Key Findings
Accident Trends	Highest accidents between **1982-2000**, decline post-2000.
Aircraft Make & Model	Most accidents in **Cessna (27,149), Piper (14,870), Beech (5,372)**. Highest in **Cessna 152, 172, 172N**. Least accidents happened in : **monroig pedro j 1,monte clark 1,moody-siple 1 ,moon mooney aircraft 1 ,mooney aircraft corp 1 ,mooney aircraft corporatio 1 ,mooney airplane company 1,mooney international corp 1**
Flight Purpose	Most accidents in **Personal flights (49,448)**, followed by **Instructional (10,601)**.
Geographic Insights	Top accident locations: **Anchorage, AK (548), Miami, FL (275), Houston, TX (271)**. Least prone accident locations :
Engine Type	**Reciprocating engines** have the most accidents (**69,530**).
Flight Phase	Highest accidents during **Landing (15,428), Takeoff (12,493), Cruise (10,269)**.

Data visualization

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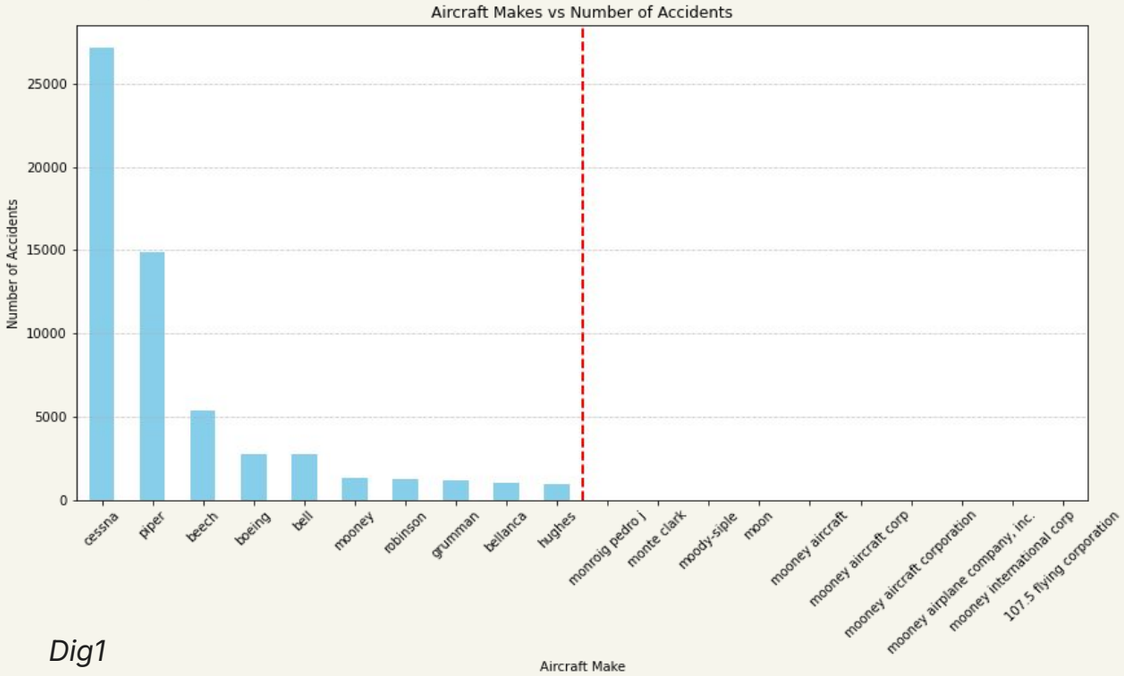
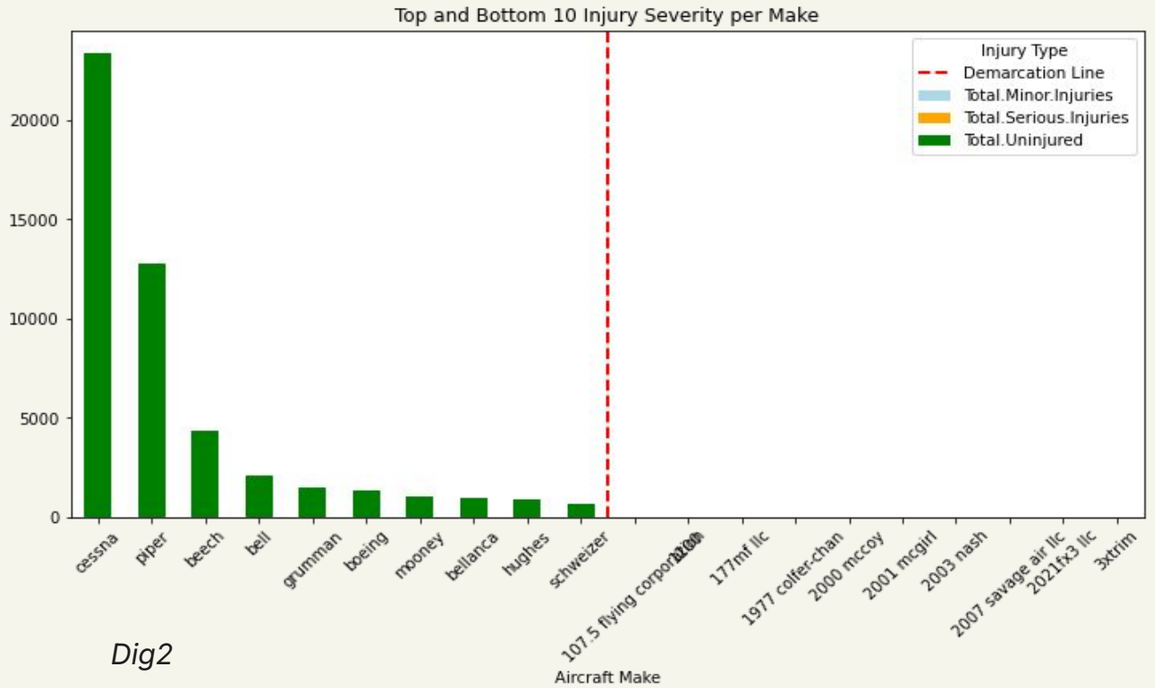


