Phase One Project:

Aviation Safety Data Analysis: Visualizing Risk Patterns Using Python

Introduction: Overview

- As Part of the company to venture into aviation Business, this project investigates the risk associated with different aircraft , aiming to identify the safest model for potential investment. The analysis focuses on determining which types of flights have the highest average fatalities and aircraft damage, assessing how engine types and weather conditions affect safety, and ranking aircraft make by risk level for commercial use.

- The dataset used comes from the National Transportation Safety Board (NTSB) and includes records of aviation accidents and incidents from 1962 to 2023.

Problem Statement

Your company is expanding in to new industries to diversify its portfolio. Specifically, they are interested in purchasing and operating airplanes for commercial and private enterprises, but do not know anything about the potential risks of aircraft. You are charged with determining which aircraft are the lowest risk for the company to start this new business endeavor. You must then translate your findings into actionable insights that the head of the new aviation division can use to help decide which aircraft to purchase.

Goal

The Data Analysis goals are:

To investigate;

1. Which flight types have the highest average fatalities and aircraft damage?
2. What effect do engine types have on safety, and how is this affected by weather conditions?
3. What aircraft make have the lowest risk for commercial ventures?

Steps

The stepped to be used in achieving the goals are;

1.Define the problem statement.

2.Data Preparation

- Data Cleaning using Pandas - Removed irrelevant or empty columns - Handled missing values using median imputation - Standardized categorical data - Trimmed whitespace and formatted date columns

3.Aggregate and analyze the data to identify low-risk aircraft.

4.Create visualizations to support findings.

- Visualization - Created plots using

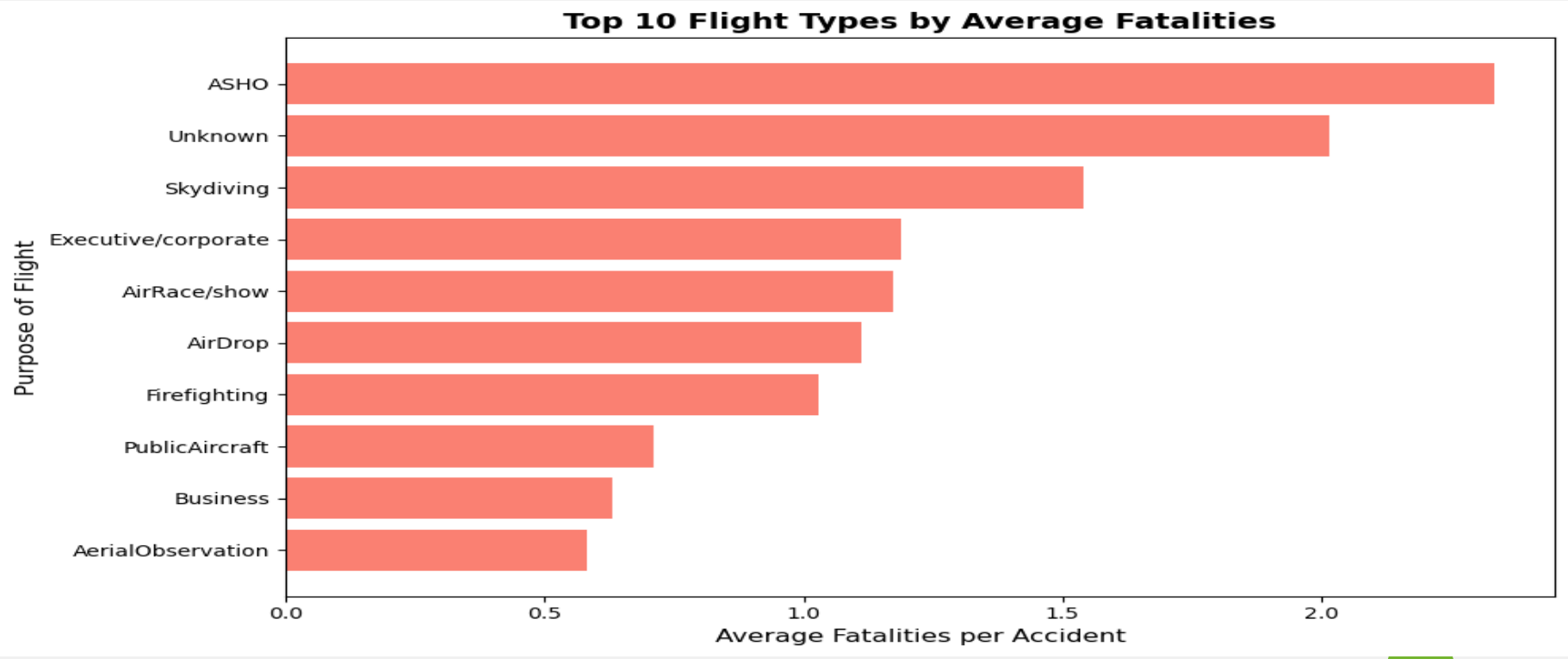
5.Translate findings into three actionable business recommendations.

