DATA DRIVEN INSIGHTS FOR SAFER AVIATION INVESTMENT

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Overview

Huru Capital Investments Group is a Venture Capital firm with a presence in the construction, real estate and logistics sector in the United States of America.

Strategic Goal: Diversification of investment - Expansion into the aviation sector

Drivers: Expected growth in regional and international air transport.

Strategic Focus: Minimise operational risk and maximise safety

Project Objective

- Identify low risk aircraft makes and models.
- Understand how design and operational factors influence accident outcomes
- Guide data backed investment decisions

Problem Statement and Stakeholders

Problem Statement

- Lack of internal expertise on the potential risks of aircraft.
- Financial and reputational risk of aviation accidents

Stakeholders

- Aircraft manufacturers
- FAA and aviation authorities
- Pilots and flight schools
- Insurers

Data Overview

Data Source: National Transportation Safety Board Database US

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

Dataset Size: 87,000+ records from 1962 to 2023

Key Features: Make/Model, Aircraft Category, Weather, Injuries, Aircraft Damage, Number of Engines, Type of Engines, Amateur Built Status

Methodology

CRISP-DM Framework

1. Business Understanding
2. Data Understanding
3. Data Preparation
4. Exploratory Data Analysis with Findings
5. Recommendations
6. Next Steps

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Data Preparation

Output:
Cleaned_Aviation_Data

Steps Taken:

- Removed nulls and irrelevant columns
- Corrected data types eg Event Year to datetime
- Standardised the categorical data eg Make, Model
- Feature Engineering : Year, Fatality Rate etc

Exploratory Data Analysis

Univariate Analysis Findings

- The dataset is primarily focused on major aircraft events(accidents - 95.67%)
- Majority of records are from United States of America
- Most aircraft were of the general aviation use with single reciprocating engines and factory built(90.63%)
- The Cessna make was the highest occurring in the dataset
- Most accidents occurred under good weather (VMC), and damage to aircraft was often substantial or total destruction.
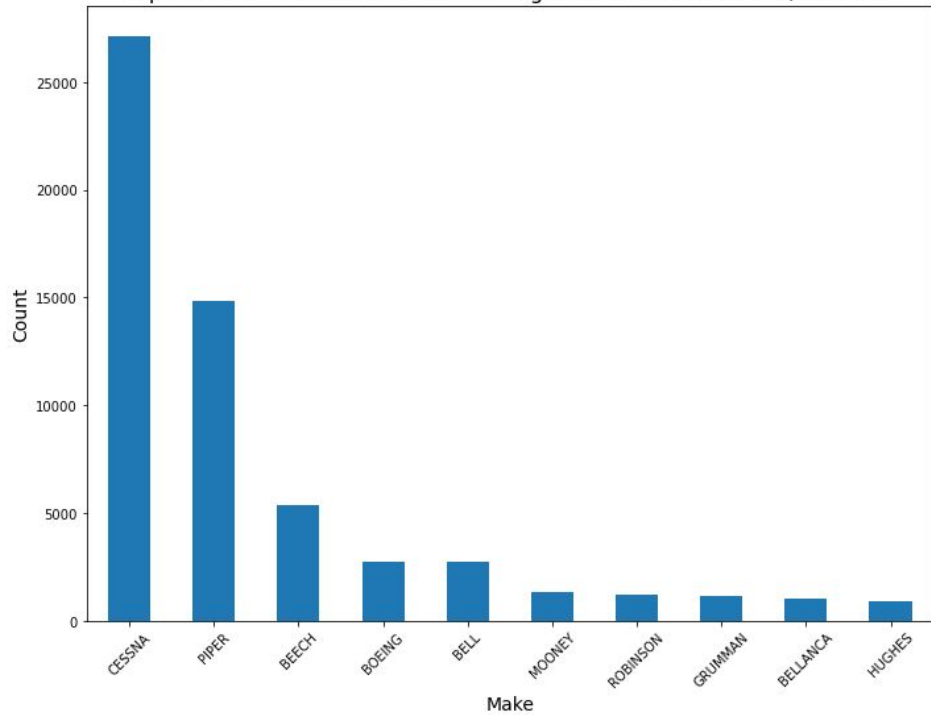
Classification of Type of Investigation by Count