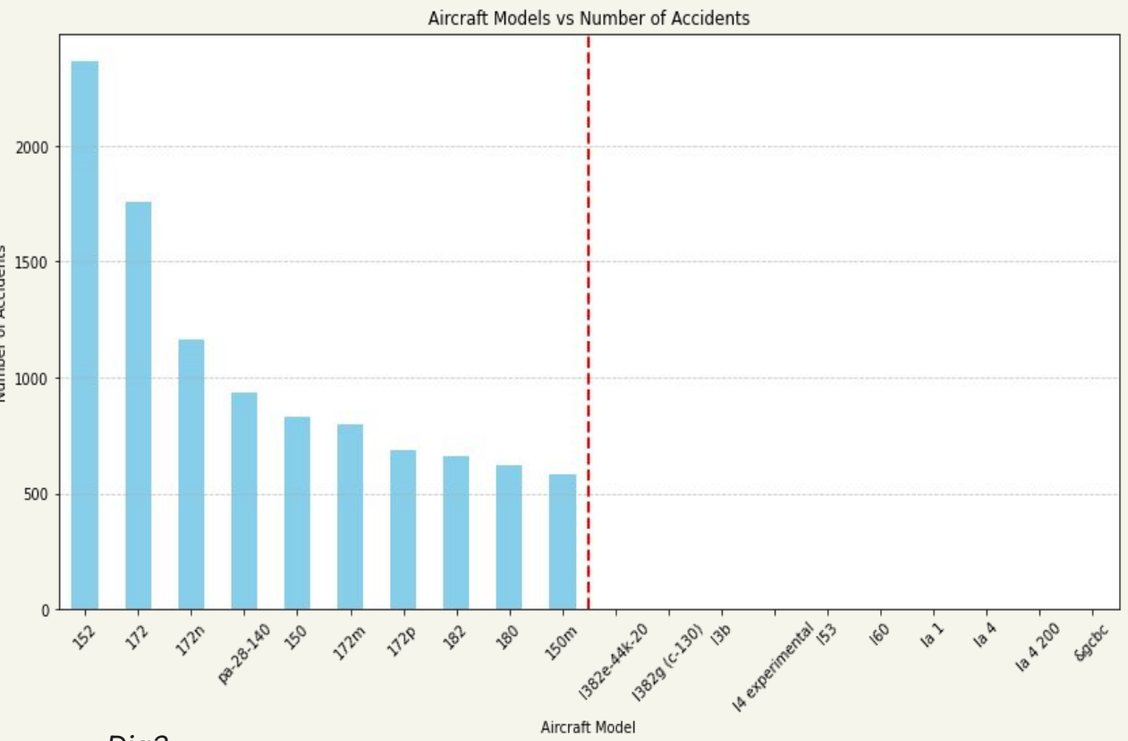
Dig1



Dig2

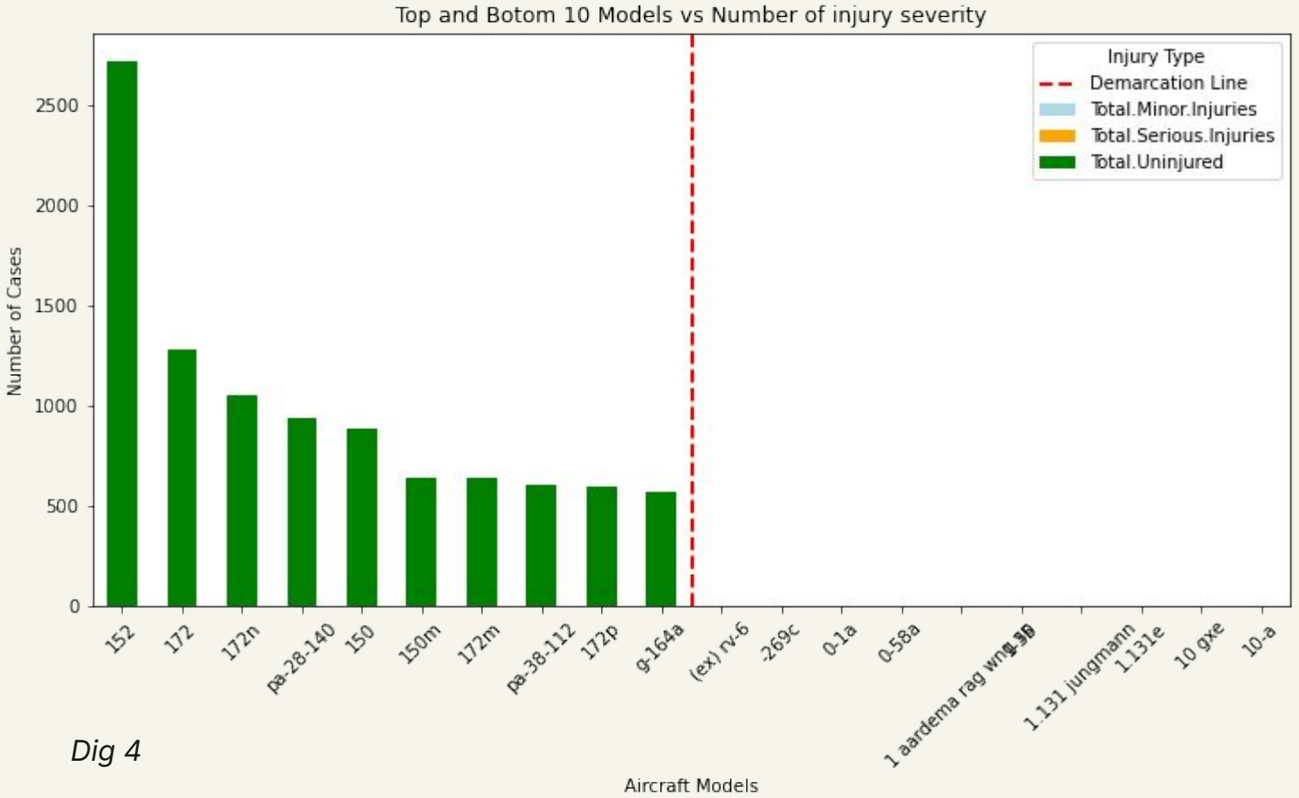
Diagram one indicates aircraft makes with highest and lowest accidents

