AIRCRAFT SAFETY PERFORMANCE METRICS.

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INTRODUCTION

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Business context

This analysis uses aviation accident data to provide insights for improving safety, reducing costs, and enhancing aircraft performance. Key variables in the dataset include:

- **Flight Phase:** Identifies accident occurrences during different stages of flight (takeoff, landing, etc.), helping target safety improvements.

- **Aircraft Make:** Highlights patterns related to specific aircraft types, informing design and safety improvements.

- **Injury Severity:** Provides insight into the effectiveness of safety measures and areas for improvement.

- **Accident Location:** Helps identify regional safety issues and environmental factors influencing accidents.

- **Aircraft Damage:** Indicates the level of damage, guiding better maintenance and design practices.

OBJECTIVES

Here are the main objectives of the dataset:

1. **Improve Safety**
    - Identify how weather conditions causes damage to the aircraft damage and the severity of the injury to the patients to enhance safety protocols.
2. **Optimize Operations**
    - Analyze the number and type of engine and how effective it was built to optimize the running of operations.
3. **Assess Financial loss Impact**
    - Understand which aircraft make, the purpose of the flight and the total injuries to see accident-related flights cost which passengers and mitigate them.
4. **Enhance Marketability**
    - Evaluate which flights , going to which countries will we have to start marketing with reduced accidents.

KEY PERFORMANCE INDICATORS

This section outlines the **Key Performance Indicators (KPIs)** and the corresponding **key variables** used to measure success in the four critical areas of this analysis:

Safety	• Total injuries • Weather condition • Aircraft damage
Operational performance	• Number of engines • Total uninjured • Amateur Built
Financial costs	• Aircraft make • Purpose of flight • Total injuries
Marketability	• Purpose of flight • Country • Injury severity

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METHODOLOGY

Methodology for Data Processing

The data processing methodology consists of several key steps:

1. Data Structure Overview

- **Objective:** Understand the dataset's structure by examining rows, columns, and data variables.
- **Process:** Loaded the dataset, checked the shape, and identified column variables   and inconsistencies.

2. Data Cleaning

- **Objective:** Prepare data for analysis by handling missing values and irrelevant columns.
- **Process:** Addressed missing data through imputation by mode and mean and removal of irrelevant columns.

3. Descriptive statistics

- Objective: Summarize the data to understand its distribution.
- Process: Generated summary statistics and frequency counts. Found the range between the numerical columns

4. Feature engineering

- **Objective:** Enhance the dataset by creating new variables.
- **Process:** Created new features like total injuries with the highest injury count this transformed and scaled thevariables for better analysis.

EXPLORATORY DATA ANALYSIS

1. Univariate Analysis:

Objective: Explore individual variables.

Methods: Used **histograms** for continuous variables and **bar charts** for categorical variables to visualize distributions and detect outliers.

2. Bivariate Analysis:

Objective: Examine relationships between two variables.

Methods: Used **scatter plots** for continuous-variable relationships and **boxplots** to compare continuous variables across categories.

3. Multivariate Analysis:

Objective: Analyze relationships between multiple variables.

Methods: Used **pair plots** and **heatmaps** to visualize correlations across multiple variables.