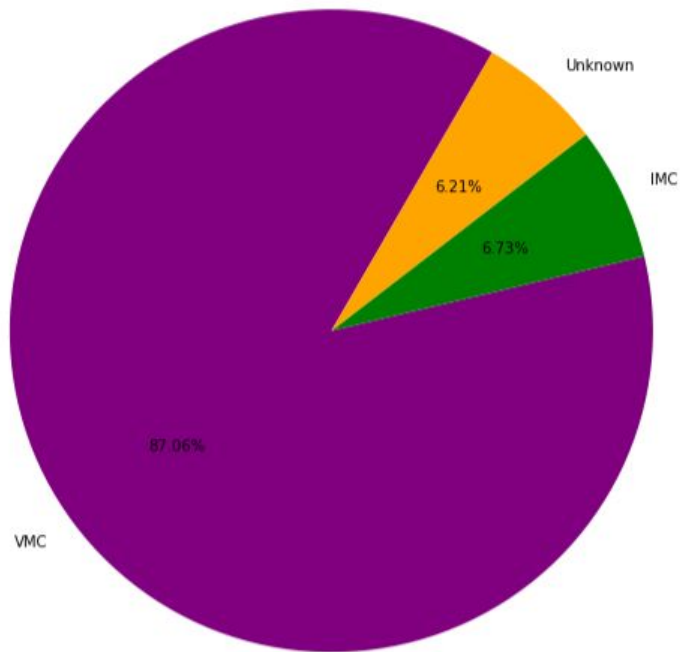Incident
4.33%

95.67%
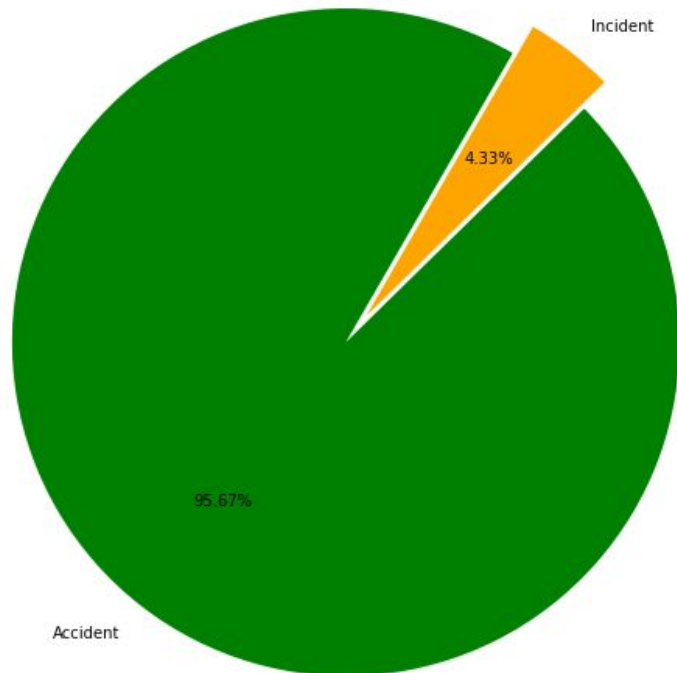
Accident

Top Ten Countries with Highest Aviation Accidents/Incidents
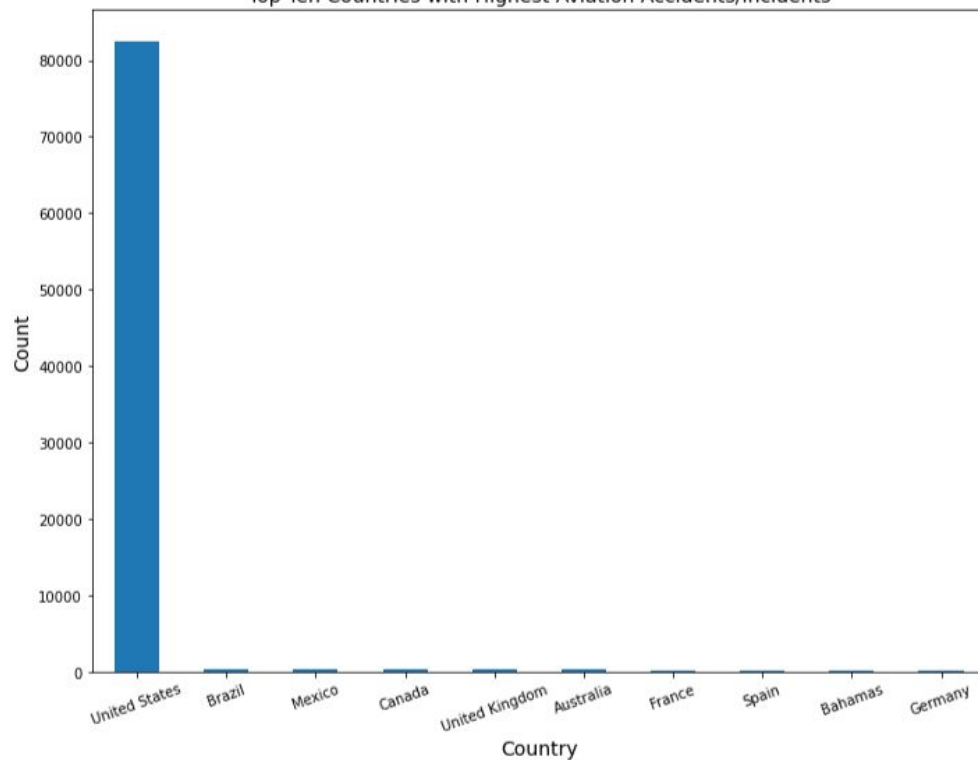
Top Ten Aircraft Manufacturers with Highest Aviation Accidents/Incidents