Diagram two indicates highest and lowest injury severity aircraft makes



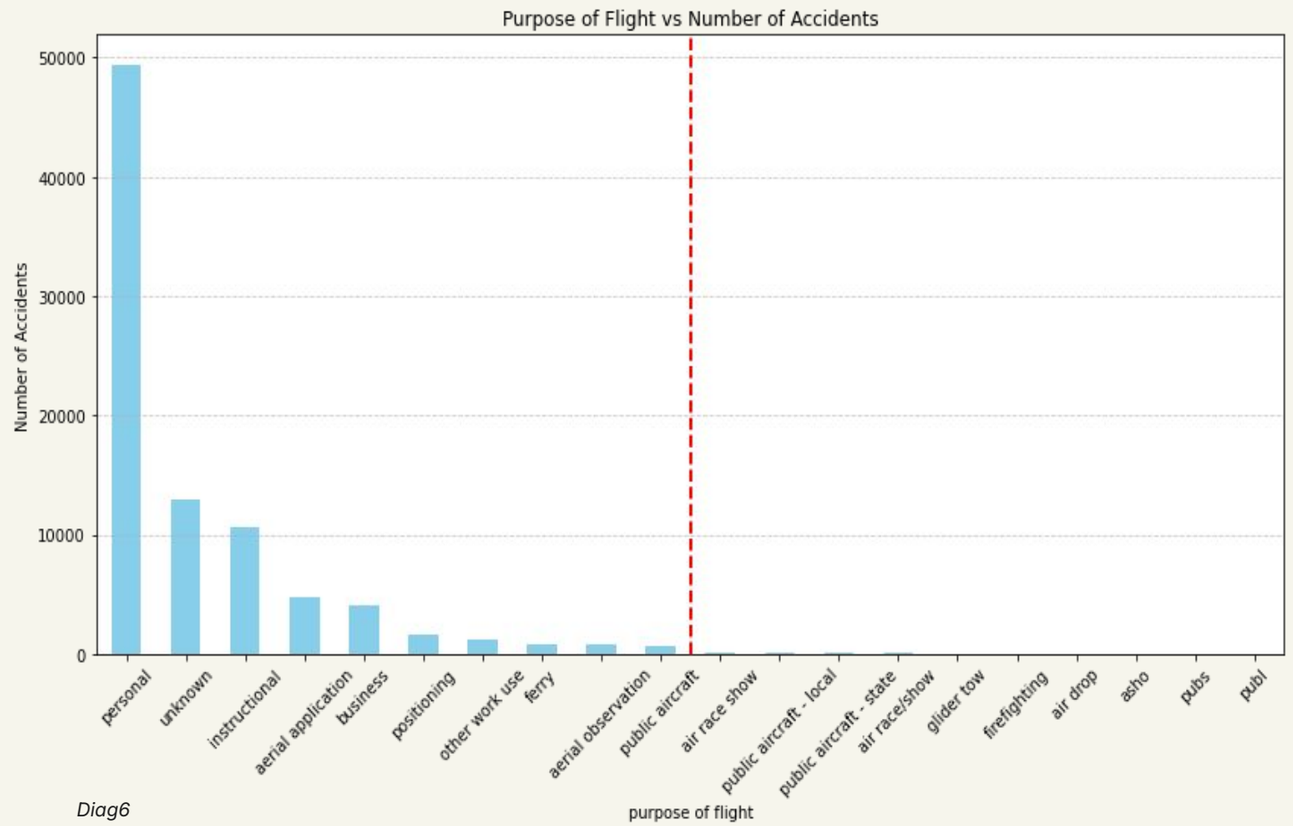
