Aviation Risk Analysis

Data driven approach to pick low-risk aircraft

CONTENTS

01 Business Understanding

The goal is to identify low-risk aircraft for expansion for the company in the aviation industry by purchase and operating in the commercial and private mode.

However there's a risk associated with different aircrafts to understand which ones are more suitable for purchase to help in making more informed decisions

1.Expand Aviation operations.

2.What factors affect risk?

3.How can we reduce risk?

4.Aircraft performance in different

 environments?

Overview of the dataset

- *First we have to understand the data that has been collected.*
- *The dataset provided is from the National Transportation Safety Board that includes aviation accident data from 1962 to 2023 about civil aviation accidents and selected incidents in the United States and international waters.*
- *Here are the features it focuses on:*
  - *Aircraft category: This is the make or model of the aircraft.*
  - *Operation: Is it commercial or private use*
  - *Date & Location: When the accident took place and coordinates for where it happened.*
  - *Number of fatalities, serious injury and minor injury*
  - *Accident cause: What factors or parameters could be identified to find cause of accident.*

Here is a chart to show distribution of aircraft categories

Distribution of Aircraft Categories
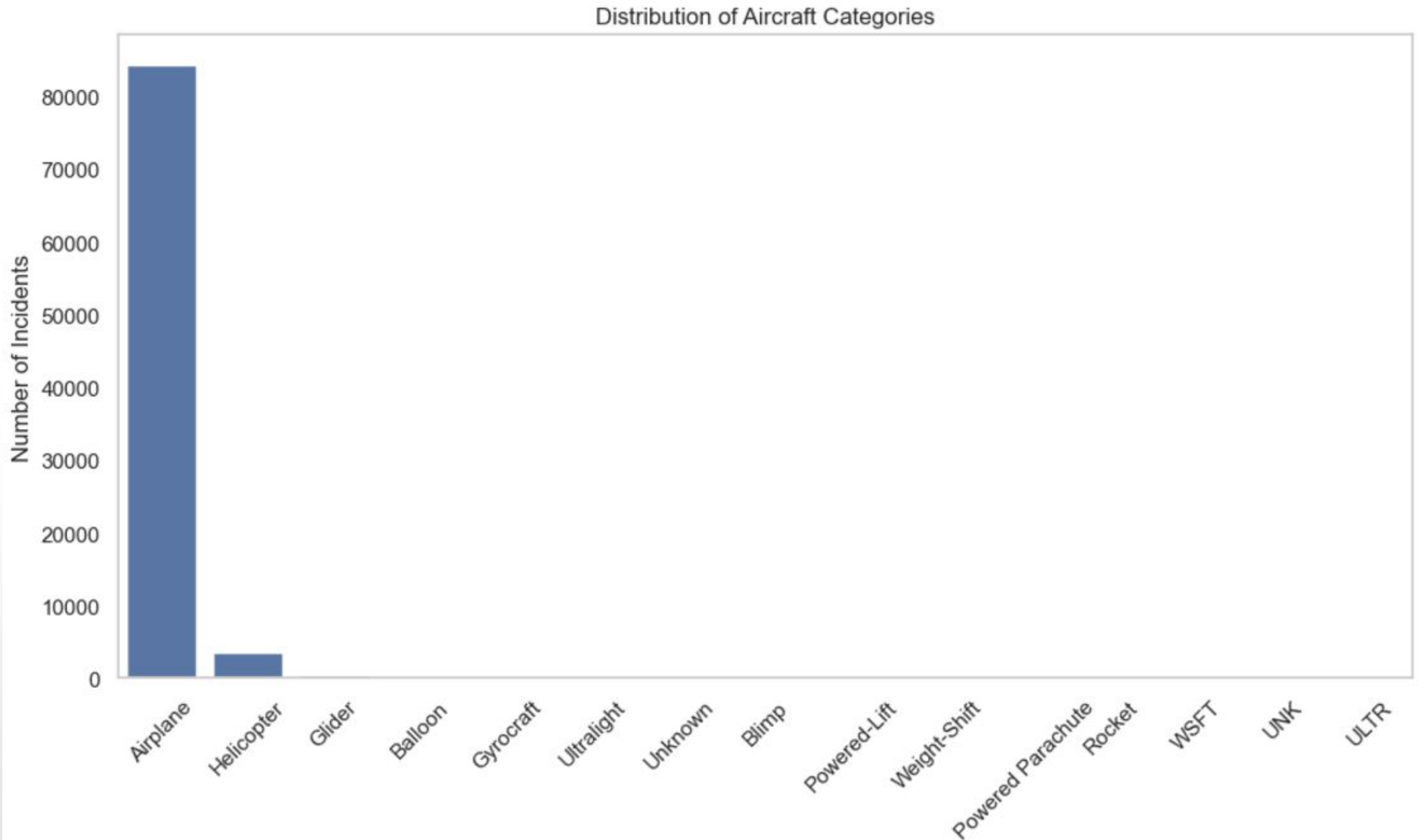
Data cleaning