Classification of Weather Conditions by Count

Bivariate Analysis Findings

- Fatal events are almost exclusively reported as formal accidents
- IMC weather conditions are riskier overall, with a greater likelihood of a fatal outcome when an accident occurs
- Amateur built aircraft have a noticeably higher rate of fatal accidents compared to factory built aircraft
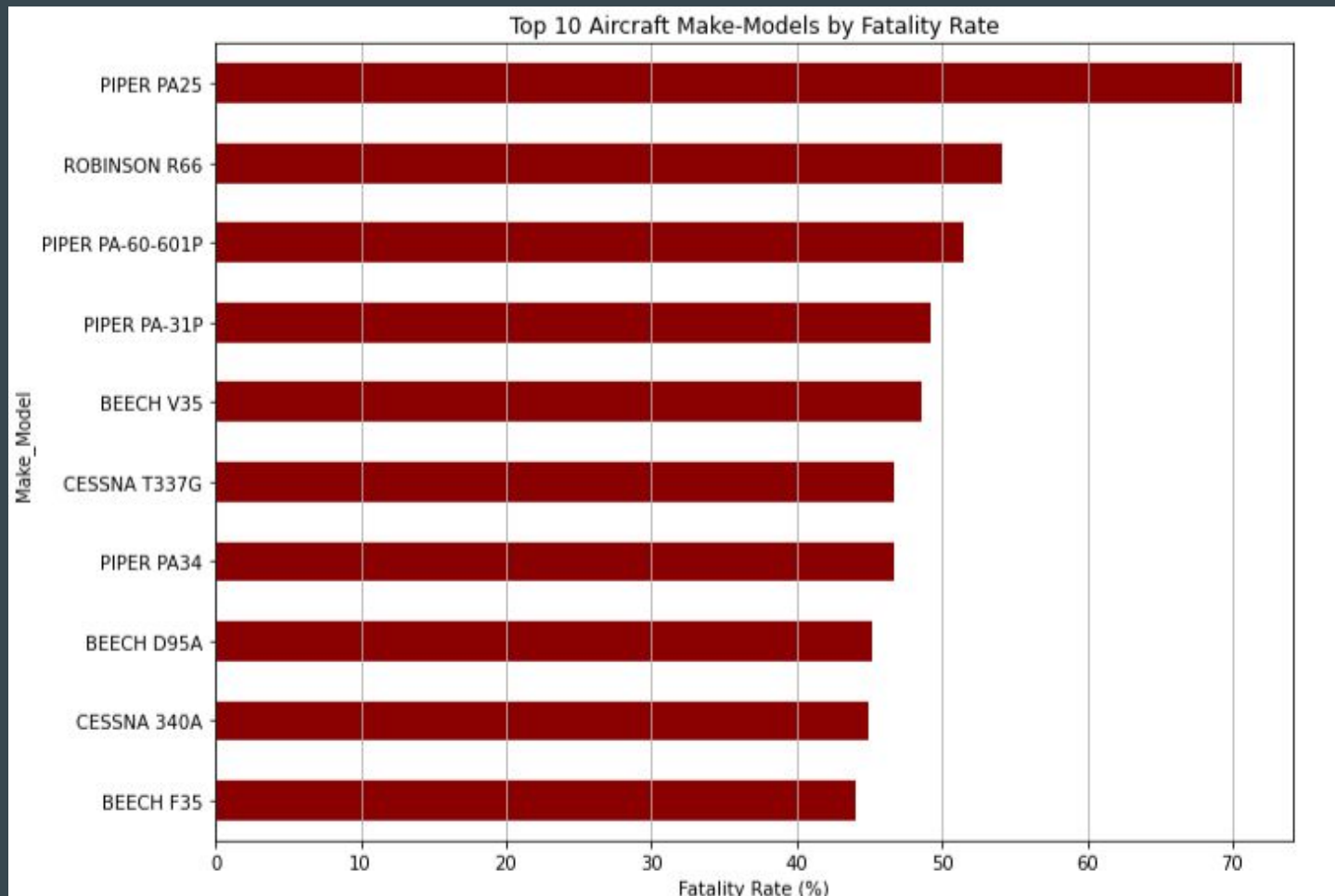
% of Fatal Accidents Over Time
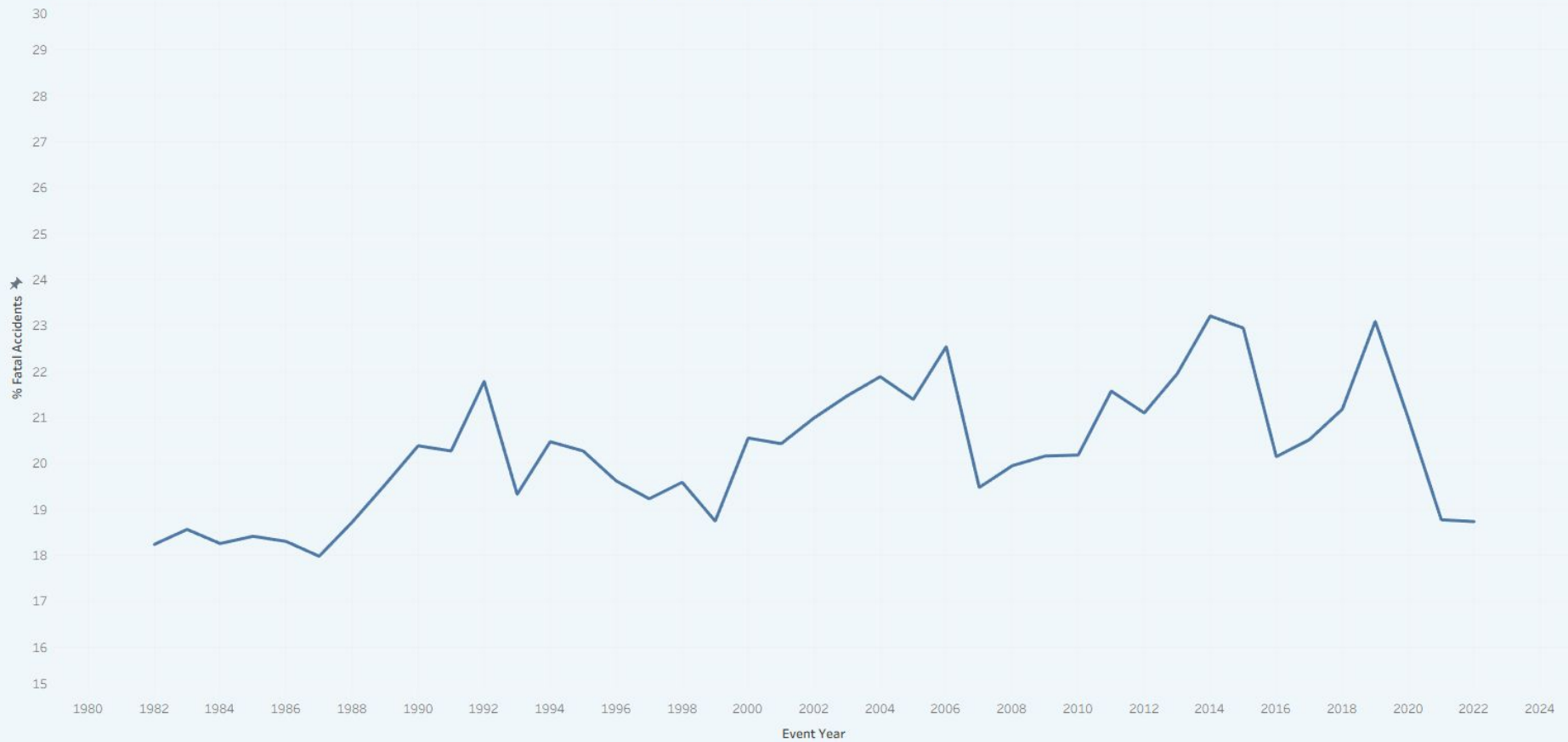
Aviation accidents from 1982 to 2023 range between 18-25% fatalities signaling improved safety protocols and survivability.

