EVALUATING AIRCRAFT SAFETY FOR INVESTMENT DECISIONS

Guiding Aircraft Selection for Commercial and Private Operations

By: Emma Kahoro| October 2025

The Challenge: Defining and Quantifying Aviation Risk

BUSINESS PROBLEM

The company is expanding into new industries to diversify its portfolio, specifically purchasing and operating airplanes for commercial and private enterprises. Lack of domain knowledge mandates a data-driven risk assessment.

PROJECT GOAL

To determine the lowest risk aircraft and translate findings into three actionable recommendations for acquisition and operations.

Aircraft Risk Assessment Criteria

Acquisition Strategy: Which *make and category* offer the least incidents and fatal outcomes?

Characteristics Focus: How many number of engines, which engine types and the aircraft builder carries the highest consequence (fatal/serious injury rate)?

Operational Protocols: What seasonal and environmental factors must we consider to avoid the most severe incidents?

The Data Foundation: Cleaning for Statistical Reliability

Columns Used:

Make

Aircraft.Category

Engine.Type

Number.of.Engines

Amateur.Built

Weather.Condition

Event.Date

Total.Fatal.Injuries

Total.Serious.Injuries

- ✓ Focused on the dimensions most critical for purchase and operations.
- ✓ **Action:** Handled nulls and standardized non-uniform entries (e.g., merging similar makes).