We need to prepocess and clean the data to avoid irregularities in the data so as to achieve consistency in the data. Let's have a view of how the data was looking originally.

	Event.Id	Investigation.Type	Accident.Number	Event.Date	Location	Country	Latitude	Longitude	Airport.Code	Airport.Name	...	Purpose.of.flight
0	20001218X45444	Accident	SEA87LA080	1948-10-24	MOOSE CREEK, ID	United States	NaN	NaN	NaN	NaN	...	Personal
1	20001218X45447	Accident	LAX94LA336	1962-07-19	BRIDGEPORT, CA	United States	NaN	NaN	NaN	NaN	...	Personal
2	20061025X01555	Accident	NYC07LA005	1974-08-30	Saltville, VA	United States	36.922223	-81.878056	NaN	NaN	...	Personal
3	20001218X45448	Accident	LAX96LA321	1977-06-19	EUREKA, CA	United States	NaN	NaN	NaN	NaN	...	Personal
4	20041105X01764	Accident	CHI79FA064	1979-08-02	Canton, OH	United States	NaN	NaN	NaN	NaN	...	Personal

5 rows × 31 columns

What can we see here and steps to prepare for data analysis?
- Missing values - There's missing data in fields like Accident date so we fill with median values to maintain data quality
- Duplicates - There are duplicate records that need to be erased for asymmetric distribution and bring accuracy.
- Change data type - For good and accurate analysis we beed to work with the right datatype for instance Event.Date column for proper analysis should be under the datetime format.

Now after cleaning this is how the data is presented.

	Event.Id	Investigation.Type	Accident.Number	Event.Date	Location	Country	Latitude	Longitude	Airport.Code	Airport.Name	...	Purpose.of.flight
0	20001218X45444	Accident	SEA87LA080	1948-10-24	MOOSE CREEK, ID	United States	38.167361	-95.478611	NONE	Private	...	Personal
1	20001218X45447	Accident	LAX94LA336	1962-07-19	BRIDGEPORT, CA	United States	38.167361	-95.478611	NONE	Private	...	Personal
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All missing values and datatypes have been rectified to help with our data analysis for the company.

Data Analysis

Let's look at the key insights from the data now that it's clean and accurate.