Distribution of Fatal Accidents by Aircraft Category
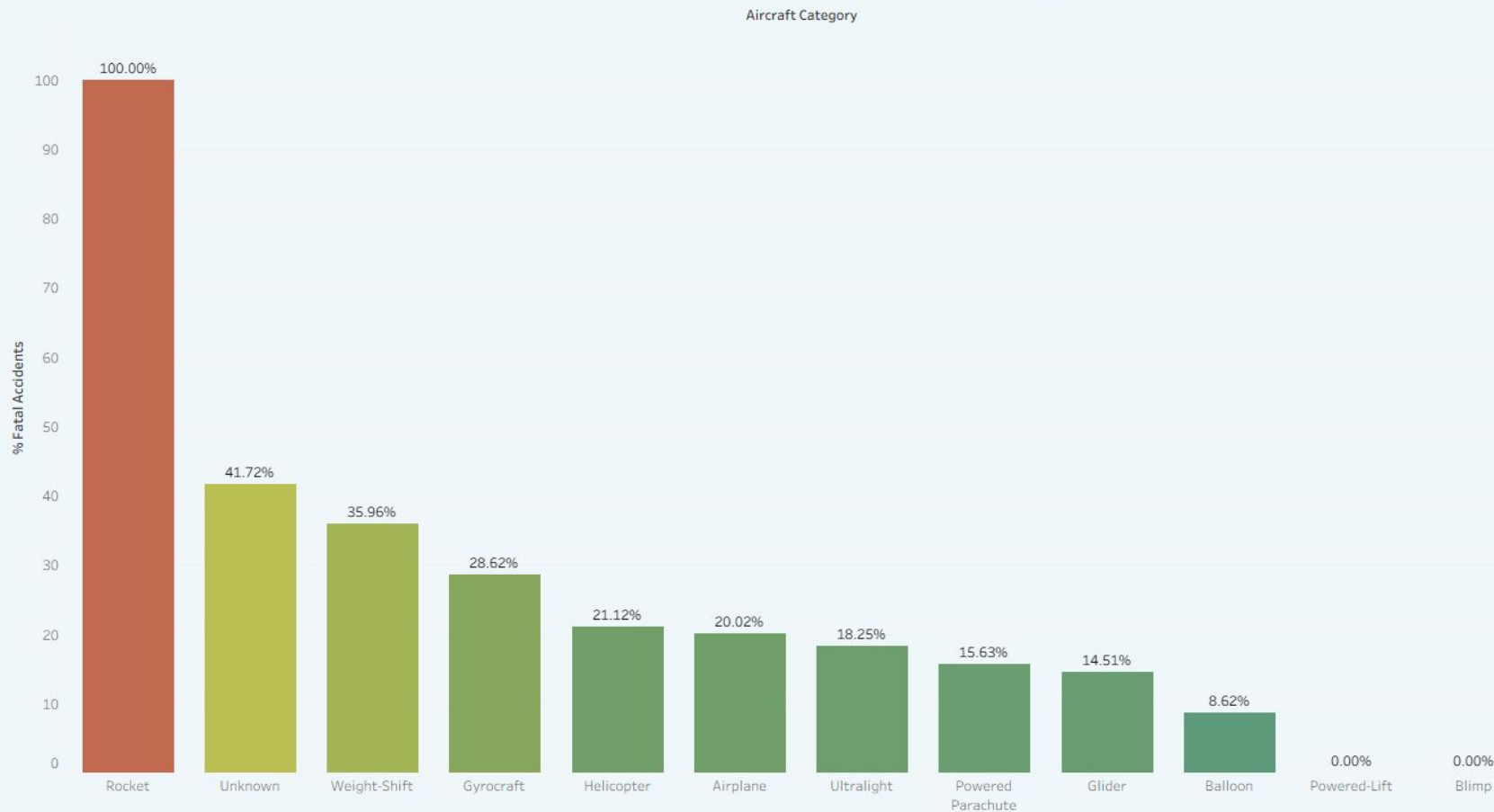
Relatively high fatality rates in general aviation aircraft manufacturers