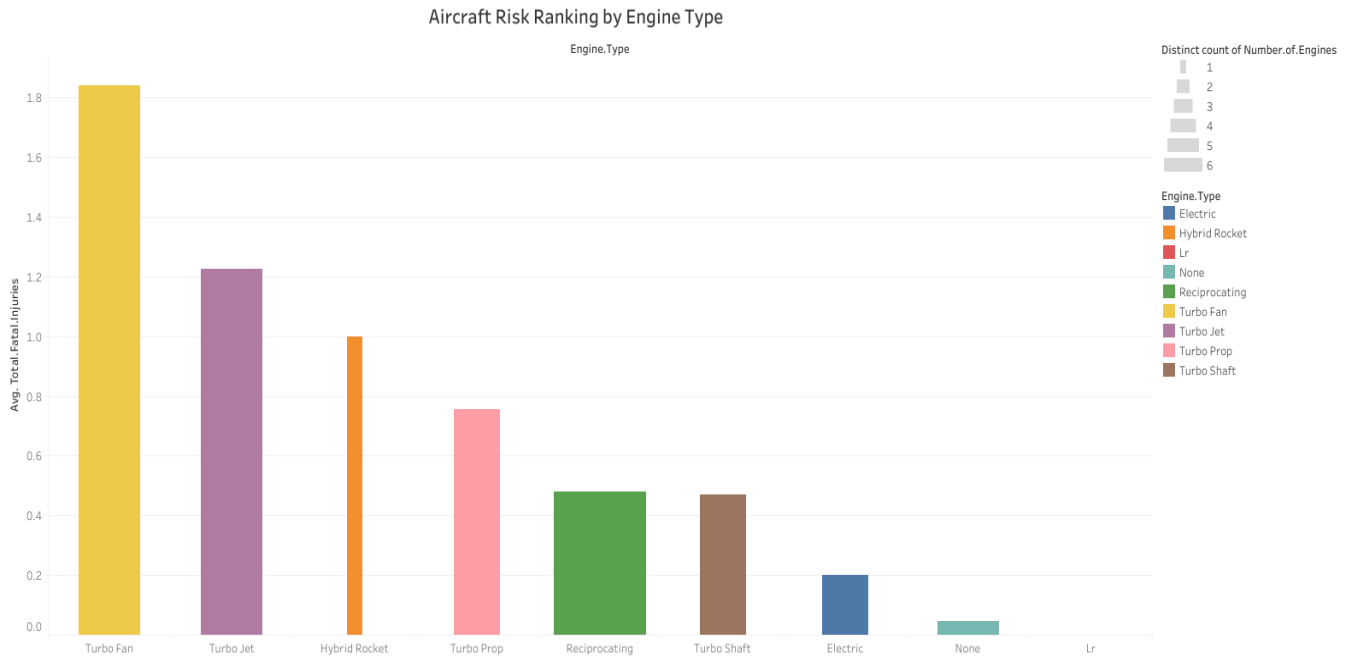
Finding 1: Safest and Riskiest Makes

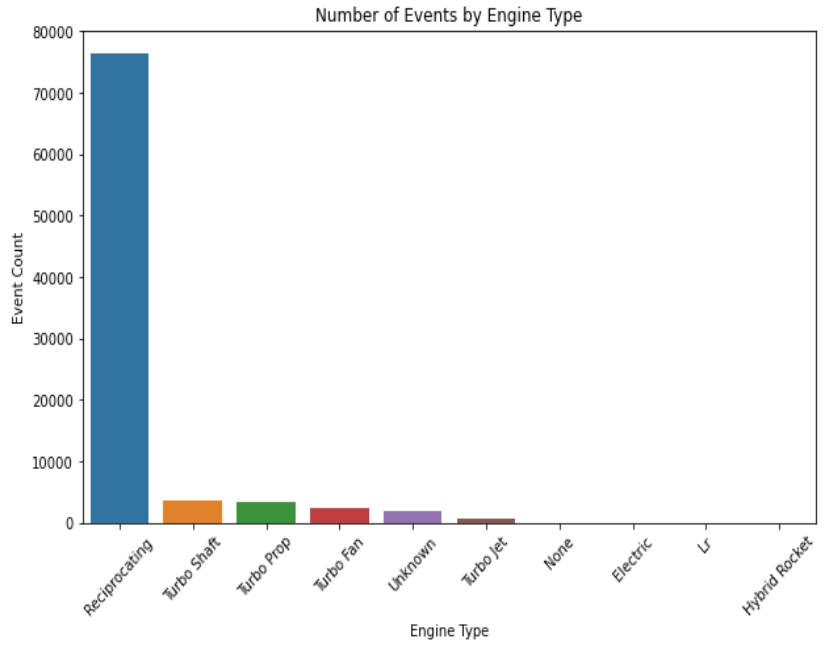
- Safest Makes: manufacturers have lower fatality rates relative to the number of accidents.
- Riskiest Makes: manufacturers have higher fatality rates despite fewer total events.

- Fatality rate is a better safety measure than total accidents. A common make may have more incidents since it is common.

Rank	Safest Make	Fatality Rate	Total Events	Riskiest Make	Fatality Rate	Total Events
1	Cub Crafters Inc	0.00	22	Airbus	7.67	153
2	Barnes	0.00	22	Atr	5.29	35
3	Grumman	0.02	58	Sukhoi	4.27	22
4	Gulf Stream	0.04	27	Boeing	3.37	2595
5	Stearman	0.04	27	Fokker	3.35	66

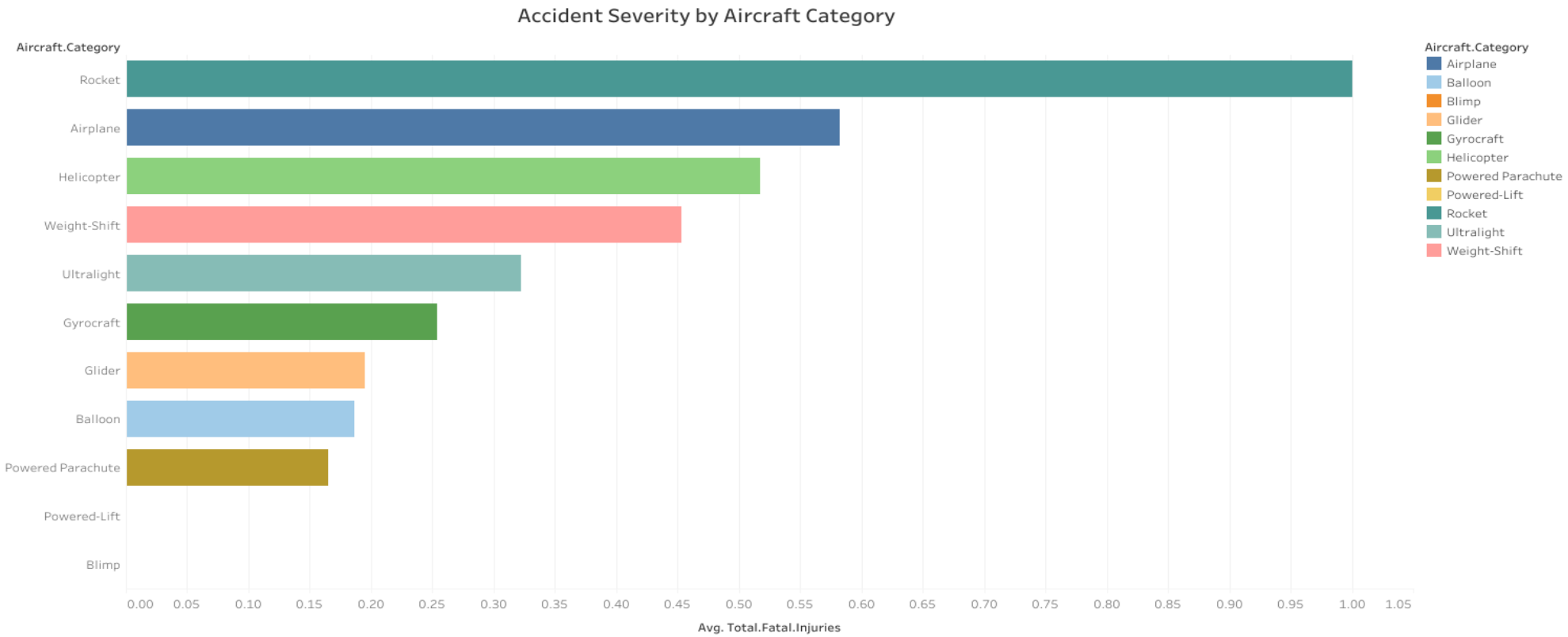
Finding 2: Engine Type is the Primary Risk





- Reciprocating has the highest frequency but low average fatalities: A frequent risk but a low-consequence risk.
- Turbo Fan has a low frequency but high average fatalities: Rare risk but a high-consequence risk.