Dig3

Aircraft models with highest and least accident counts

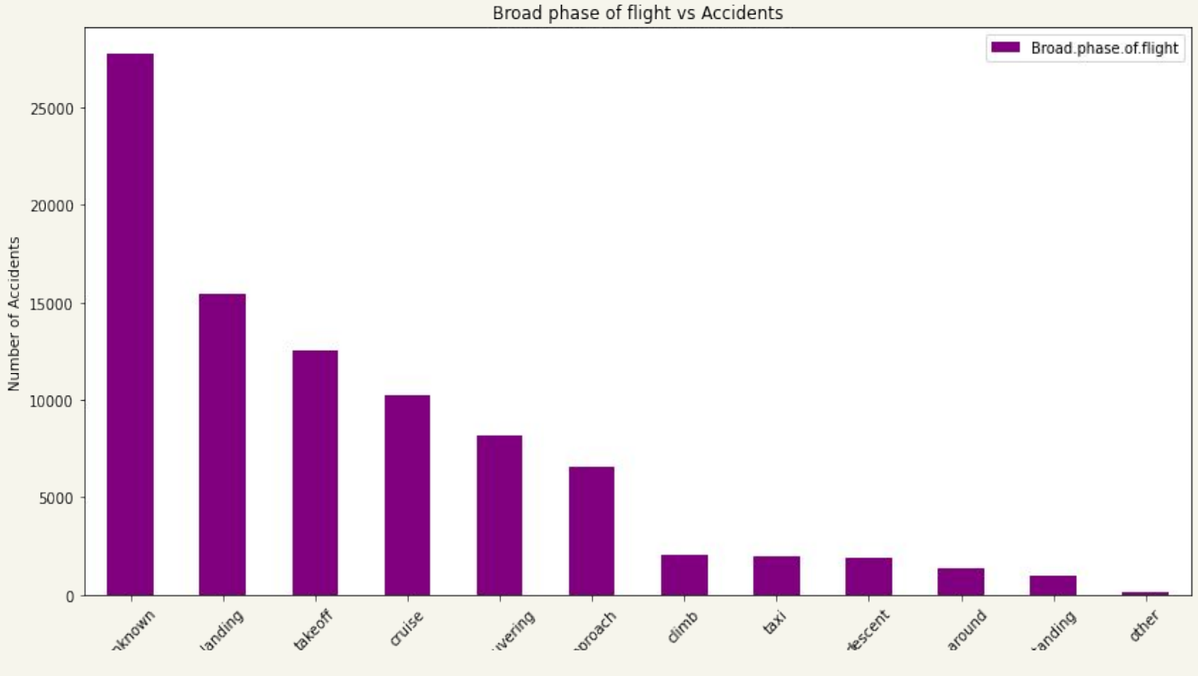


Dig 4