Correlation Heatmap
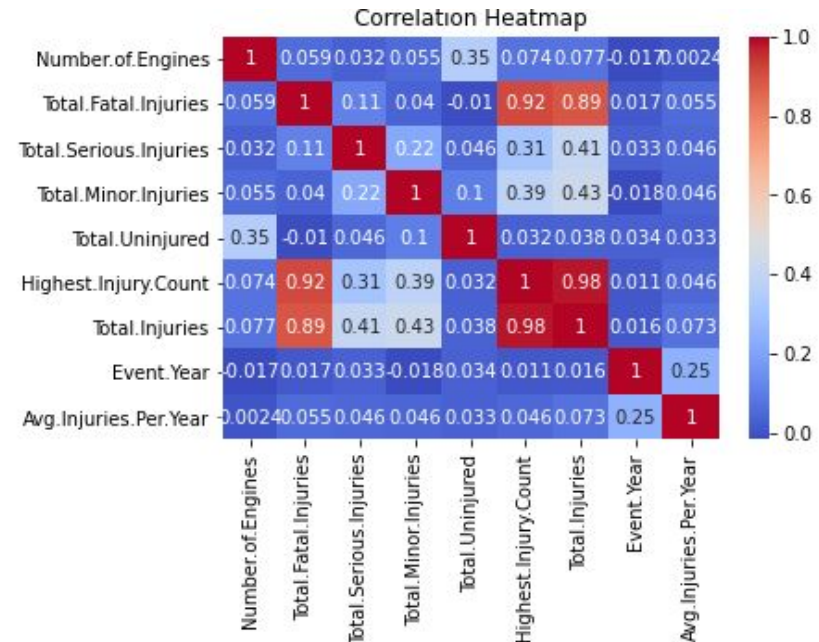
03

KEY FINDINGS

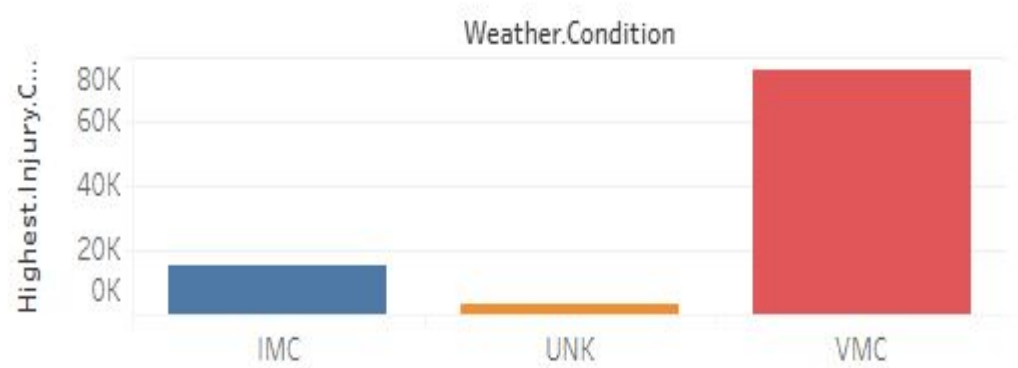## 1.1 SAFETY

WEATHER CONDITION VS HIGHEST INJURY COUNT

1.1.1 WEATHER CONDITIONS TO INJURY COUNTS.

- **Weather Correlation**: VMC weather conditions lead to more injury counts than IMC and UNK in turn significantly impacting both the frequency and severity of accidents. Although accidents may be more frequent in VMC conditions, IMC conditions cause more serious injuries per accident due to the increased dangerous weather conditions and reduced control over aircraft control..

1.1.2 NUMBER OF ACCIDENTS OVER TIME.

- **Trends**: From 1980 to 2007, the number of accidents fluctuated, with periodic increases and decreases,.
- **Post-2007 Decline**: After 2007, the number of accidents showed a gradual decline.

TOTAL INJURIES OVER THE YEARS

1.2 FINANCIAL

1.2.1 AIRCRAFT DAMAGE TO THE TOTAL NUMBER OF INJURIES.

- Aircraft with **destroyed damage** typically have more incidents because these are often the result of **total loss of the aircraft**. In contrast,**substantial** also has a high rate of accidents due to a good amount of aircraft damage while **minor** damage typically involve less severe accidents..

1.2.2 PURPOSE OF FLIGHT. TO UNINJURED PASSENGERS.

- .Personal flights had the highest number of uninjured passengers compared to other flights. This is likely due to their smaller aircraft, less severe incidents, and well operation in controlled conditions, resulting in fewer injuries overall.