Tools Used –Python Libraries

1. Pandas
2. NumPy
3. Matplotlib
4. Seaborn)
5. Jupyter Notebook
6. Tableau

Aggregate and analyze the data to identify low-risk aircraft.

Goal 1: Which flight types have the highest average fatalities and aircraft damage?



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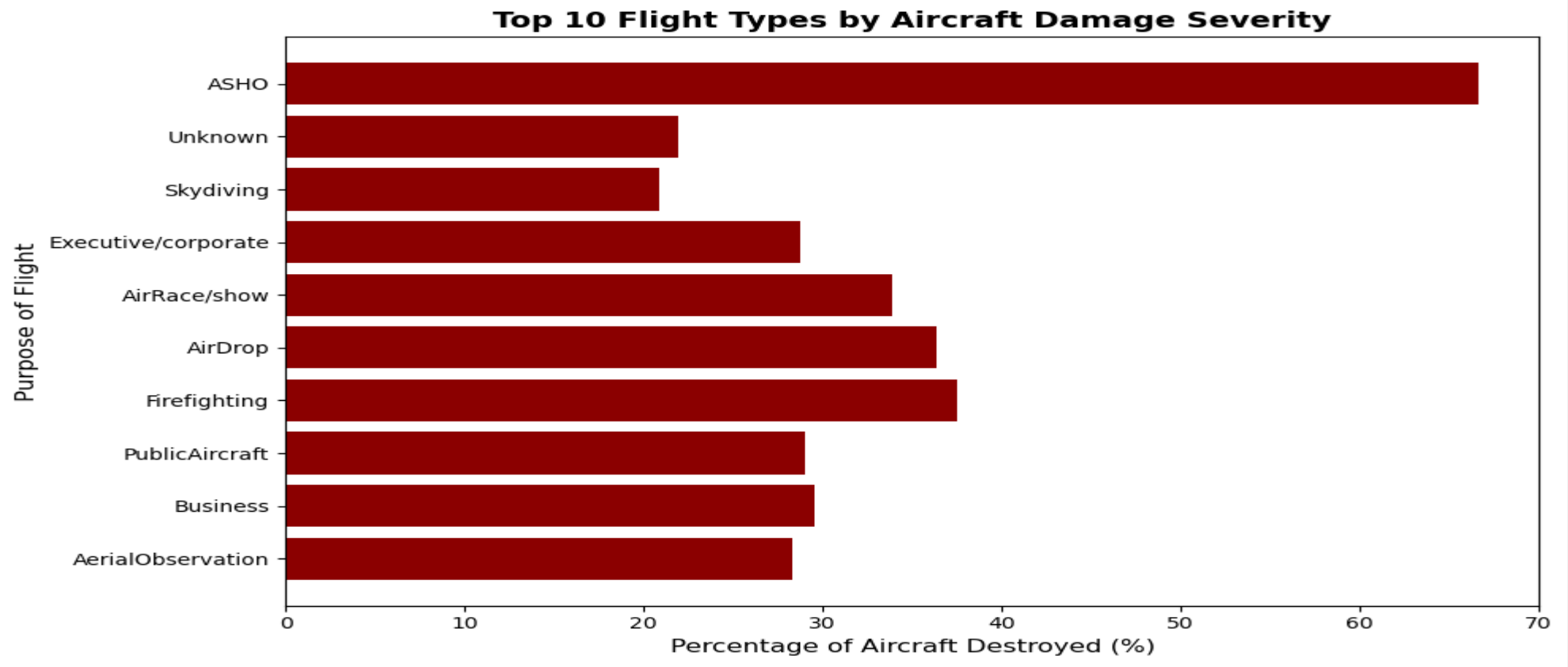