Top and Bottom 10 Models vs Number of injury severity



Diag6



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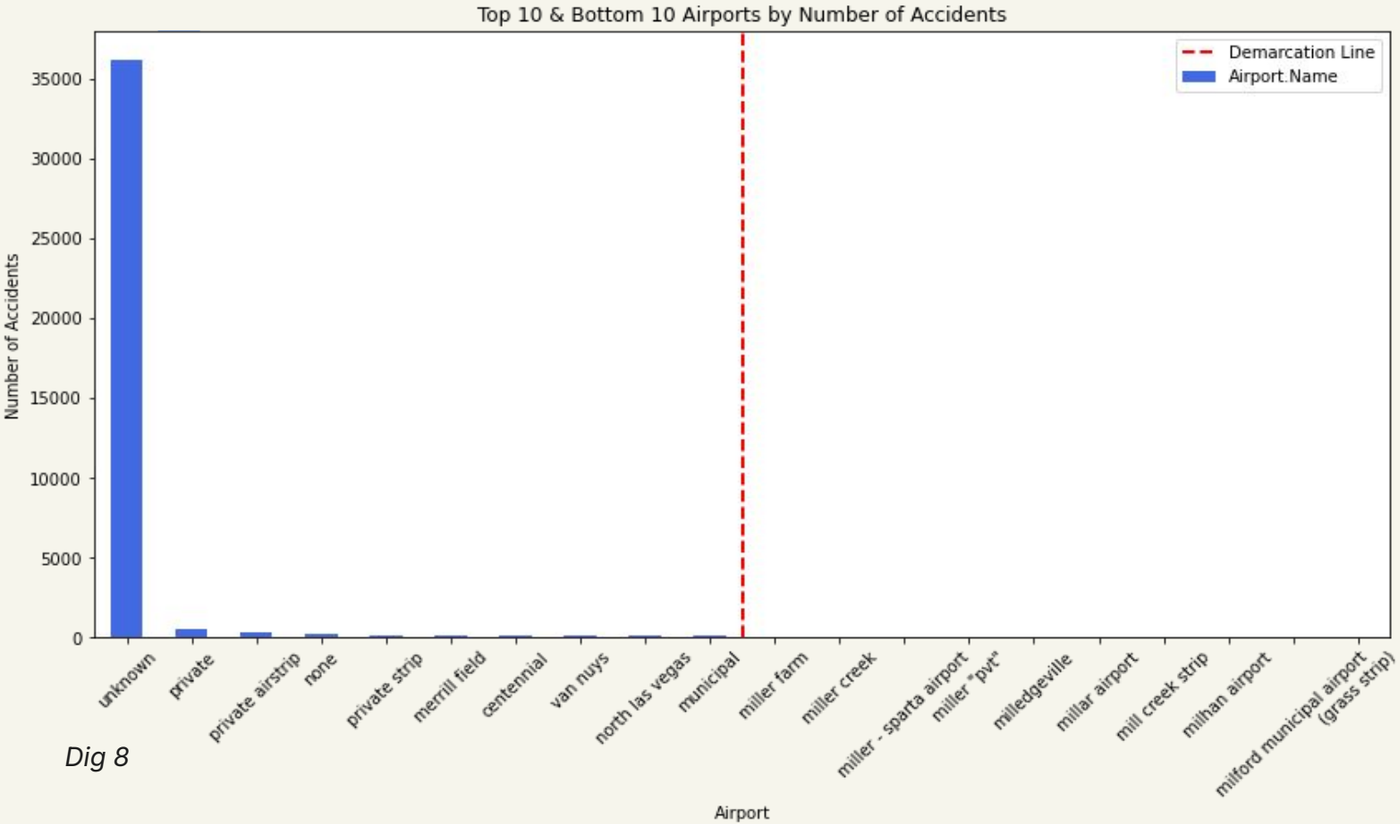
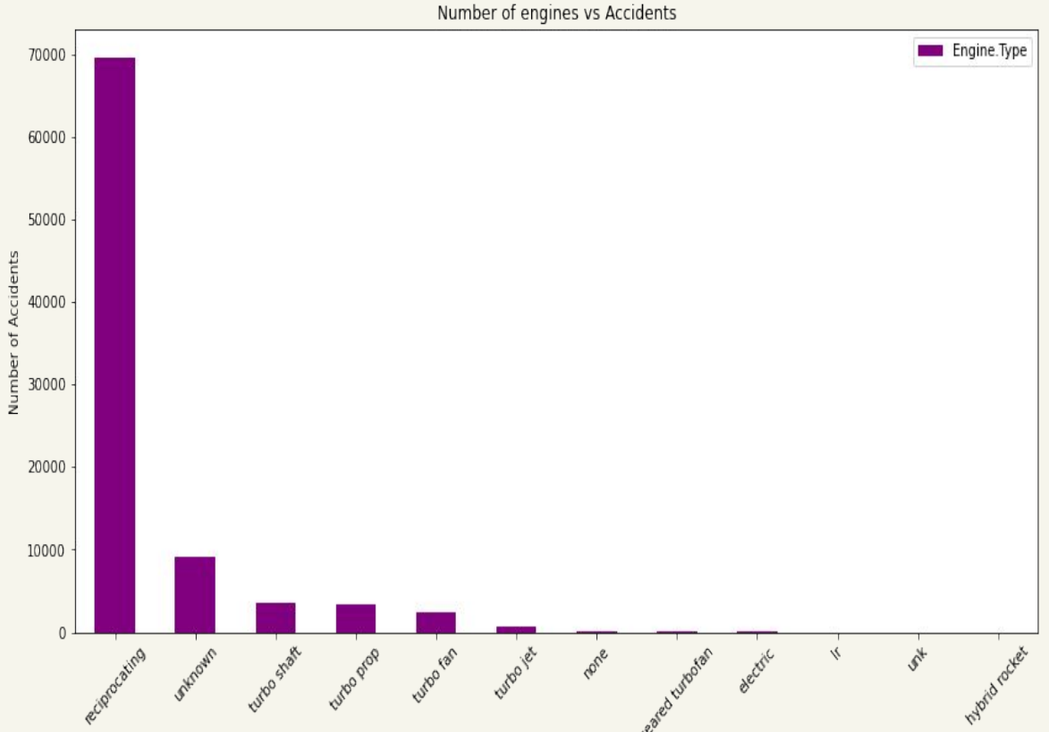
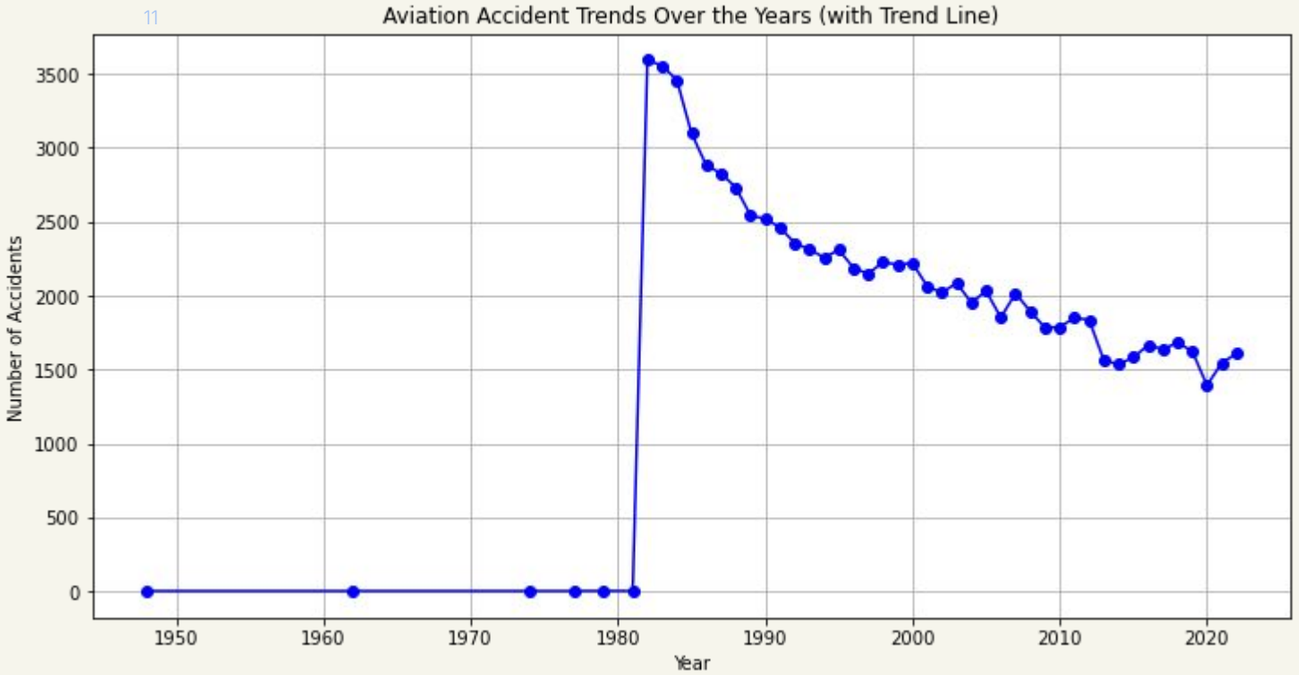