AIRCRAFT DAMAGE VS TOTAL NUMBER OF INJURIES

Aircraft.damage

PURPOSE OF FLIGHT VS TOTAL UNINJURED

Purpose.of.flight
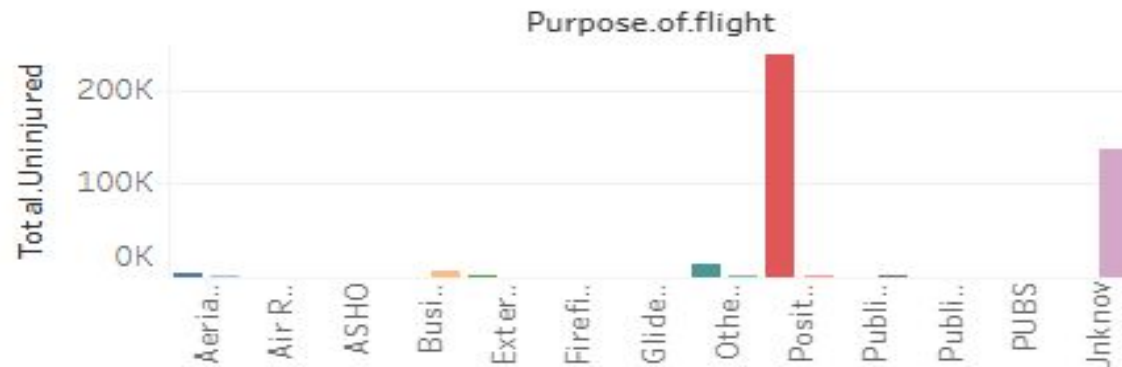
1.3 OPERATIONAL

1.3.1 ENGINE TYPE TO TOTAL NUMBER OF INJURIES.

- Reciprocating engine aircraft have the highest number of accidents due to their **widespread use** in general aviation, frequent operation by **less experienced pilots**, and challenges in **uncontrolled airspace**. Additionally, their **smaller size** and lack of modern safety features make them more prone to incidents.
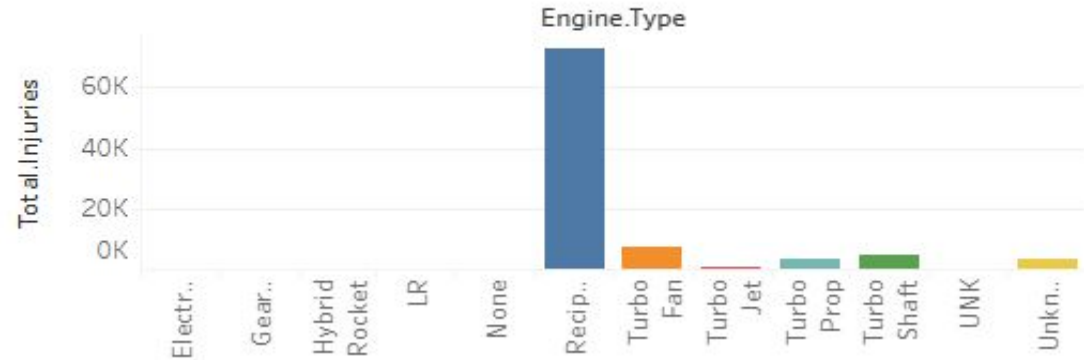
1.3.2 PHASE OF FLIGHT TO TOTAL INJURED

- Most aircraft accidents occur during landing due to the **technical demands** of precise control, **challenging conditions** like wind or poor visibility, and the potential for **pilot errors** or **mechanical failures**. High traffic at airports also increases the risk.