Below is data showing the top 10 accident causes across the different phases of flight and number of accidents. We can see upon landing is when we have the most severe accident occurence. This data helps in training the pilots on the landing aspect to address the risk factors.
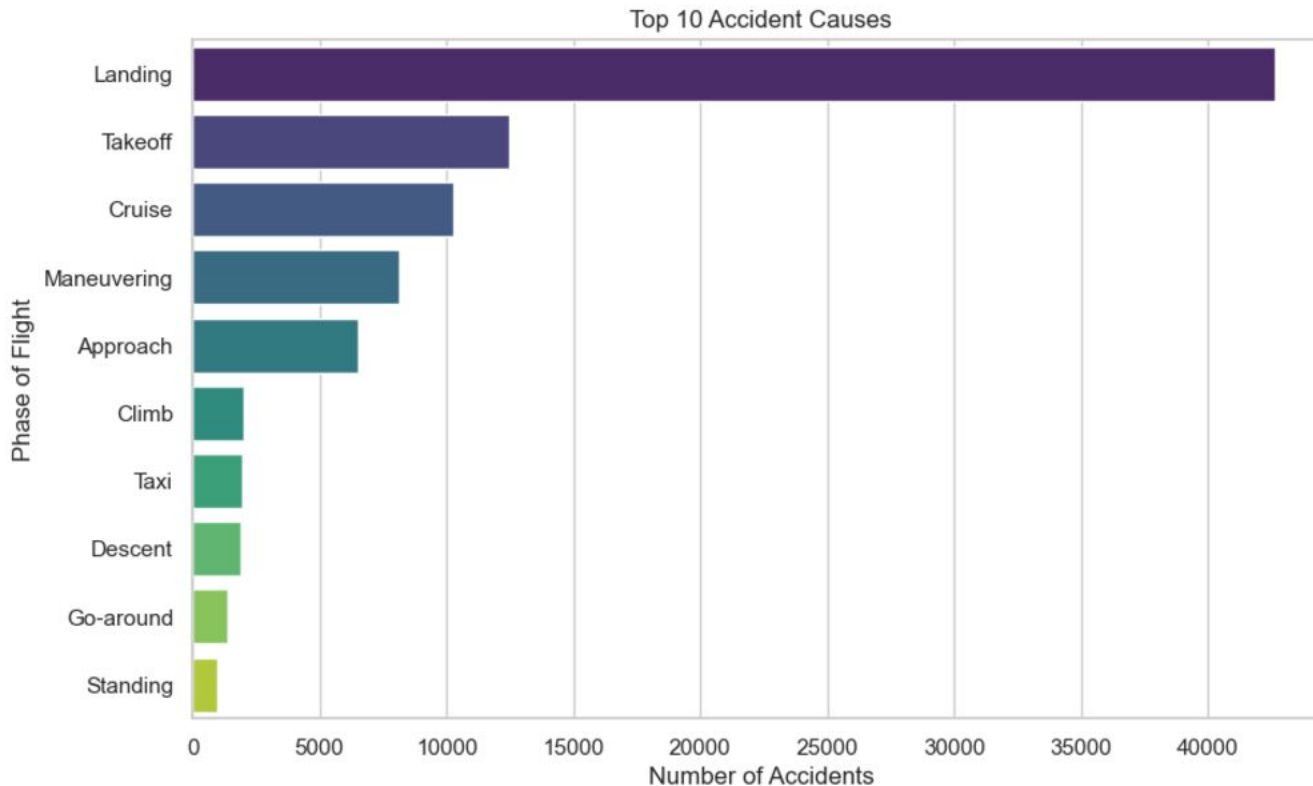