Goal 1: Which flight types have the highest average fatalities and aircraft damage?

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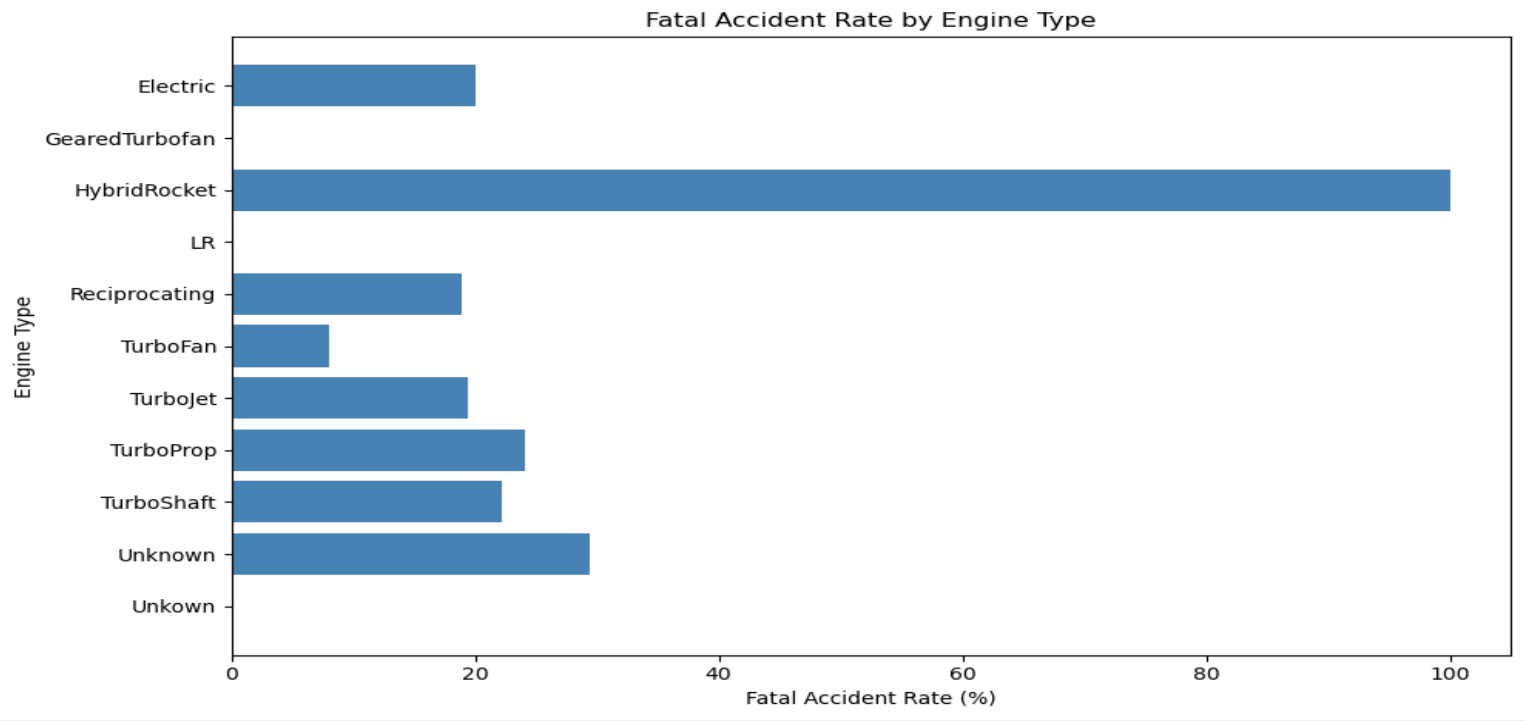
From the visuals:

