Aircraft Risk Analysis

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Project Overview

This project identifies the lowest-risk aircraft for the company's new aviation division by analyzing historical flight safety data. The aviation accident historical data is from the National Transportation Safety Board(NTSB) from 1962 to 2023 and its about civil aviation accidents and selected incidents in the United States and international waters. Through thorough data cleaning, imputation, and risk assessment, I transformed raw accident records into actionable insights to guide strategic purchasing decisions and minimize operational liability.

Business Problem

The organization is entering the aviation sector with no prior operational history, creating significant exposure to safety and financial liabilities. Without a data-driven understanding of aircraft reliability, the company risks investing in high-maintenance or accident-prone models. This project identifies aircrafts with the highest safety ratings and lowest historical risk profiles to ensure a secure market entry.

DATA UNDERSTANDING

The dataset initially contained 90,348 rows and 31 columns but after thorough data cleaning and feature engineering I eventually worked with 88860 rows and 20 columns.

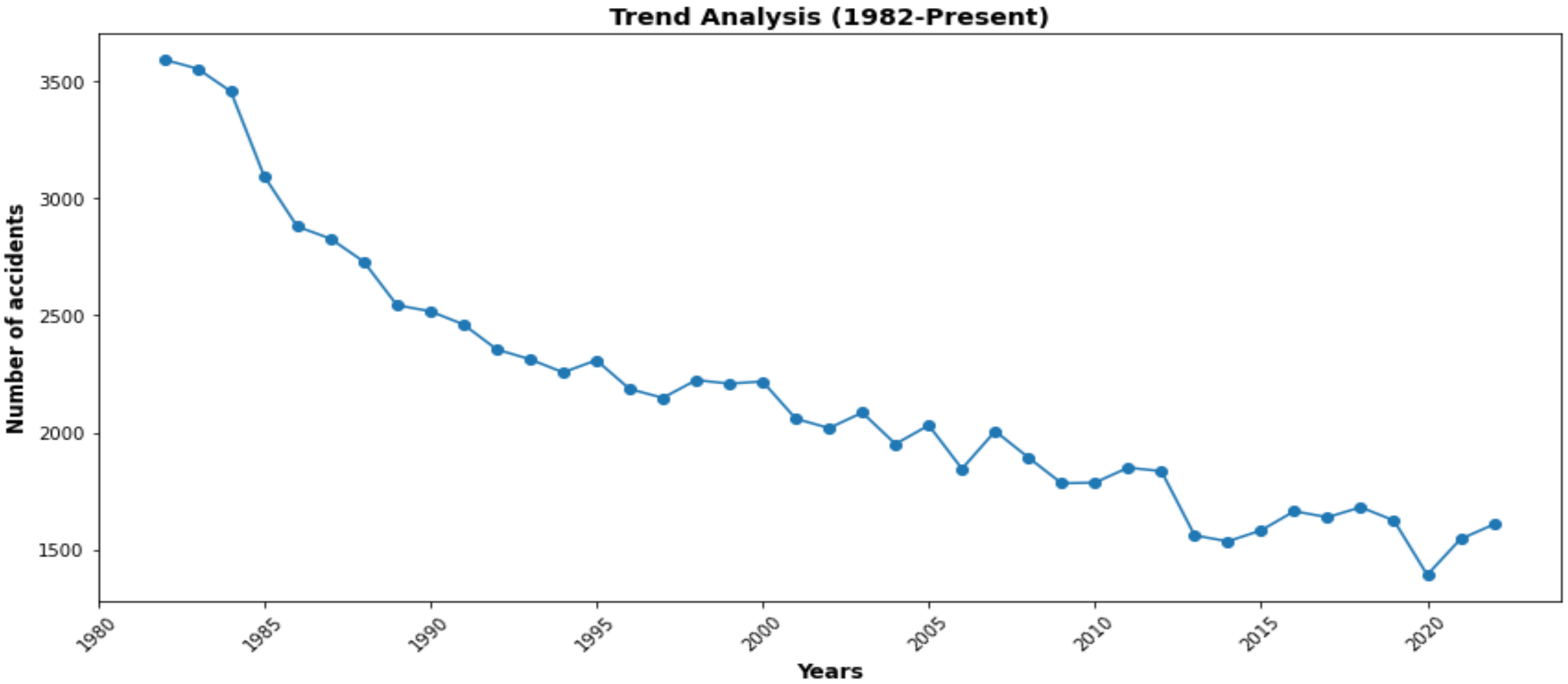
Project Analysis

OBJECTIVES

- To analyze the accidents trends over the years
- To identify which aircraft Make and Model present the highest survival rate
- To assess whether multi-engine aircraft improve survival chances during emergencies and to determine which engine type offers the highest level of safety
- To identify the best-performing aircrafts in adverse weather conditions
- To determine the Hull Loss Ratio in the case of an incident occurrence

DATA ANALYSIS

TREND ANALYSIS



Project Analysis

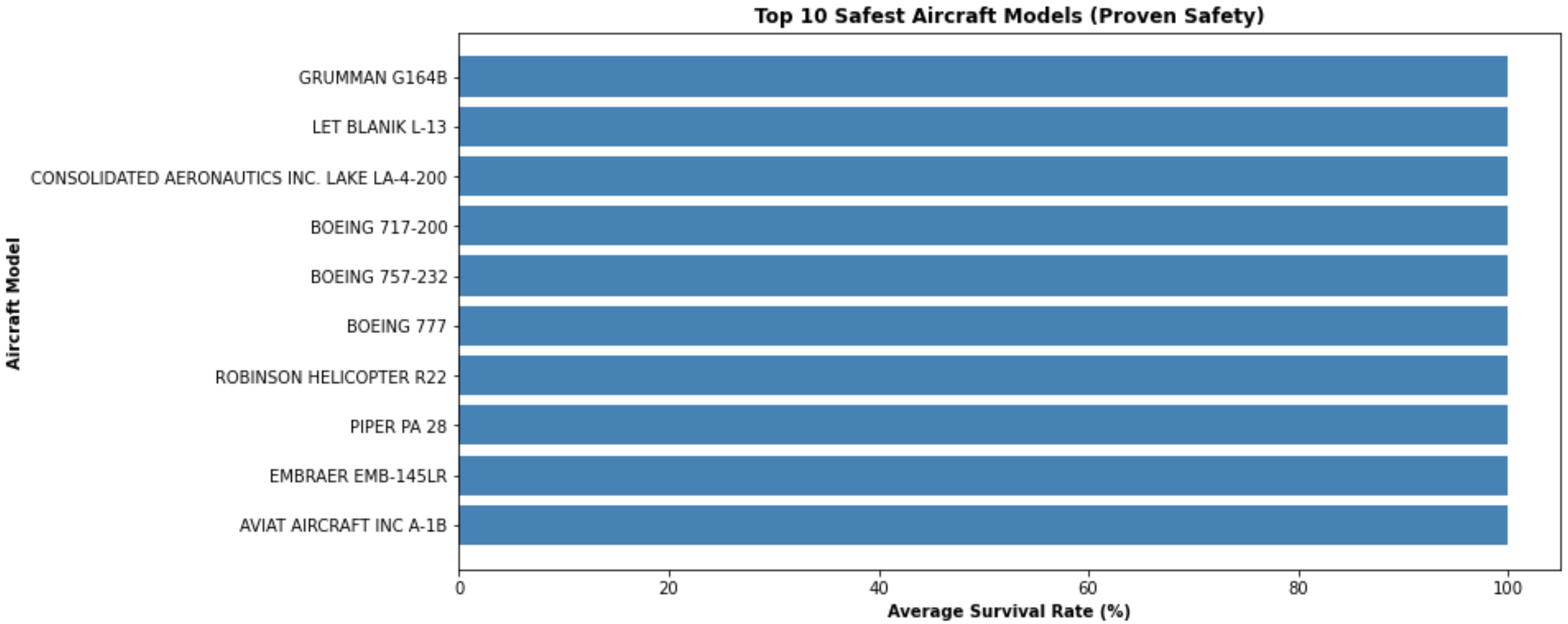
We can see that in the early 80s, there were nearly 3,600 accidents a year but that improved by 2020 and the number dropped significantly to roughly 1500.