Top 10 Aircraft Make-Models by Fatality Rate

Piper, Beech and Cessna models of aircraft dominate the list of high fatalities, many of which are high-performance general aviation planes
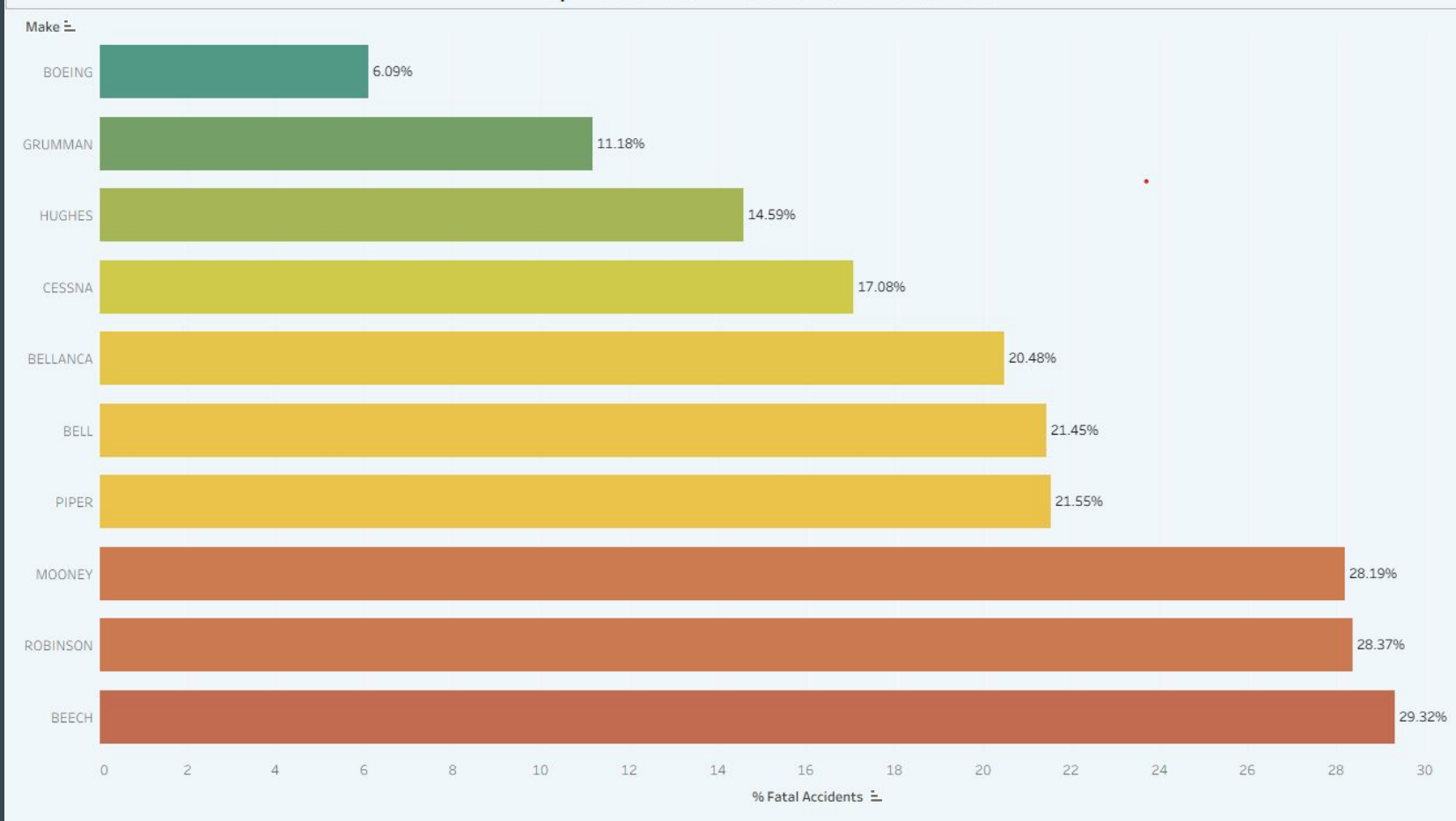
Multi Variate Insights

- Optimal weather conditions do not fully mitigate risk when the aircraft sustains major damage.
- Combinations of aircraft with 1 engine had higher fatalities