1. Skydiving ,Airdrop and Air rate have the highest fatality rates and aircraft destruction percentages. This means that they have a higher operational risk
2. 2. Business and Executive/Corporate flights show moderate fatality averages and slightly lower destruction rates. Suggesting stronger safety oversight and maintenance.

Goal 2: What effect do engine types have on safety, and how is this affected by weather conditions?



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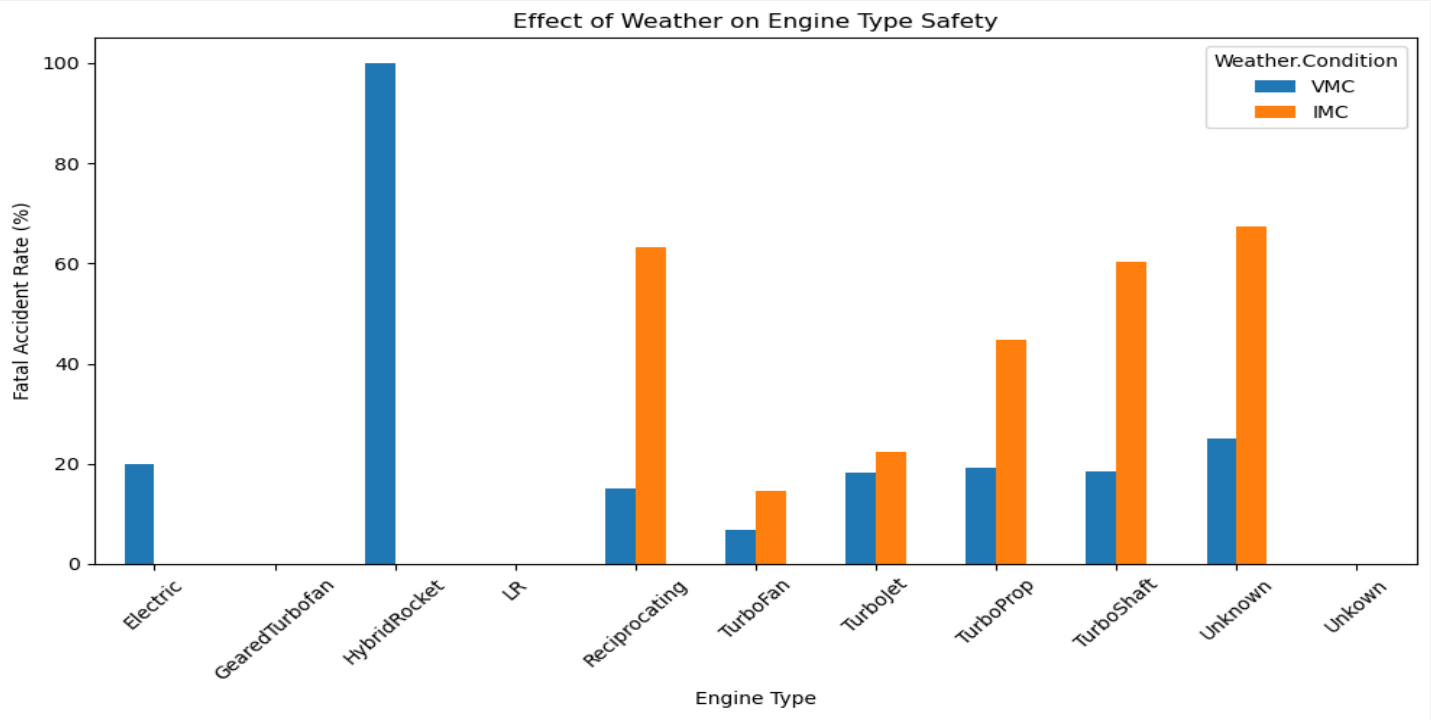