ENGINE TYPE VS TOTAL NUMBER OF INJURIES

PHASE OF FLIGHT VS TOTAL INJURIES
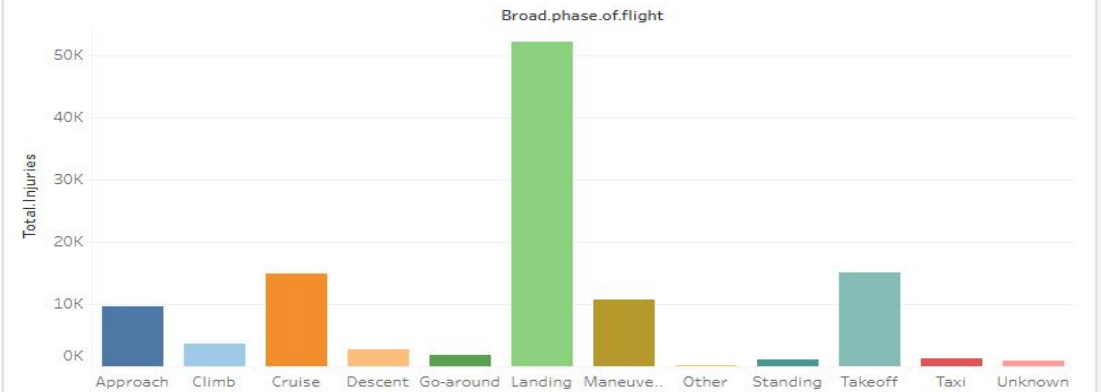
1.4 MARKETABILITY

1.4.1 COUNTRY TO TOTAL NUMBER OF INJURIES.

- The USA has the highest number of injuries because of its **large and active aviation sector**. Additionally, the USA has extensive **general aviation activities**, including training and recreational flights, which often involve smaller aircraft and less experienced pilots, increasing the risk of injuries.

1.4.2 PURPOSE OF FLIGHT TO TOTAL NUMBER OF UNINJURED
- Personal flights had the least number of injuries because they involve **smaller aircraft**, **more experienced pilots**, and **fewer passengers**. These flights are typically shorter and operate in controlled environments, resulting in less severe incidents and fewer injuries.

PURPOSE OF FLIGHT VS TOTAL UNINJURED
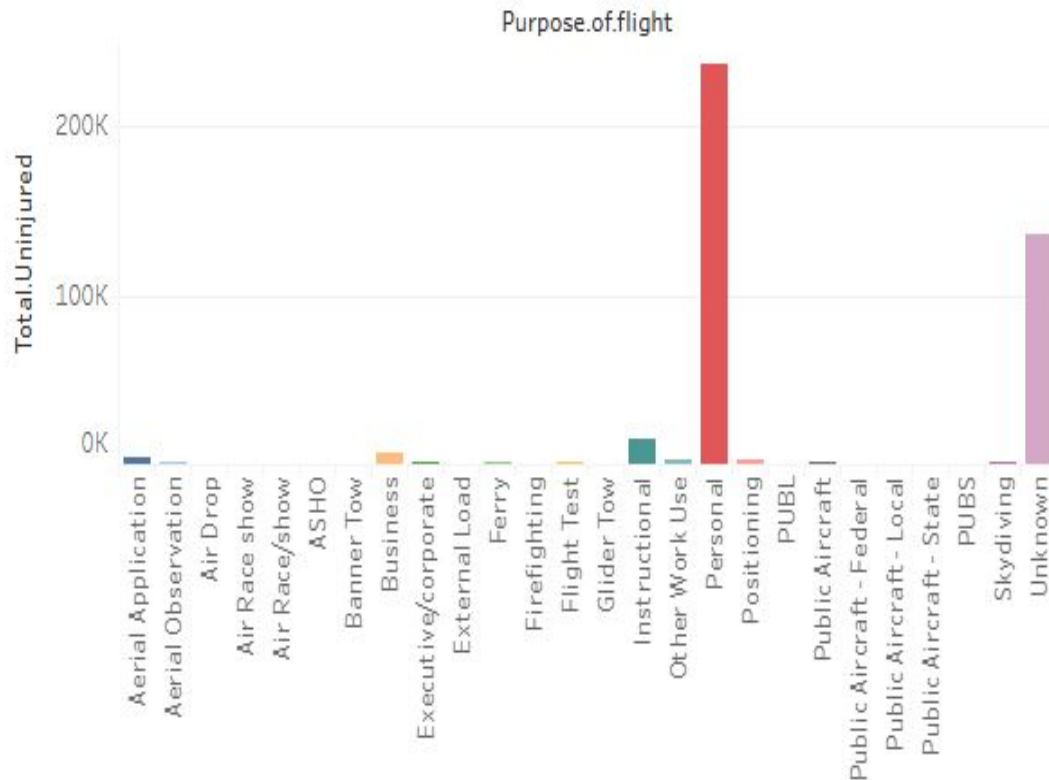
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Action Plan

RECOMMENDATIONS BASED ON OUR METRICS

The following describes the recommendations that we can put into practice based on our findings from the metrics:

1. SAFETY

- **Enhance Training**: Offer regular safety training for pilots during rough weather conditions..
- **Strengthen Risk Management**: Conduct safety audits and identify any engine hazards before flying.
- **Improve Reporting**: Create a clear system for reporting safety incidents to be able to figure out problems faster and solve them just as fast.