Top 10 Safest Aircraft Manufacturers

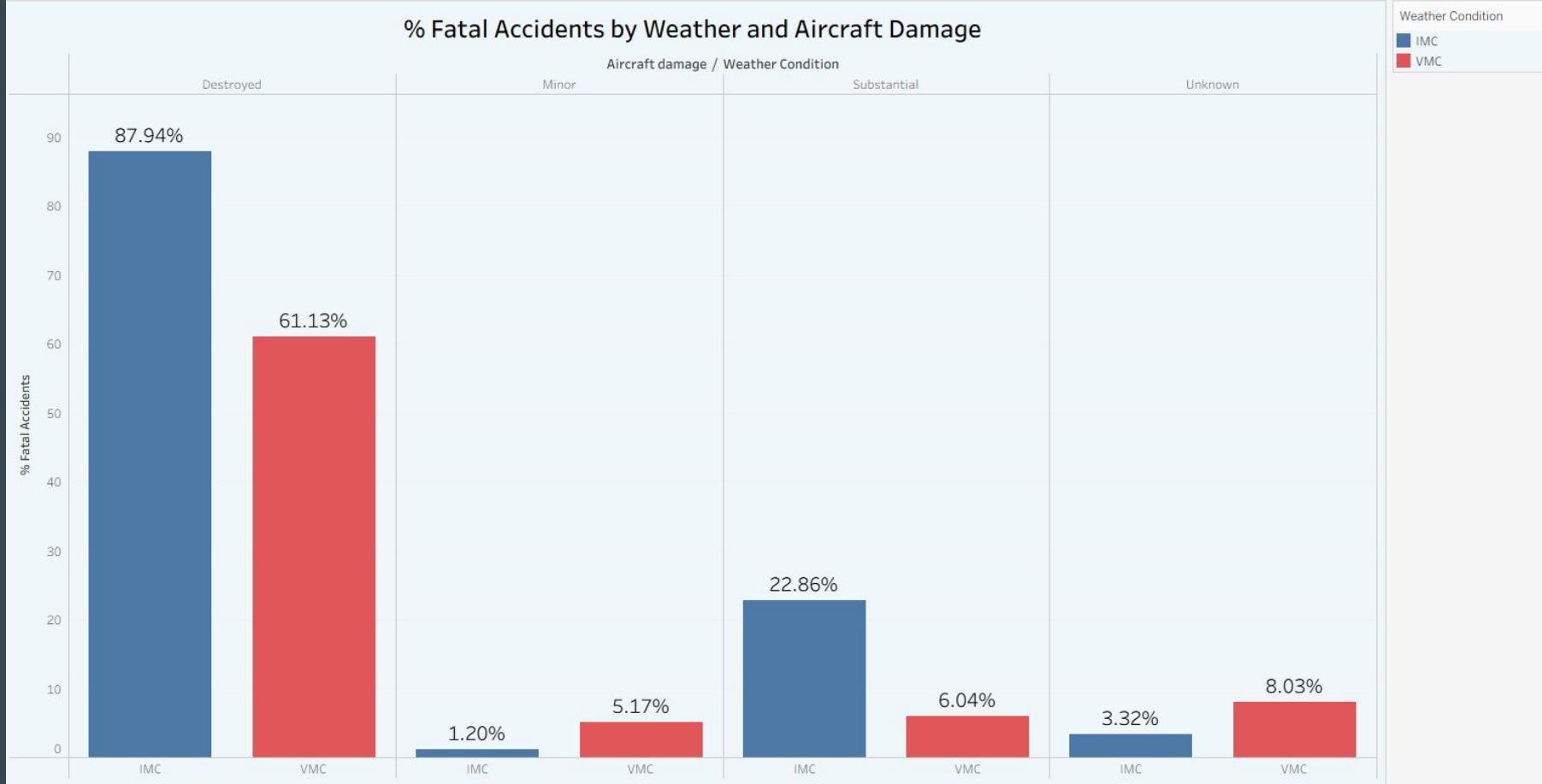| Make	% Fatal Accidents
BOEING	6.09%
GRUMMAN	11.18%
HUGHES	14.59%
CESSNA	17.08%
BELLANCA	20.48%
BELL	21.45%
PIPER	21.55%
MOONEY	28.19%
ROBINSON	28.37%
BEECH	29.32%

Boeing (commercial aircraft), Grumann (military aircraft) and Hughes are the top 3 safest aircraft manufacturers.