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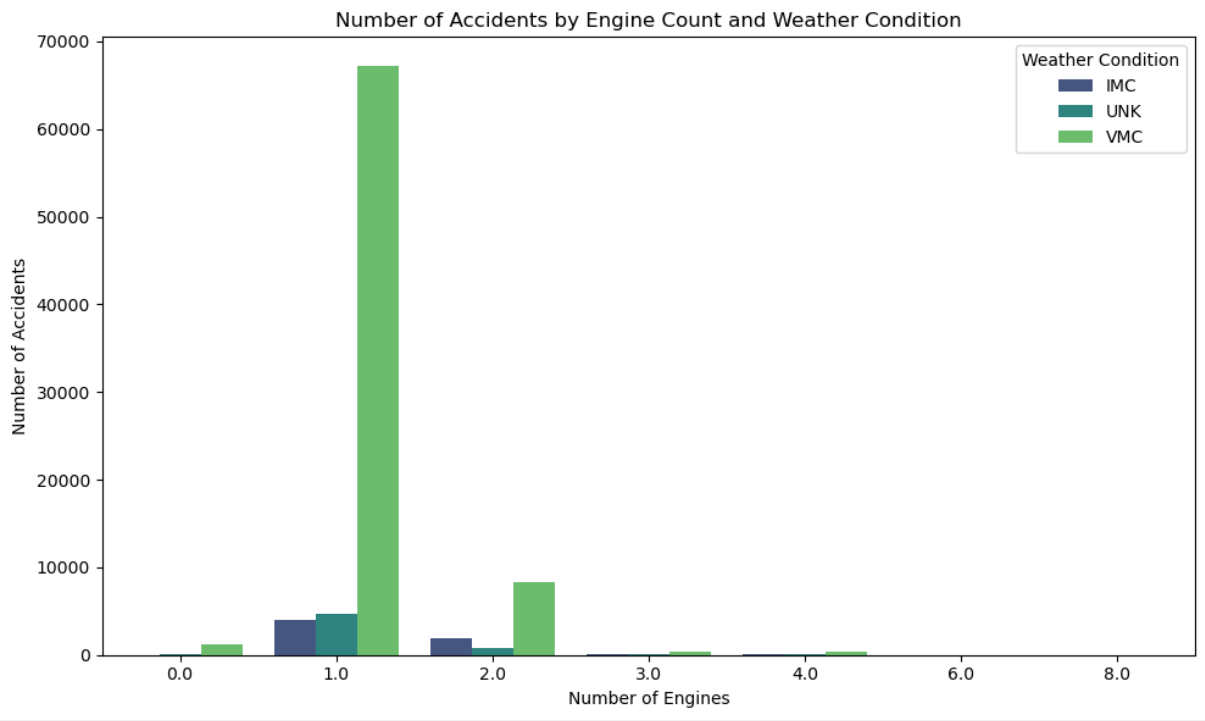