Dig 8



Dig9



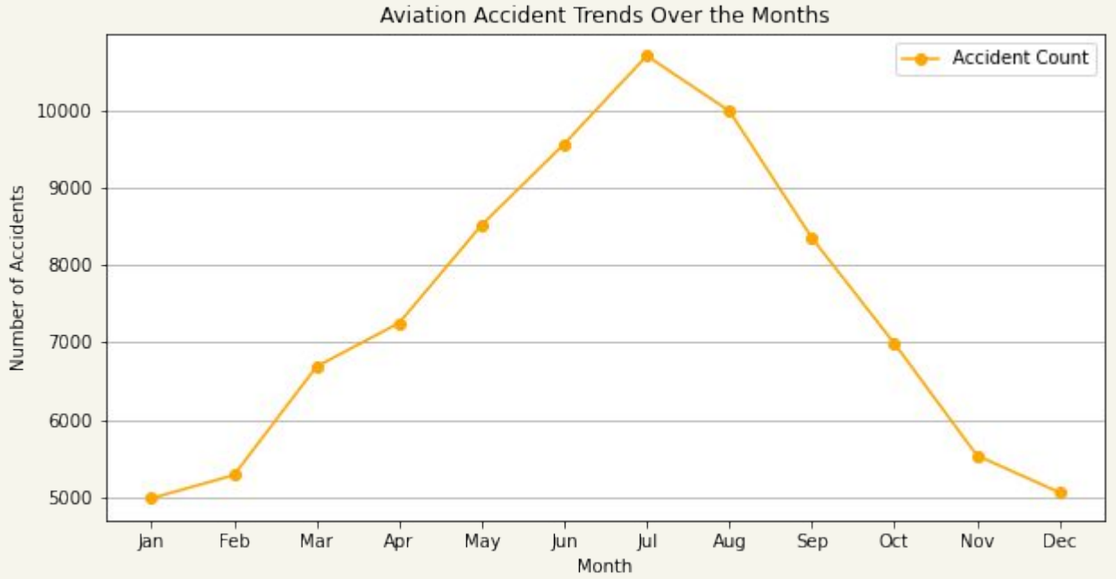
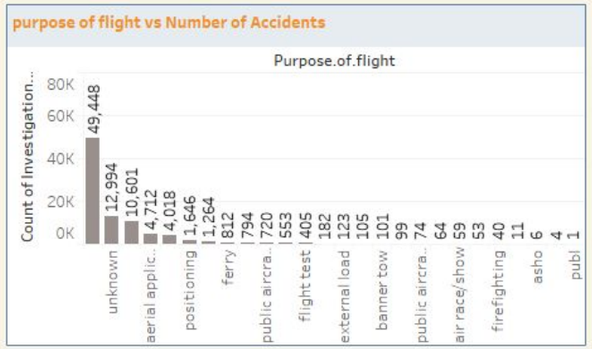
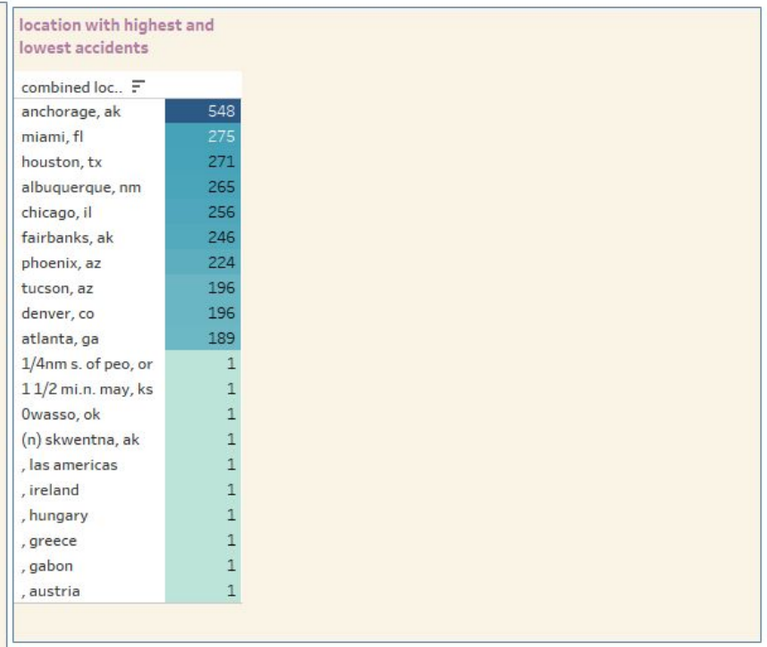