Finding 3: Aircraft Category Determines Risk



When a rocket accident happens, it is on average, the **most consequential** in terms of human cost.

Finding 4: Enforce Protocols for Seasonal & Environmental Hotspots

Seasonal & Environmental Risk

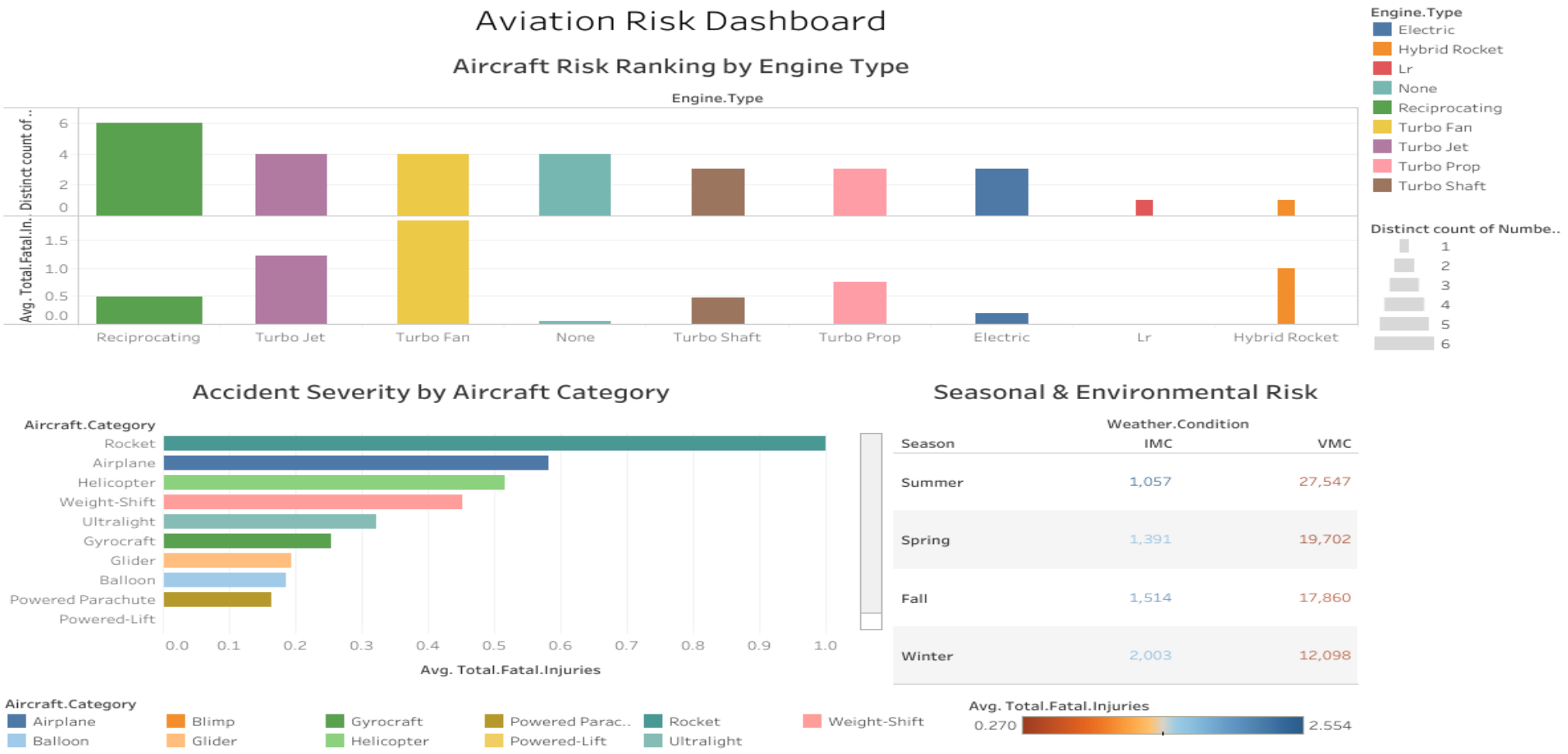
Season	Weather.Condition: IMC	Weather.Condition: VMC
Summer	1,057	27,547
Spring	1,391	19,702
Fall	1,514	17,860
Winter	2,003	12,098

Avg. Total.Fatal.Injuries
0.270 — 2.554

While flight activity is higher during summer and VMC are more used than IMCs;

- IMCs are more fatal during winter
- VMCs are more fatal during summer

The Low-Risk Path Forward



This dashboard is a living risk management tool. It ensures that there is no guesswork into the aircraft to purchase.

My three actionable insights:

Buy Low-Risk Engine - *Mandate Low-Risk Engine Technology*

Limit High-Severity Category - *Limit Exposure to High-Consequence Categories*

Enforce Weather Policy - *Enforce Strict Weather Minimums*

The End

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