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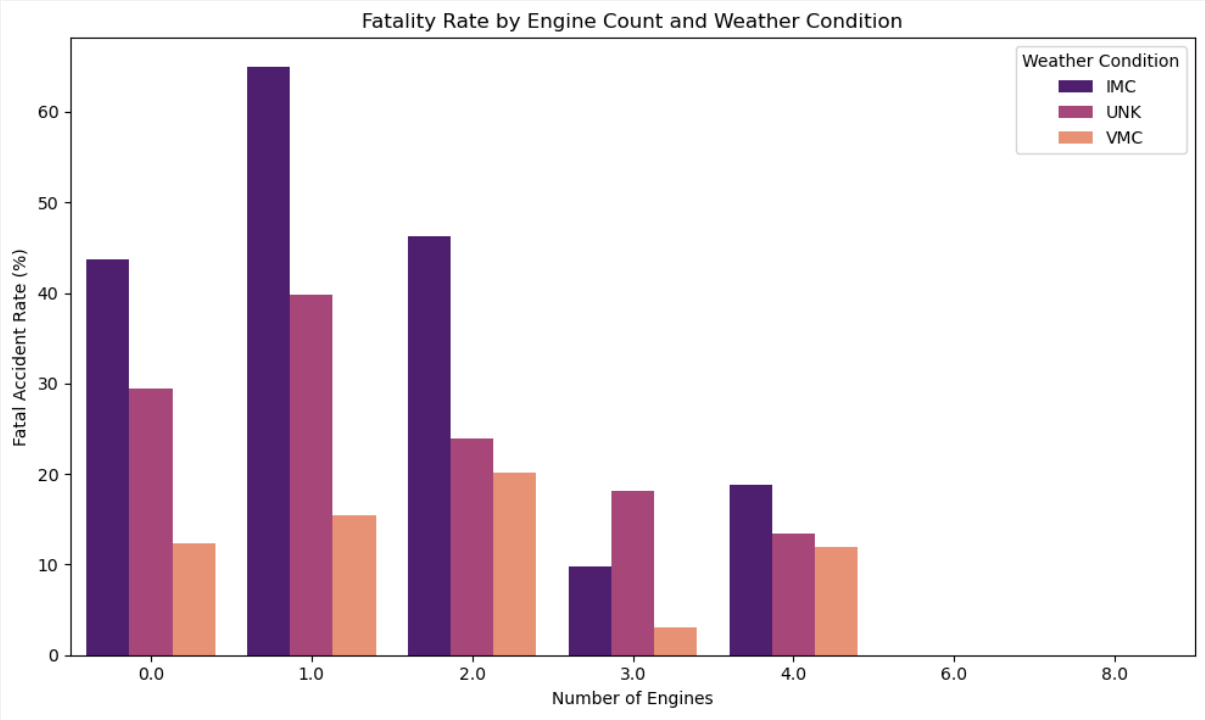


Goal 2: What effect do engine types have on safety, and how is this affected by weather conditions?

