Aviation Accidents & Incidents Data Analysis (1962–2023)

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Introduction

- This presentation identifies low-risk aircraft types and operational risk drivers using historical accident and incident data (1962–2023).

Business Problem

- The company is planning a new aviation venture and must decide which aircraft types to purchase to minimize operational risk and costs.

Business Context

- Aircraft selection affects safety, insurance, maintenance costs, and brand reputation. Data-driven choices reduce long-term risk and operating expenses.

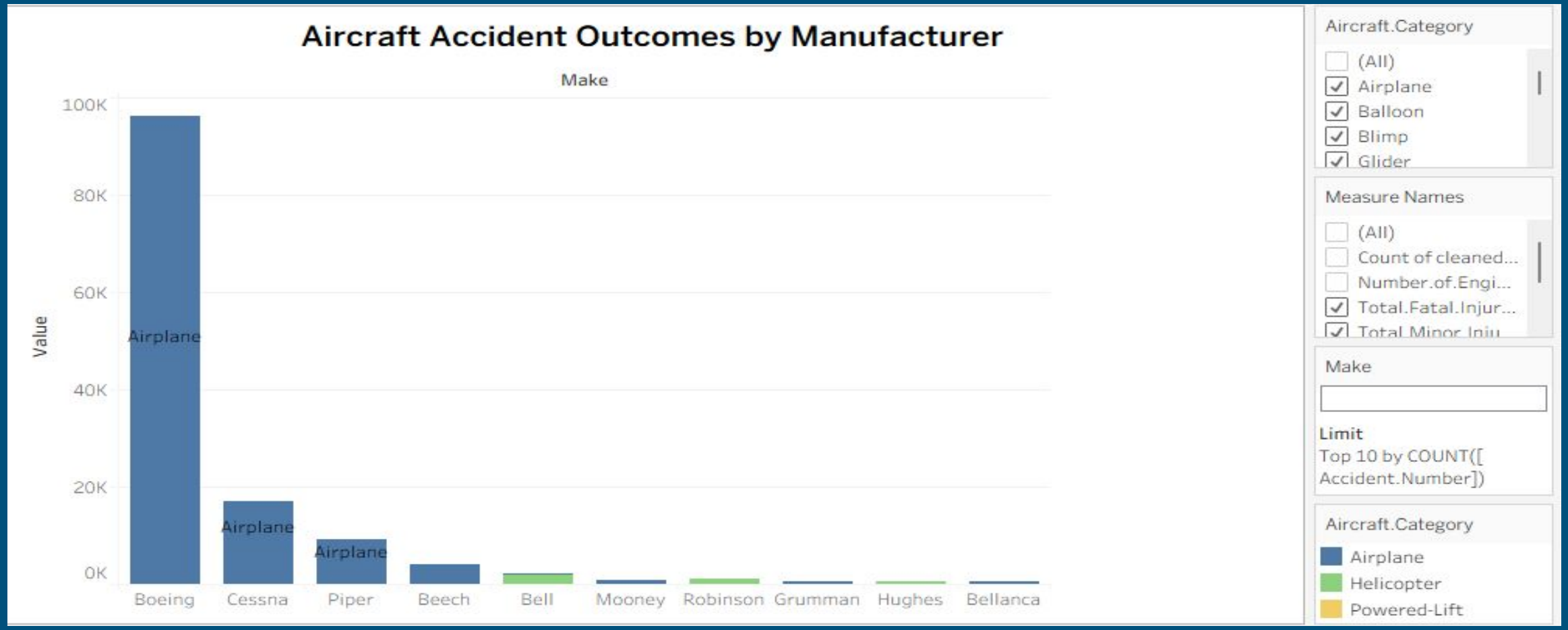
Data Overview

- Dataset: NTSB aviation accidents and incidents (1962–2023).
- Key fields: Aircraft Category, Make, Model, Purpose of Flight, Weather Condition, Phase of Flight, Injury counts.

Process Steps

- 1. Understanding data: assess completeness, variable definitions, and missing values.
- 2. Data cleaning and transformation (computed Aircraft Category, aggregated injury measures).
- 3. Exploratory analysis (descriptive stats) in Python / Jupyter.
- 4. Visual analytics in Tableau to reveal trends and contextual risks.
- 5. Translate findings into business recommendations.

Aircraft Category Risk



Insights — Aircraft Category Risk

- • Most categories show high proportions of fatal injuries.
- • Powered-Lift and Ultralight categories show relatively more non-fatal outcomes.
- • Categories with Unknown/UNK/ROCKET labels were excluded from decision recommendations due to unreliable data.