Therefore, even though there are significantly more planes in the sky today than in 1982, the total number of accidents has dropped by more than **50%**.

This then confirms that the aircraft industry currently presents a sound investment opportunity.

Project Analysis

MAKE AND MODEL



Project Analysis

I recommend the **Boeing 717-200**, **757-232** and **777** series, as well as the **Embraer EMB-145LR**, for commercial operations.

For private use, the **Grumman G164B** is well suited for agricultural applications, while the **Consolidated Aeronautics Inc. LAKE LA-4-200** is an amphibious aircraft capable of both land and water operations, making it ideal for ecological surveys and personal transport.

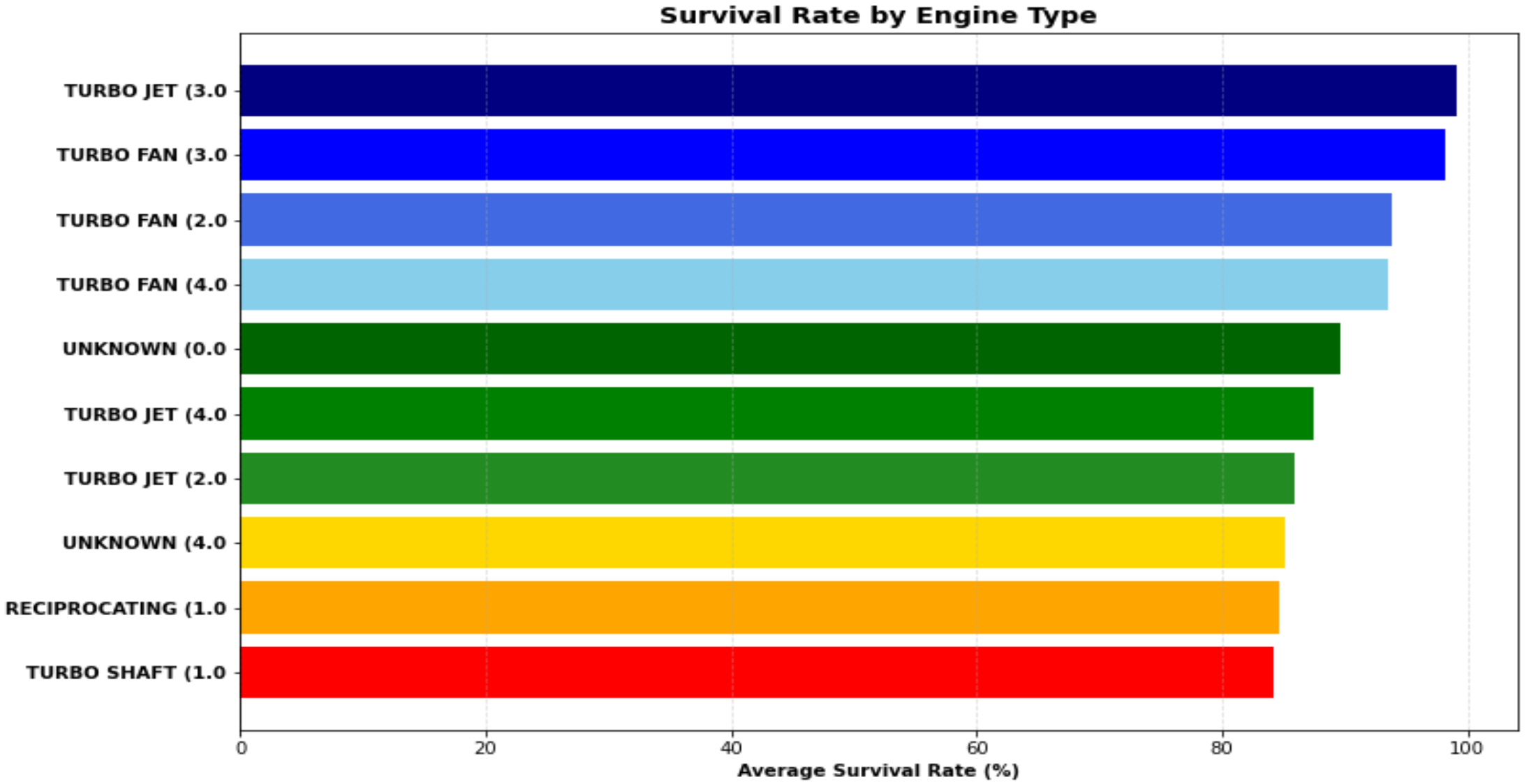
Project Analysis

The **Piper PA-28** and **PA-18** models are well suited for flight training, and the **Evektor-Aerotechnik AS SPORTSTAR** is suitable for both flight training and touring flights.

For bush flying and wildlife patrol missions, the **Aviat Aircraft Inc. A-1B** is a strong choice. In addition, the **LET BLANIK L-13** is recommended for gliding activities, while the **Robinson Helicopter R22** is an appropriate option in the helicopter category.

Project Analysis

ENGINE RELIABILITY



Project Analysis

I recommend a fleet strategy centered on **multi-engine** aircrafts powered by **Turbofan** or **Turbojet** technology. Multi-engine configurations provide critical redundancy, meaning that in the rare event of an engine failure, the aircraft maintains the thrust necessary to land safely. Furthermore, turbine-based engines (turbofans and turbojets) offer significantly higher mechanical reliability compared to older reciprocating engines, leading to the superior survival rates as observed in our data.

