Aviation Risk Analysis for Business Expansion

Project Overview

- **Project Goal**: Identify low-risk aircraft makes and safer airplanes to support the company's entry into aviation.
- **Key Focus:** Analyze NTSB aviation accident data (1948–2023) for severity trends and manufacturer performance.
- **Outcome:** Data-driven recommendations to minimize risks and maximize safety in commercial operations.

Business Understanding

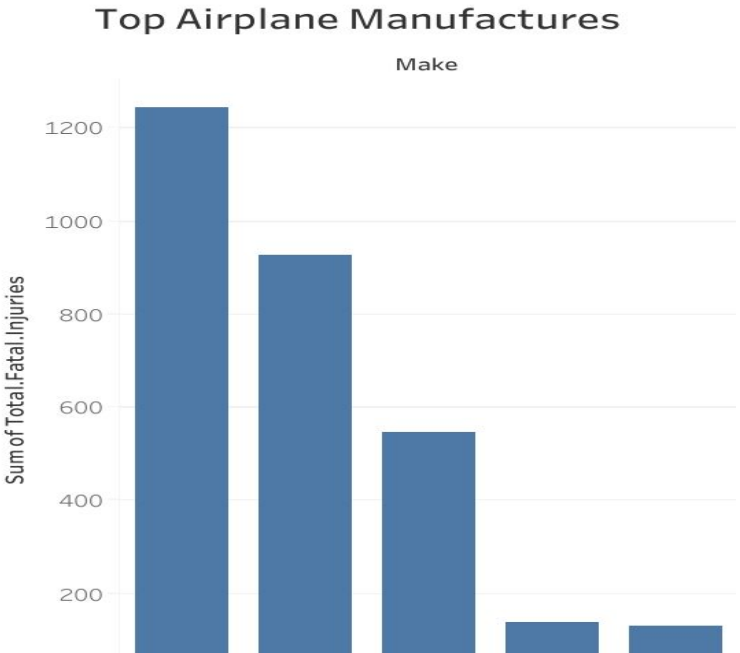
- **Business Opportunity:** Aviation industry offers expansion potential, but safety is critical for its sustainability and good reputation.
- **Risks:** High severity outcomes for injuries and aircraft damage
- **Criteria**: Recommend aircraft with declining injury rates and resilient damage profiles.

Data Understanding

- **Data Source:** NTSB civil aviation accidents/incidents dataset (~90,000 records).
- **Key Variables:** Make/Model, Engine Type, Purpose of Flight, Damage Severity, Injuries (Fatal/Serious/Minor/Uninjured).
- **Data Cleaning:** Standardized text, filled missing injuries with 0, extracted Year, focused on relevant columns, dropped rows missing key aircraft properties.