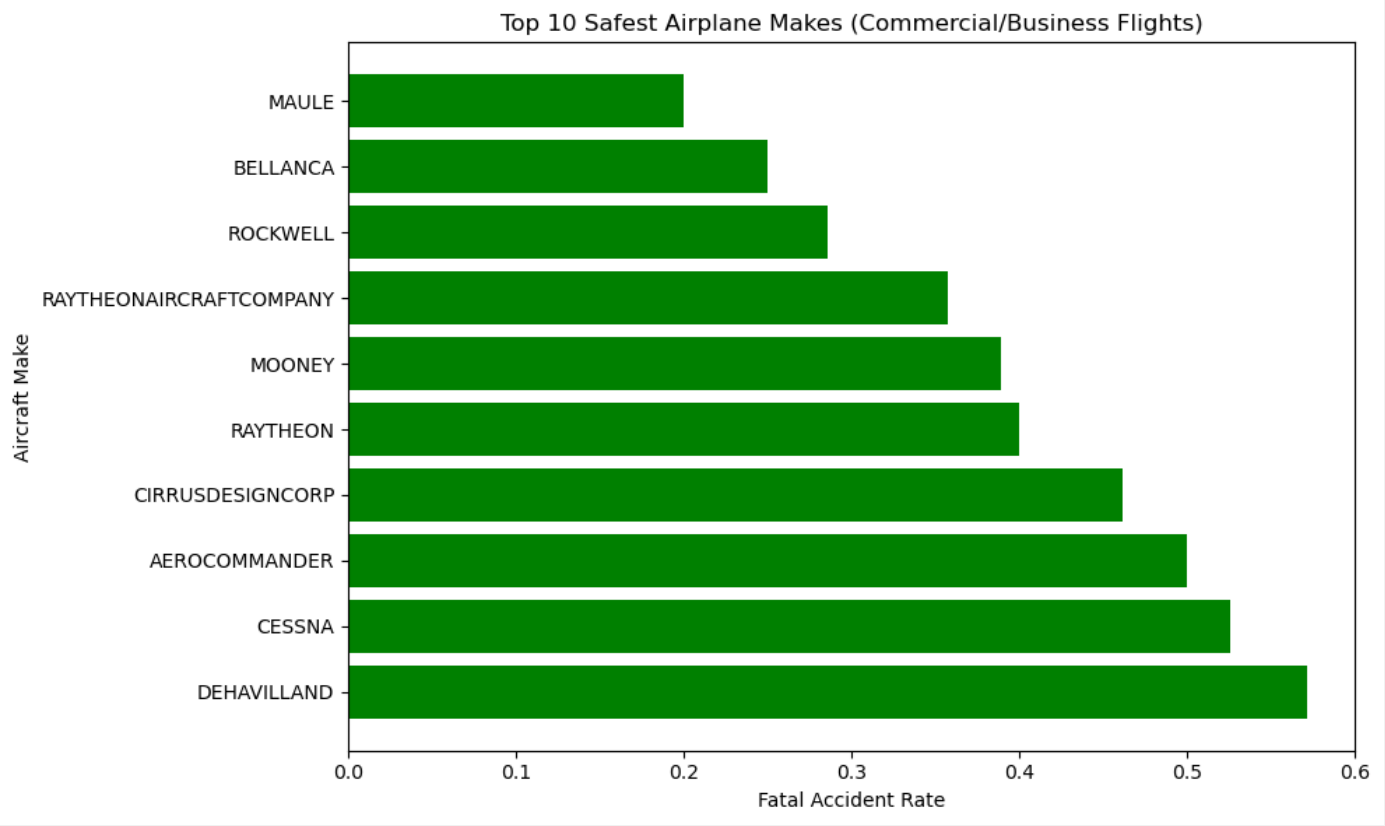
1. The analysis reveals that reciprocating-engine aircraft experience the highest fatal accident rates, especially under Instrument Meteorological Conditions (IMC).

2. Turbofan, turbojet and turboprop engines tend to have lower fatality rates, likely due to more advanced systems and better-equipped aircraft.
3. Poor weather (IMC) amplifies risk across all engine types, but its effect is most severe for reciprocating aircraft and turboshaft aircraft, highlighting their vulnerability to adverse weather and limited instrument capability.

4. Aircraft with more engines and advanced engine types (turboprops, jets) are significantly safer, particularly in adverse weather.
5. For business or corporate operations, prioritizing twin-engine turboprop or jet aircraft minimizes operational risk.

6. In conclusion, weather conditions shows a positive correlation with fatalities and weather. Confirming that poor visibility and adverse weather significantly increase risk.

Goal 3: What Aircraft models have the lowest risk for commercial ventures?