Tableau Dashboards





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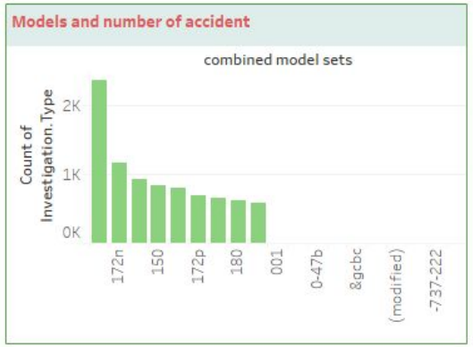
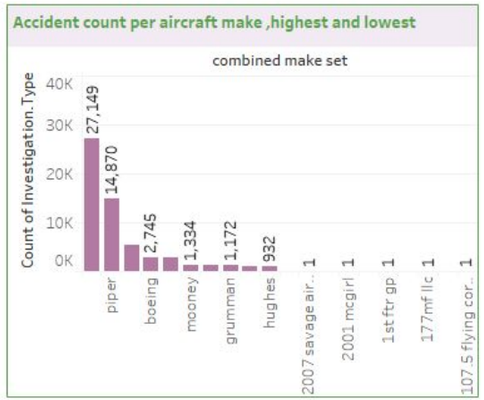


Makes vs injury severity

combined make set	Total.M..	Total.S..	Total.U..
cessna	0	0	23,358
piper	0	0	12,729
beech	0	0	4,327
bell	0	0	2,098
grumman	0	0	1,499
boeing	0	0	1,298
mooney	0	0	1,026
bellanca	0	0	981
hughes	0	0	859
robinson	0	0	531
1st ftr gp	0	0	1
2007 savage air llc			
2003 nash			
2001 mcgirl			
2000 mccoy			
1977 colfer-chan			
1200			
177mf llc			
107.5 flying corporation			
3xtrim			



Conclusion & Recommendations

The analysis revealed that **Cessna and Piper aircraft** account for the highest accident rates, especially in **personal and instructional flights**. Many accidents occur at **uncontrolled or private airstrips**, highlighting the need for better infrastructure and air traffic control. **Reciprocating engines** are linked to the most accidents, and **landing, takeoff, and cruise phases** remain the most accident-prone. However, accident rates have **declined post-2000** due to improved safety measures.

To reduce risks, it is recommended to **invest in pilot training**, enforce **mandatory safety checks for private and training flights**, enhance **small airport infrastructure**, and promote **modern engine safety systems**. Additionally, integrating **automated landing and takeoff assistance** and ensuring **continuous data-driven safety monitoring** will contribute to a **safer aviation business**.