Project Analysis

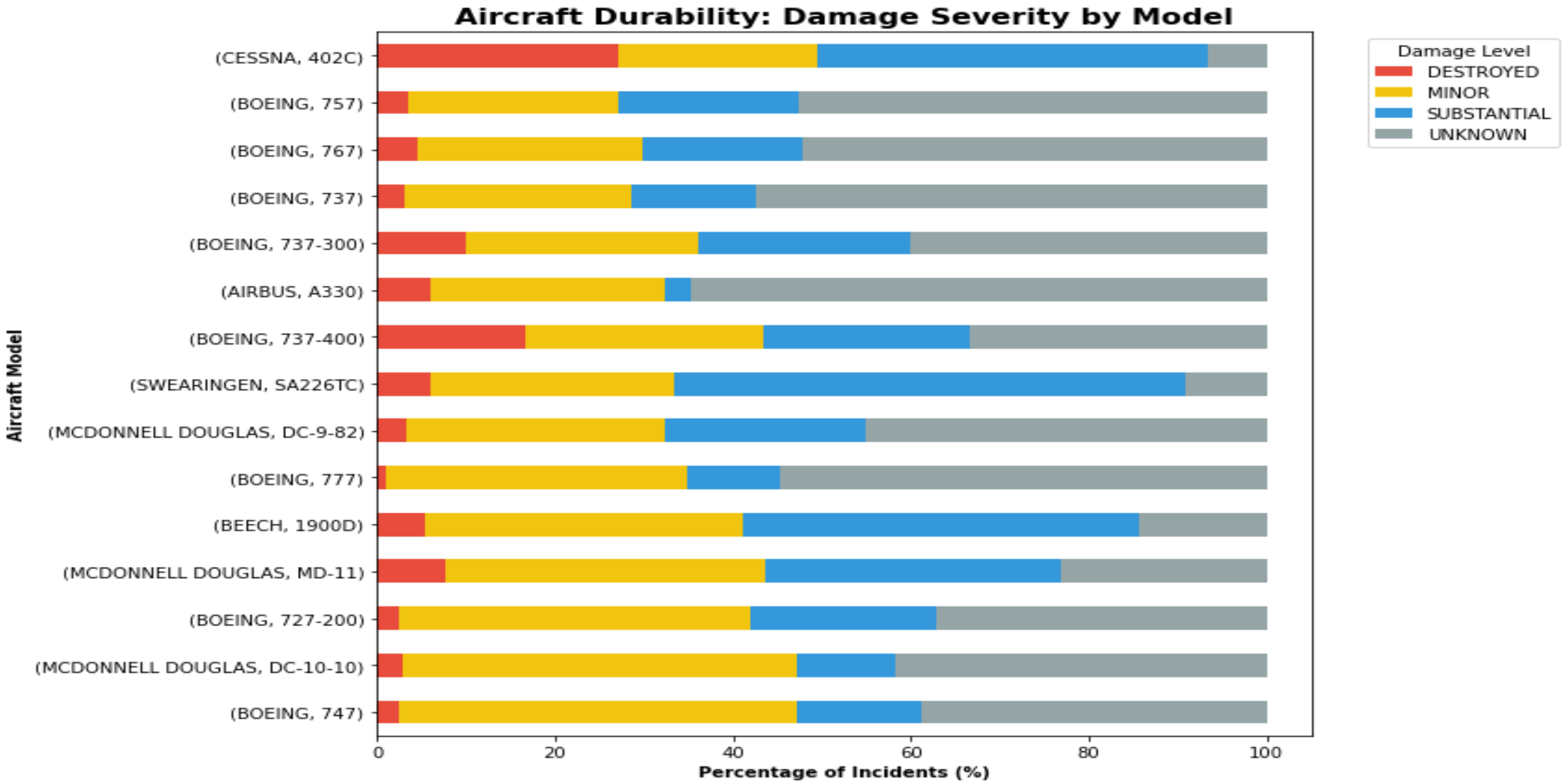
ADVERSE WEATHER RESILIENCE

Make	Model	IMC	VMC	IMC_Ratio	Survival.Rate
CESSNA	425	12	18	38.709677	63.741935
	414A	16	30	34.042553	67.595745
	414	31	56	32.978723	66.408602
BEECH	58P	21	44	31.343284	67.238806
CESSNA	340	22	42	30.985915	68.704225
	441	14	25	30.434783	59.600000
BOEING	737-200	16	24	30.188679	82.692308
CESSNA	340A	31	69	29.245283	59.714286
	T337G	9	21	29.032258	52.677419
PIPER	PA-31T	12	27	28.571429	57.666667

We can establish that the **Boeing 737-200** performs well in bad weather and equally has a high survival rate.

Project Analysis

HULL LOSS RATIO



Project Analysis

Based on the analysis, I highly recommend the **LET Blanik L-13** and **Boeing 777** due to their elite survival rates and minimal hull loss ratios. For cargo operations, the **McDonnell Douglas DC-10-10** and **MD-11** demonstrate strong safety performance with low attrition rates. Additionally, the **Boeing 757** is an ideal candidate for fleet modernization, as it offers superior safety metrics compared to the **727-200** models it was designed to replace.

CONCLUSION

This analysis provides a data-validated roadmap for a secure, low-risk market entry. Our research confirms that modern technological advancements have fundamentally shifted the safety landscape. By prioritizing **multi-engine aircraft**, we gain a critical layer of redundancy that effectively eliminates single-point engine failures. Furthermore, the superior reliability of **turbofan and turbojet** technology makes them the only logical choice for a safety-first fleet. Of course, the hardware is only half the story—our strategy also anchors on **operational excellence**, relying on rigorous pre-flight protocols and elite pilot expertise to ensure every mission is a success.


Thank You

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