Manufacturer & Model Safety (Top Makes)

Heatmap of Fatalities by Flight Purpose & Weather Condition

Purpose.of.flight	Weather.Condition: IMC	VMC
Aerial Application	13	531
Aerial Observation	28	372
Banner Tow		19
Business	905	1,337
Executive/Corporate	292	300
External Load		39
Ferry	199	169
Flight Test	0	130
Instructional	116	1,776
Other	14	167
Other Work Use	35	454
Personal	4,674	13,501
Positioning	204	401
Public Aircraft	91	289
Public Aircraft - Federal	1	40
Skydiving	5	229

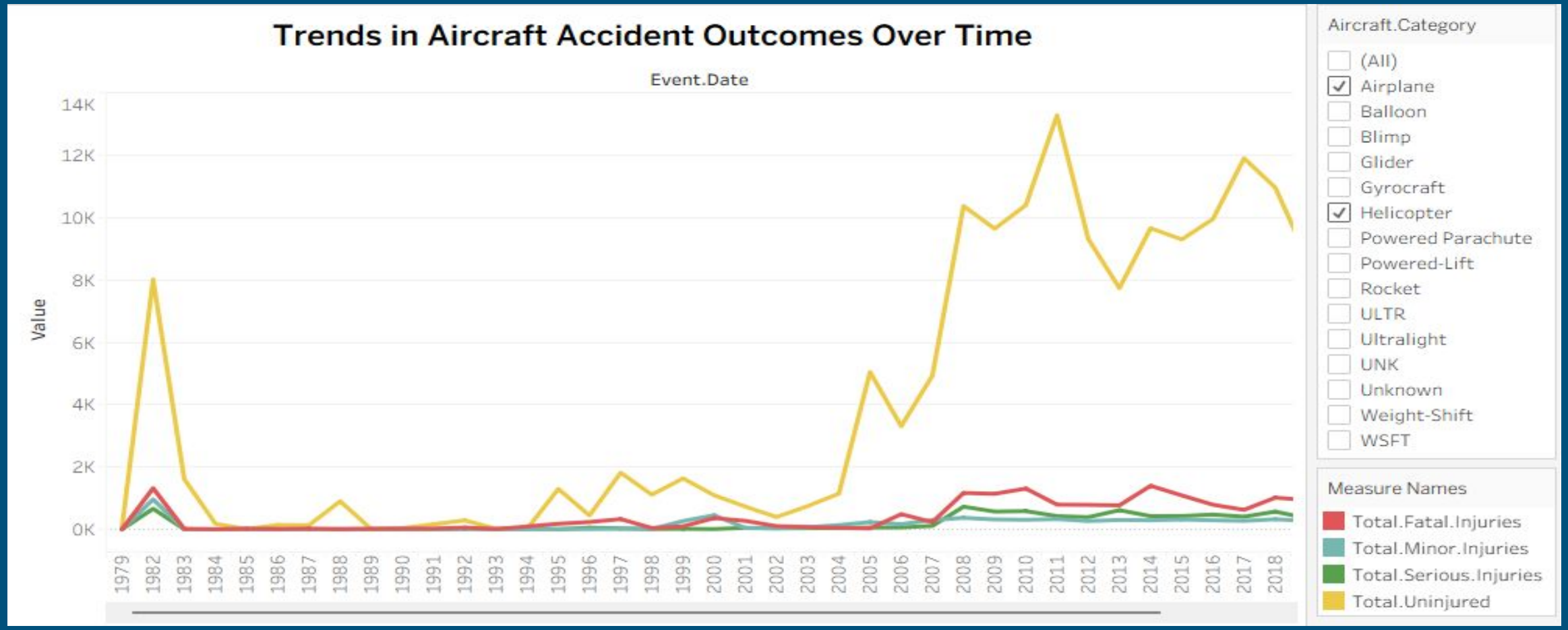
SUM(Total.Fatal.Injuries)

0 13,501

Insights — Manufacturer / Model Safety

- • Boeing shows a higher share of non-fatal and unknown-severity incidents, possibly due to operational contexts and fleet size.
- • General aviation manufacturers (Cessna, Piper) have higher fatality proportions — a focus area for training and maintenance.

Contextual Risk Factors — Heatmap



Insights — Contextual Risk Factors

- • Personal-use flights account for the majority of fatal accidents, often in good weather (VMC).
- • Landing and takeoff phases show the highest severity incidence.
- • Operational/human factors are the dominant risk drivers, not weather.

Findings (Consolidated)

- • Fatal injuries predominate across the dataset; patterns vary by category and use.
- • Commercial-grade aircraft (e.g., Boeing) show lower fatality proportions compared to small GA makes.
- • Personal flights and takeoff/landing phases are highest risk — human factors are key contributors.

Recommendations & Business Application

- 1. Prioritize acquiring aircraft types with lower historical fatality rates (consider Powered-Lift/Ultralight cautiously).
- 2. Prefer aircraft operated in business or instructional contexts for lower operational risk.
- 3. Invest in rigorous pilot training and maintenance programs for Cessna/Piper fleets.
- 4. Implement targeted safety protocols for takeoff/landing phases and personal-use fleet operations.

Evaluation, Confidence & Next Steps

- Limitations:
- • Some records include 'Unknown' labels and incomplete fields; these were excluded from critical decisions.
- • Data lacks detailed maintenance and pilot experience fields (future integration recommended).

- Confidence & Mitigations:
- • Overall trends are robust across decades; confidence in high-level recommendations is high.
- • Mitigate data gaps via targeted data collection and operational audits before purchase.

- Next Steps:
- • Integrate maintenance and pilot records; run predictive models to forecast risk by aircraft and route.

Conclusion

- Operational and human factors drive most accident severity; choosing aircraft types used in professional contexts and strengthening training/maintenance provides the best reduction in risk for the new venture.

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- Thank you .