We can look at the aircraft type distribution below involved in different accidents, this is to help in identifying which aircraft types are involved in accidents. This helps us to evaluate the risk and take neccessary measures to reduce the risk on the different aircraft types.

Aircraft Type Distribution in Accidents
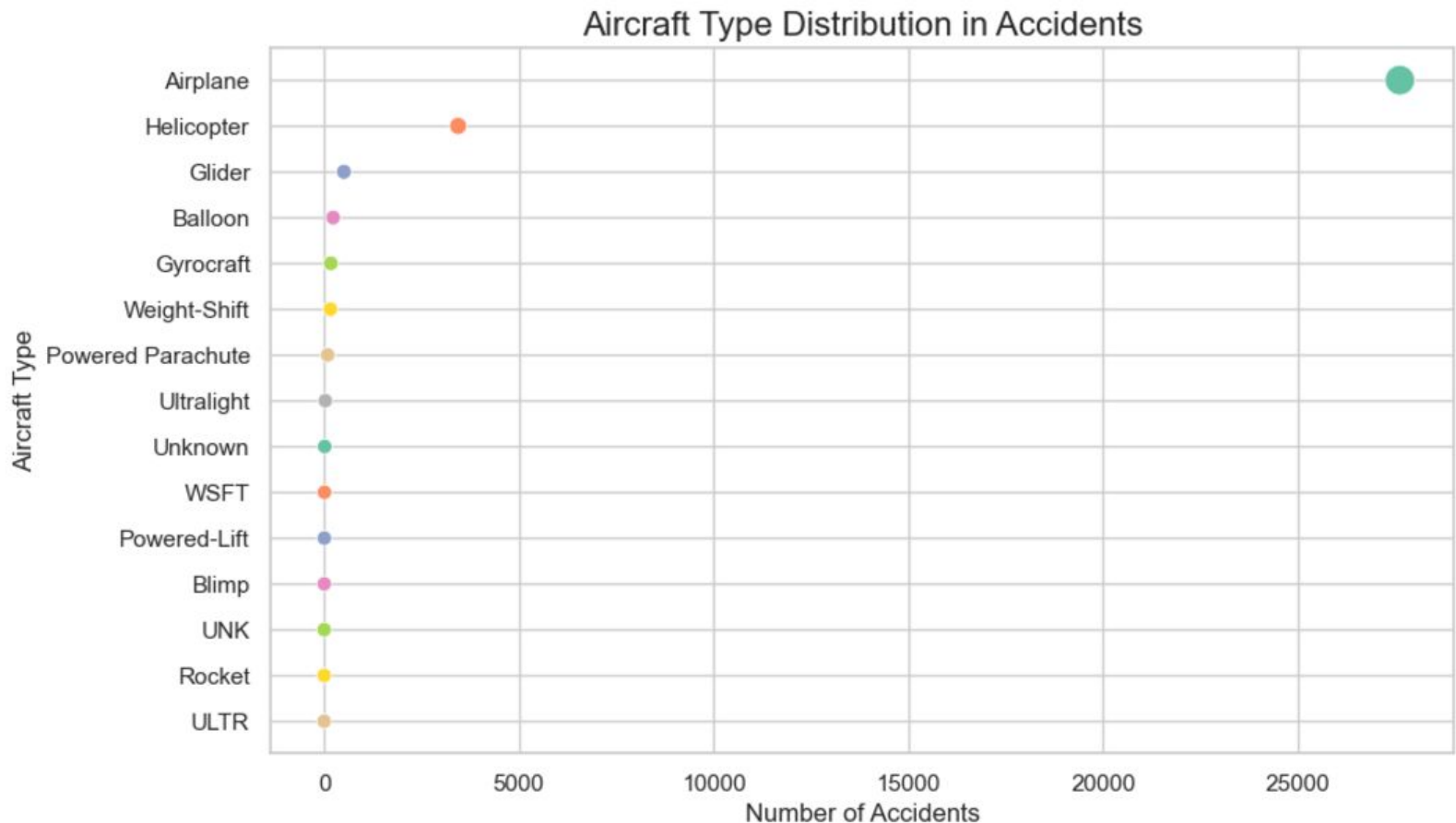
Recommendation: Low risk aircraft selection