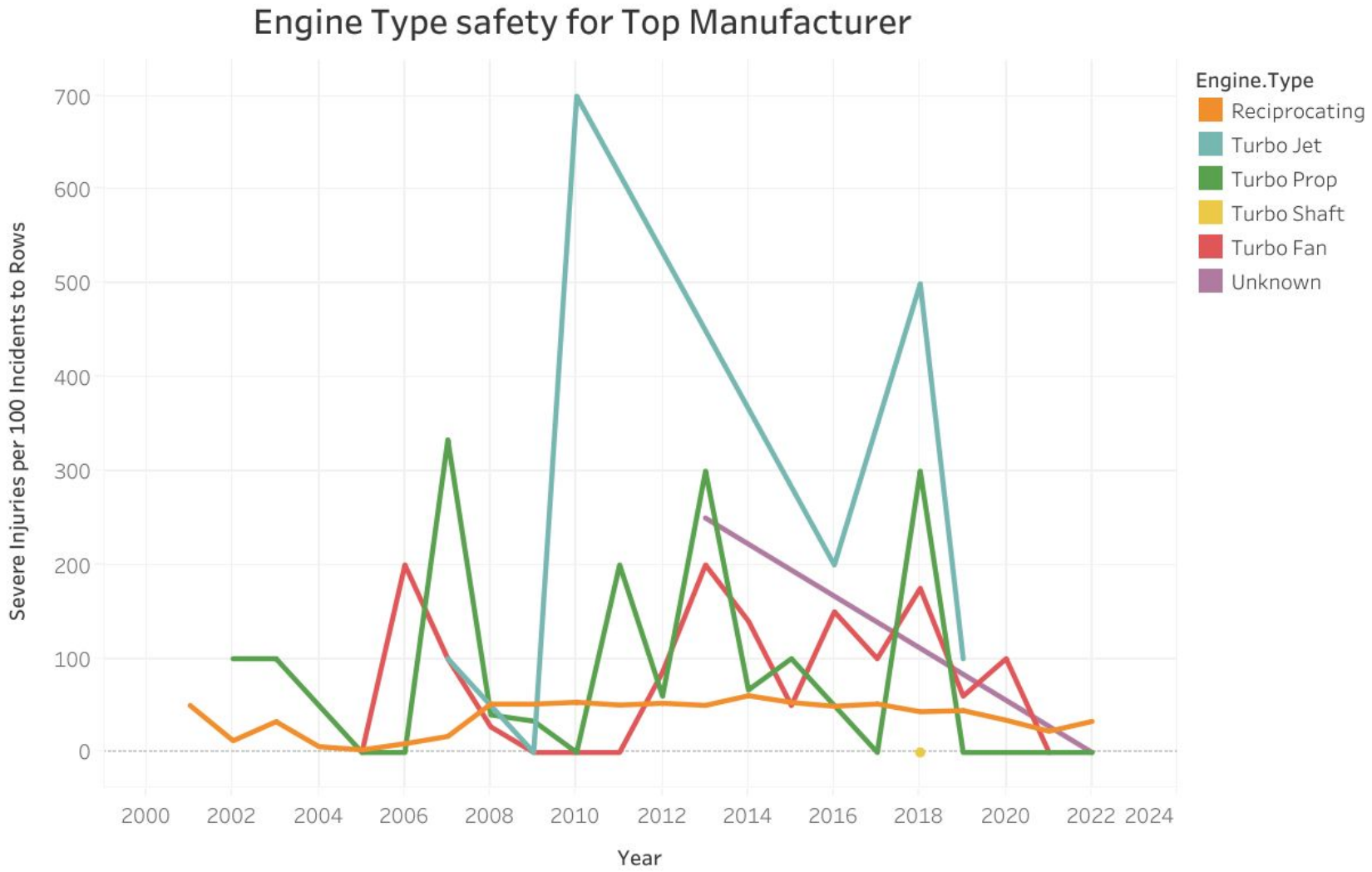
Data Analysis

- Cessna dominates volume. This mainly due to its exposure, indicating that this is the most preferred make in the aviation industry by those in operation.



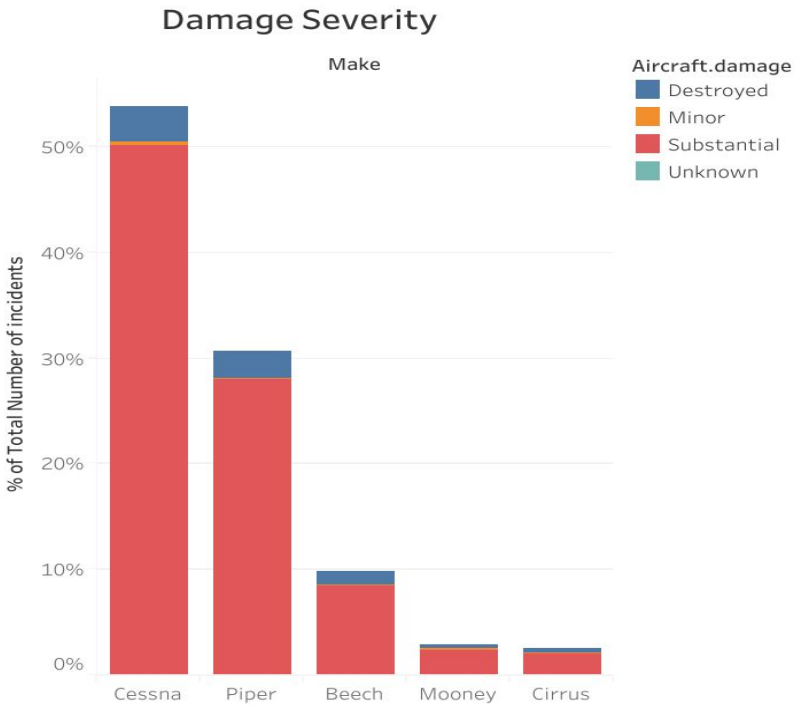
Engine Type Safety for Top Manufacturer

- Reciprocating engines: Remain consistently low with minimal fluctuations, demonstrating stable and low severe injury rates for Cessna's primary engine type.
- Turbo Engines demonstrate high volatility over time hence is not reliable engine types.
- **Insight:** For Cessna aircraft, reciprocating engines demonstrate the lowest and most consistent severe injury risk over time.
- The visualization is given below:


Engine Type safety for Top Manufacturer
Severe Injuries per 100 Incidents to Rows
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
Year
Engine.Type
Reciprocating
Turbo Jet
Turbo Prop
Turbo Shaft
Turbo Fan
Unknown

Damage Severity Distribution by Top Manufacturers

- This 100% stacked bar chart shows the proportional breakdown of aircraft damage levels for the five most common manufacturers in the dataset (Cessna, Piper, Beech, Mooney, Cirrus).
- The chart suggests that while Cessna and Piper dominate incidents due to popularity, their outcomes are mostly repairable (sustainable) rather than catastrophic(Destroyed).
- Below is the visualization:


Damage Severity
Make
Aircraft.damage
Destroyed
Minor
Substantial
Unknown
% of Total Number of incidents
50%
40%
30%
20%
10%
0%
Cessna
Piper
Beech
Mooney
Cirrus

Recommendations

- Purchases: Prioritize on top airplane makes; cessna, piper, Beech, Mooney and Cirrus
- Engine Type: A case analysis on cessna indicates that reciprocating Engines has low severity injury rates and stable over time hence reliable for business operations.
- Low cost of repairs: Cessna and Piper show predominantly Substantial (repairable) damage with low Destroyed rates.

Next Steps

- Partner with other certified operators in aviation industry focusing on commercial flight purposes.
- Conduct pilot training and ongoing risk monitoring using updated quarterly NTSB data.
- Train staff on identified best practices maintenance protocols for reciprocating engines.
- Engage aviation consultants in the new business adventure.

Thank you

Feel free to ask any questions. I am happy to discuss details or dive deeper into the data understanding.

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