2.FINANCIAL

- **Optimize Revenue**: Identify high-performing aircraft engines and invest in those for flying..
- **Control Costs**: Regularly review of engines to see how well they are built to reduce expenses.
- **Use Analytics**: Leverage the data science team to help make financial decisions.

3.OPERATIONAL

- **Engine Type vs. Total Number of Injuries**: Multi-engine aircraft tend to have fewer injuries compared to single-engine aircraft, highlighting the safety benefits of using more reliable engine configurations.
- **Phase of Flight**: The highest number of injuries occur during the takeoff and landing phases, emphasizing the need for enhanced safety pr

4. MARKETABILITY

- **Refine Branding**: Creating a brand for commercial and private flights that have a reputation of not having alot of accidents.
- **Targeted Marketing**: Use data-driven decisions to help make decisions that will improve the safety of the aircraft performance in different countries

INVESTMENT PLAN

This are some of the investment strategies that the company should look into before investing in the aircraft industry.

1. Safety Investments

- Invest in aircrafts like Cessna, Piper and Bollanda that have demonstrated a consistent reduction in accidents over time, this signals improved safety protocols and operational excellence.
  Recommendation: Focus on airlines or operators with a strong safety track record and continuous safety improvements through modern technology and risk mitigation strategies.
- Given the impact of adverse weather on accident rates, investing in aircraft companies that incorporate advanced weather forecasting systems and onboard safety technologies is crucial.
  Recommendation: Support operators utilizing predictive weather analytics and enhanced navigation systems to minimize the risk of accidents due to weather conditions.

2. Financial Investments

- Frequent high-damage incidents lead to increased repair costs and potential loss of aircraft value.
  Recommendation: Prioritize investments in aircraft with lower incident rates and better maintenance practices, reducing financial exposure to damage.
- Aircraft from reputable manufacturers typically have lower maintenance costs and higher resale value.
  Recommendation: Invest in operators using well-established, reliable aircraft makes that have a proven track record of low operational costs and high resale value.
- Commercial and private flights tend to be more financially stable due to high demand and consistent schedules.
  Recommendation: Focus on airlines operating primarily commercial flights and commercial, as these generate consistent revenue. Also, consider cargo operations or specialized flight services that provide diversified income streams.

INVESTMENT PLAN

This are some of the investment strategies that the company should look into before investing in the aircraft industry.

3. Operational Investments

- Multi-engine aircraft are generally safer and less prone to accidents during emergencies, leading to fewer injuries. Single-engine aircraft have a higher risk of fatal incidents.
  Recommendation: Invest in operators utilizing multi-engine aircraft, which offer higher safety margins and are more likely to reduce the number of injuries in emergencies.
- Certain flight phases, particularly takeoff and landing, are more accident-prone. Companies that focus on safety during these critical phases are likely to have fewer injuries.
  Recommendation: Support airlines with comprehensive training programs and safety protocols focused on high-risk flight phases, ensuring fewer accidents and injuries during takeoff and landing.

4.Marketability Investments

- Airlines catering to private and commercial flights and specialized markets like, cargo transport, medical flights are more profitable.
  Recommendation: Invest in operators offering private and commercial flights and those focused on profitable niches, like cargo, private charters, and medical flights, which have higher margins and long-term growth potential.
- **Countries Flew To**:Airlines flying to emerging or high-demand international markets offer significant growth opportunities. Focus on regions with rising middle-class populations, tourism, and business travel.
  Recommendation: Prioritize airlines expanding into high-growth markets, such as Asia-Pacific, Africa, and Latin America, where demand for air travel is increasing. Airlines with diverse international routes are also well-positioned for long-term success.

Questions?

THANK YOU

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