- ❏ *To put into perspective the aircraft with least fatalities and injury reports technically have least risk making them safer options.*
- ❏ *This is important for the company due factors such as:*
  - ● *Financial records*
  - ● *Reputation of the company*
  - ● *Safety implications*
- ❏ *Historic data shows that certain aircrafts like private lighter models or newer commercial aircrafts have less reported accidents compared to the older and heavier models.*
- ❏ *To mitigate the risk and have a reputable aviation portfolio we need to prioritize proven safety measures. We can start by prioritizing private aircraft compared to commercial models since they've proven to having more exposure on accidents affecting the company negatively.*
- ❏ *Invest in models that meet the safety and operation regulation standard such as integrating avionics systems can help to improve the safety of aircraft by providing pilots with information about the aircraft's performance, surroundings, and potential hazards. They can also include features such as automatic flight control and collision avoidance systems, which can help to prevent accidents.*

Visualization of accident frequency to aircraft type

Accidents by Aircraft Type with Severity Indication
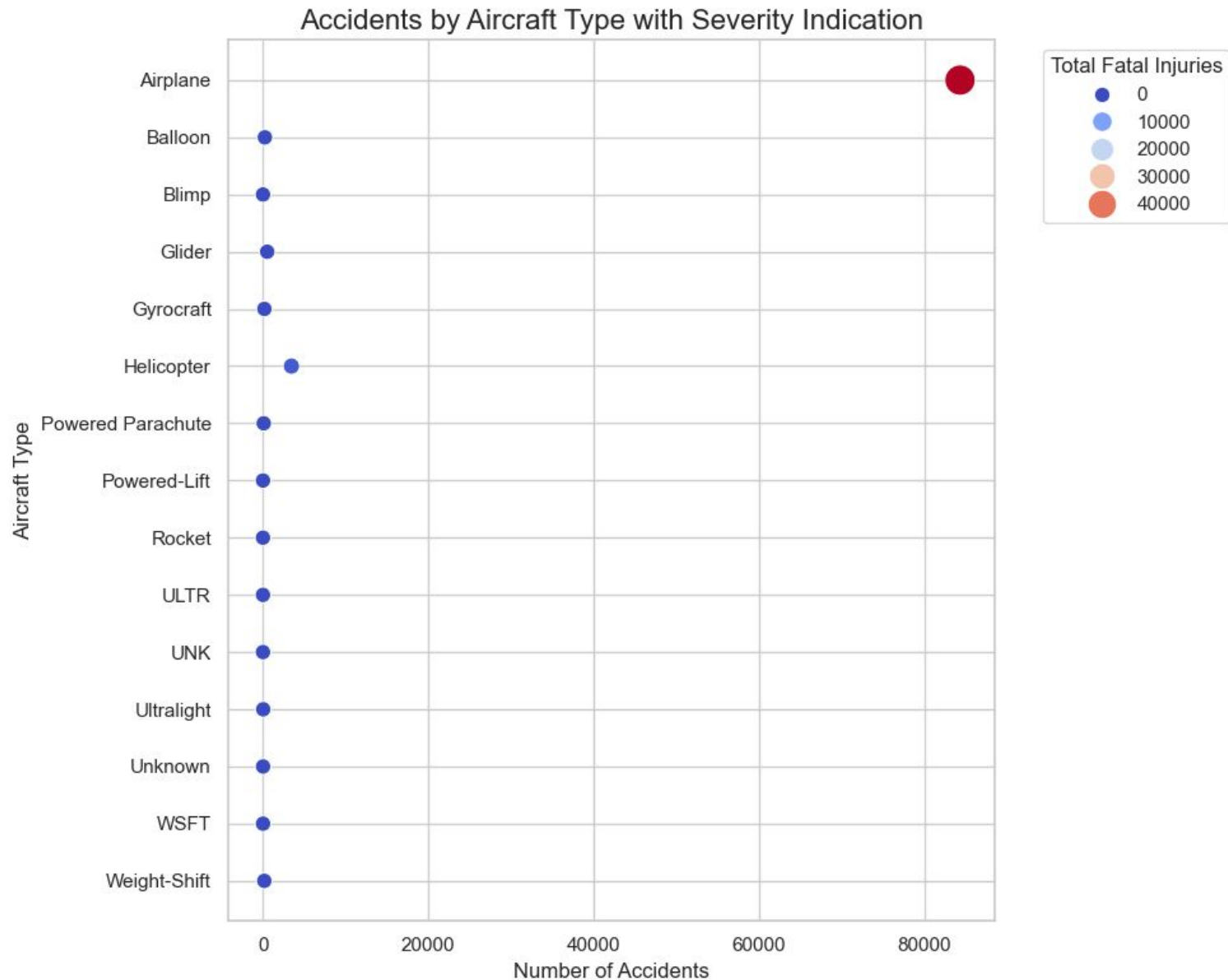
Next steps: Acquisition

- *We need to identify the short-term actions and long-term scheme in moving forward with this aircraft acquisition.*
- *Short-term plan:*
  - *Use data from the analysis to help in aircraft selection process.*
  - *Look at purchase of aircrafts that have lower risk as identified in the data.*
- *Long term scheme:*
  - *Setup Safety Performance Indicators(SPI) and Safety Performance Targets(SPTs) to help monitor and track safety performance. This will aid in operations and guidance on aircraft purchases over the long run*
  - *Implement a predictive pilot maintenance program which reduces risk on high models while maintaining company safety standards.*
- *Next step is to create a roadmap of timelines with milestones for the company.*

Refine Aircraft Selection   **Acquire Aircraft**   **Monitor Performance**   **Implement Safety Measures**

Aircraft Acquisition and Safety Roadmap

Timeline

(0-6 Months)   (6-12 Months)   (12-18 Months)   (Ongoing)

Phases of the roadmap

- *Refine Aircraft selection (0-6 months):*
  - *This uses the accident data analysis to identify models that match with safety priorities.*
  - *Assess the operations and in this case is the work in either private or commercial use.*
  - *Pivot the newer models that meet the safety regulation standards.*
- *Acquire aircraft (6-12 months):*
  - *This will be the procurement process on certain models that have been shortlisted.*
  - *Conduct inspections of these models.*
  - *Initiate contract negotiations with owners with safety procedures of maintenance and insurance.*
- *Monitor performance(12-18 months):*
  - *Create a system on tracking the aircraft model performance after purchase.*
  - *Look at the regular operation information such as logs on maintenance, hours used*
  - *Look at the safety performance and compare to safety standards.*
- *Implement safety measures(Current):*
  - *This is a dynamic procedure on risk deduction by onboarding higher risk safety programs*
  - *Schedule consistent maintenance check and upgrades.*
  - *Invest in advanced programs for pilots using simulation for visualized reality to adapt to environment.*

Thank you for your attention! I'm happy to answer any questions or provide further details

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THANK YOU