% Fatal Accidents by Make and Amateur Built

Make

Amateur Built
- No
- Yes

Make	Yes	No
BEECH	37.50%	29.30%
BELL	47.37%	21.24%
BELLANCA	20.00%	20.48%
BOEING	7.14%	6.09%
CESSNA	26.19%	17.03%
GRUMMAN	20.00%	11.14%
HUGHES	33.33%	14.53%
MOONEY	33.33%	28.15%
PIPER	20.45%	21.51%
ROBINSON	55.56%	28.11%
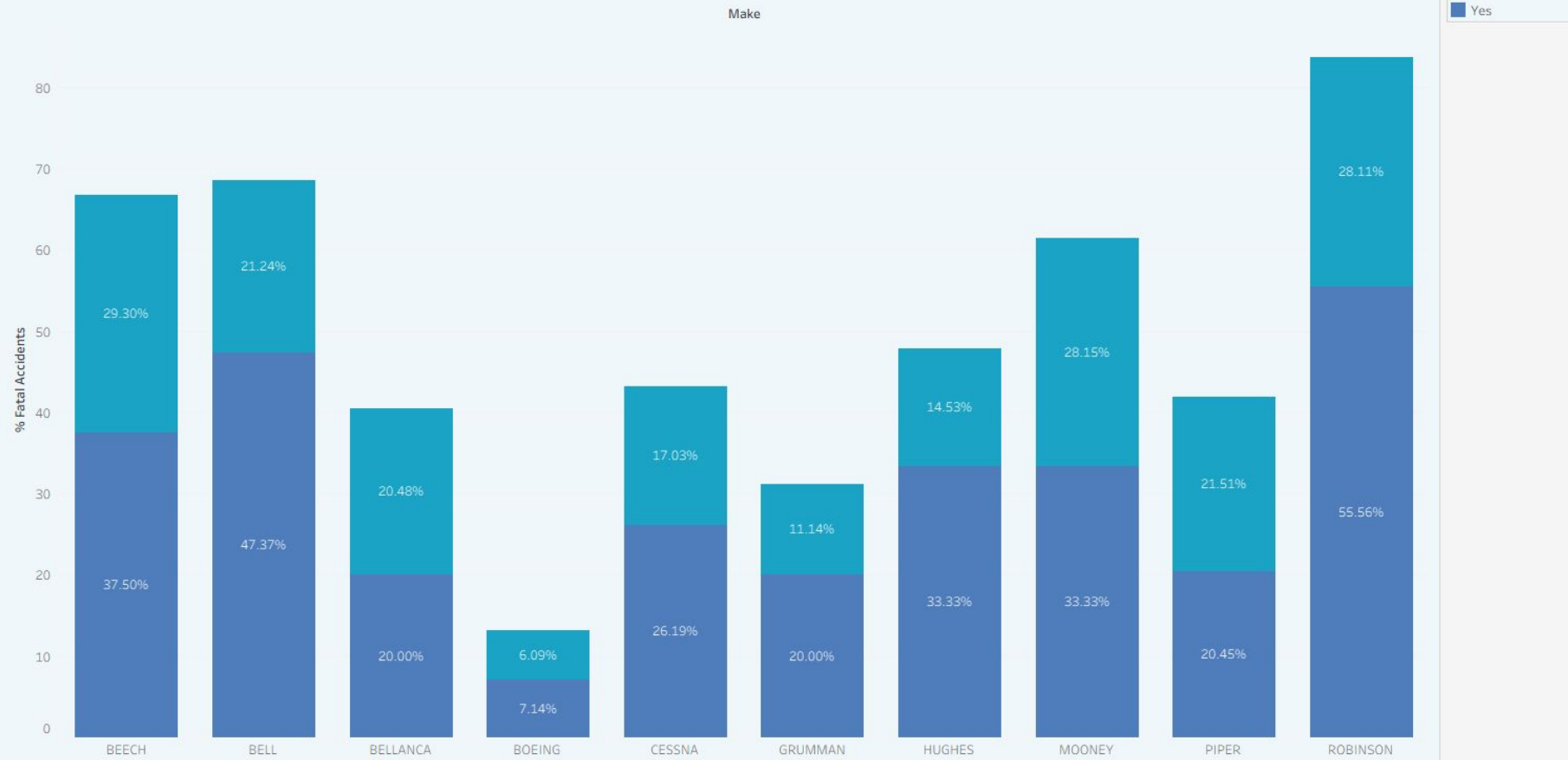
Factory-built aircraft had significantly lower fatality rates compared to their amateur-built models.

% Fatal Accidents by Weather and Aircraft Damage

Fatal Accidents still occurred under Visual Meteorological Conditions (VMC) suggesting that visual weather conditions do not fully mitigate risk when the aircraft sustains major damage.

Recommendations

- Prioritize investment in aircraft makes with historically low accident and fatality rates such as Boeing, Grumann and Hughes
- Develop a risk scoring framework for top fatal aircraft models and either avoid or subject these aircraft to enhanced inspection, pilot training or operational limits
- For commercial/high value operations, prioritize investing in certified factory built aircraft
- Prioritize multi engine aircraft for low visibility weather conditions and invest in pilot training in these conditions.

Limitations and Next Steps

Limitations

- Majority of data (92%) was from the US
- No pilot experience metrics
- Lack of operating environment information

Next Steps

- Analysis of aircraft costs, age of fleet and Maintenance history
- Final shortlist for acquisition

THANK YOU

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