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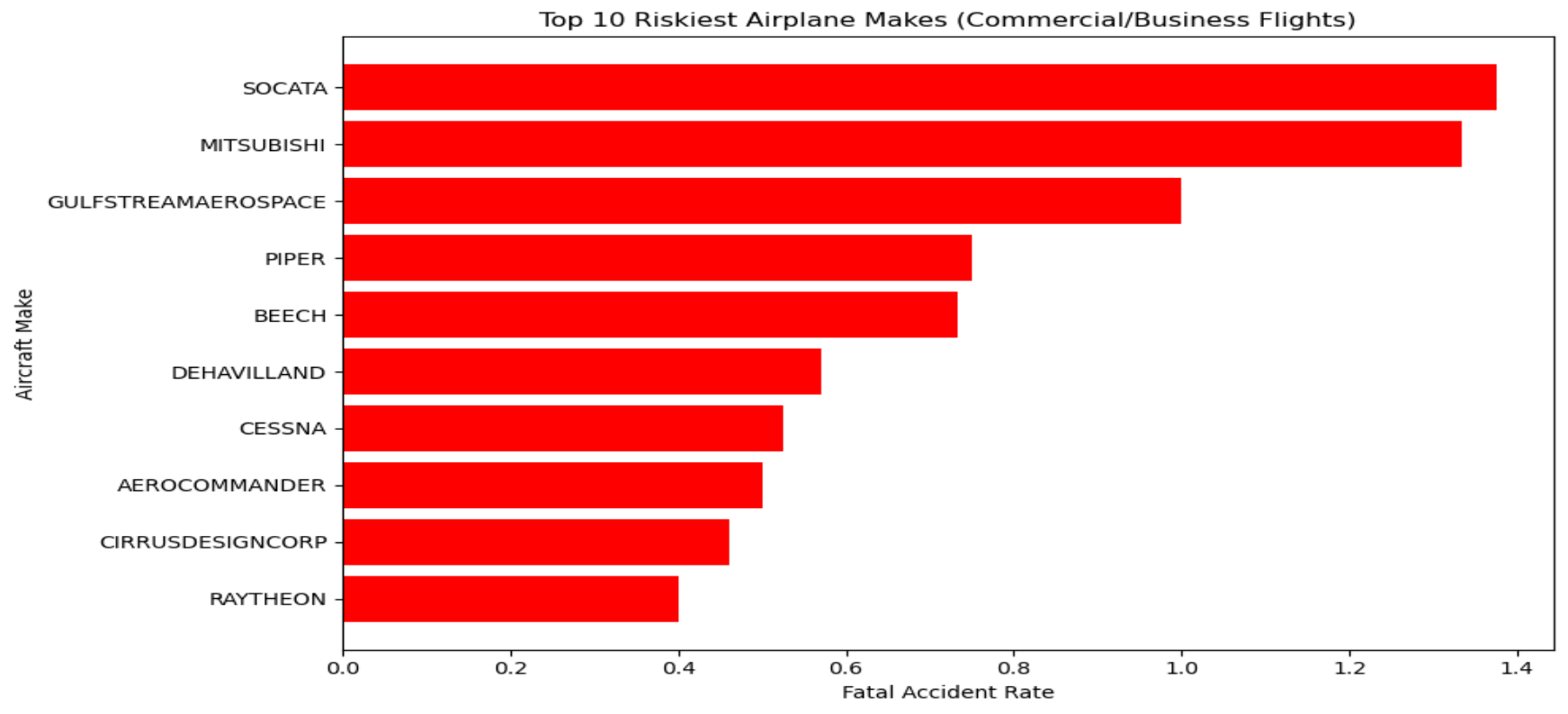

Goal 3:

What Aircraft models have the lowest risk for commercial ventures?

From the chart, Bellanca, and Rockwell aircraft exhibit the lowest fatal accident rates, indicating a strong safety record in commercial operations. Manufacturers such as Raytheon Aircraft Company and Mooney also maintain relatively low fatality rates, suggesting dependable safety outcomes.SOCATA and Mitsubishi pose the greatest operational risk for commercial ventures,

Conclusion and Recommendation

1. Based on the data, skydiving, firefighting, and executive flights show the highest risk of fatalities and aerial application activities demonstrate the least risk.
2. The data suggests that a single-engine setup might be more conducive to surviving adverse weather conditions. The larger volume of data for single-engine aircraft likely contributes to its higher accuracy. I believe the dataset lacked enough data for multiple engine planes.
3. Begin operations with Executive/Corporate or Small Business Charter aircrft, where accident frequency and fatality rates are lower.
4. For commercial ventures prioritizing safety, aircraft from Maule, Bellanca, and Rockwell represent the lowest risk choices in this dataset. Overall, consistent maintenance practices, pilot training, and operational oversight remain the key determinants of aviation safety, regardless of manufacturer.
5. Choosing aircraft with low fatality and damage rates helps reduce financial risk and improve profitability in commercial aviation.
6. Invest in pilot training programs, aircraft maintenance, and weather monitoring systems to make the airplane extra safe.