Aircraft Risk Analysis for Business Expansion into Aviation

Evaluating Safety Trends and Identifying Low-Risk Aircraft for Strategic Investment

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Executive Summary

- Content Summary:
- The company plans to diversify into the aviation industry.
- The goal is to understand aircraft safety and identify low-risk models for purchase.
- Python and Tableau data analysis was used to evaluate accident trends and risk profiles.

Introduction & Background

- Aviation is a capital-intensive industry where safety is a key performance factor.
- Selecting aircraft with a strong safety record minimizes operational and financial risks.
- Understanding historical accident data helps in evidence-based decision-making

Data Overview - Accidents & Fatalities over time

- Dataset: Airline accident records (e.g., 1908–present).Key attributes: aircraft type, operator, fatalities, year, and location. Data cleaned and prepared in Python using Pandas and NumPy.

The data includes the following key fields:

- **Date** – The date the accident occurred.
- **Location** – The geographical location of the accident.
- **Operator** – The airline or operator of the aircraft involved.
- **Aircraft Type** – The make or model of the aircraft.
- **Purpose of Flight** – The intended operation (e.g., personal, instructional, commercial, or military).
- **Aboard** – Total number of people aboard the aircraft.
- **Fatalities** – Number of fatalities from the accident.
- **Ground** – Number of fatalities on the ground (if any).
- **Summary** – Brief narrative description of the incident.

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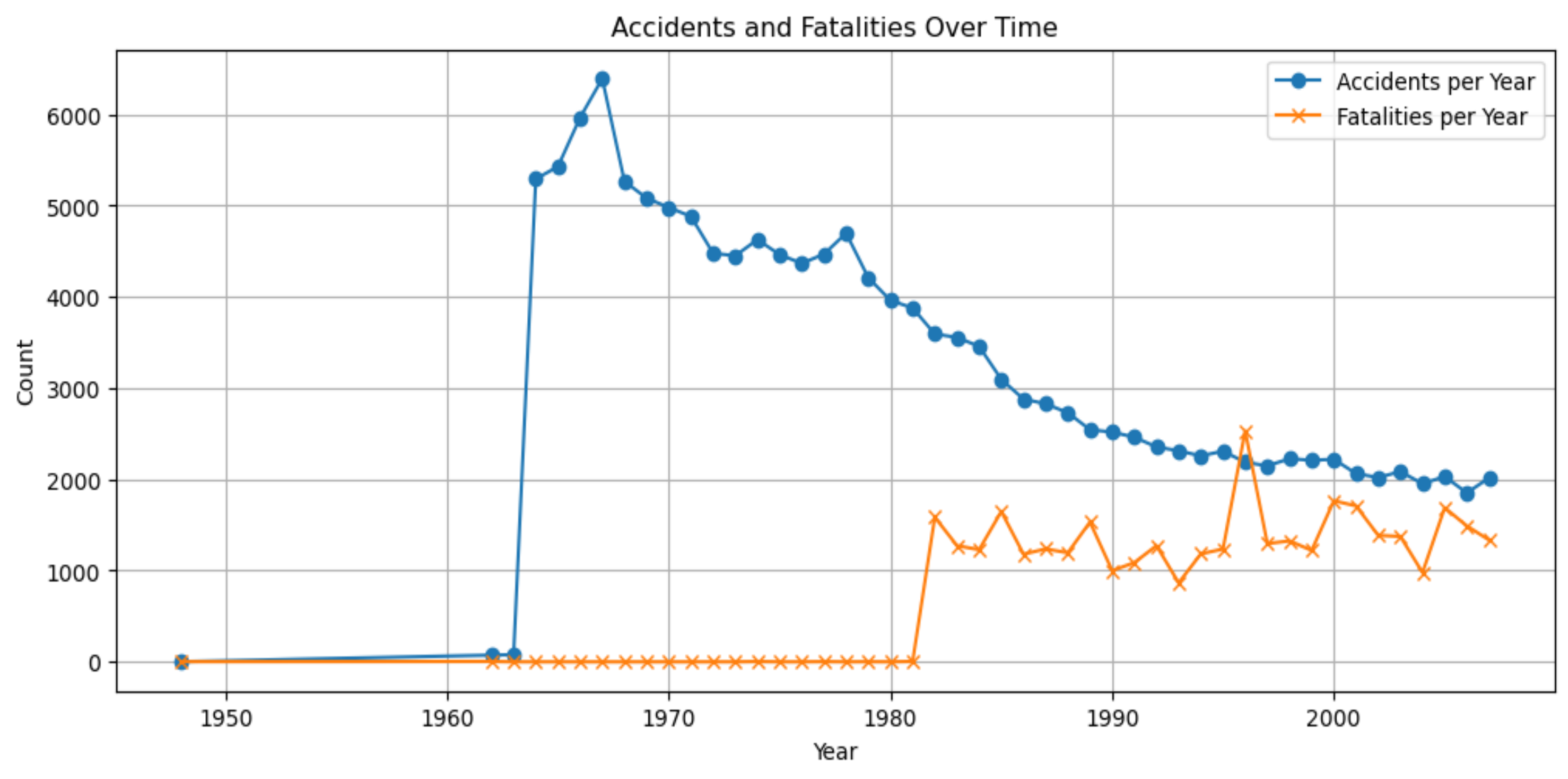
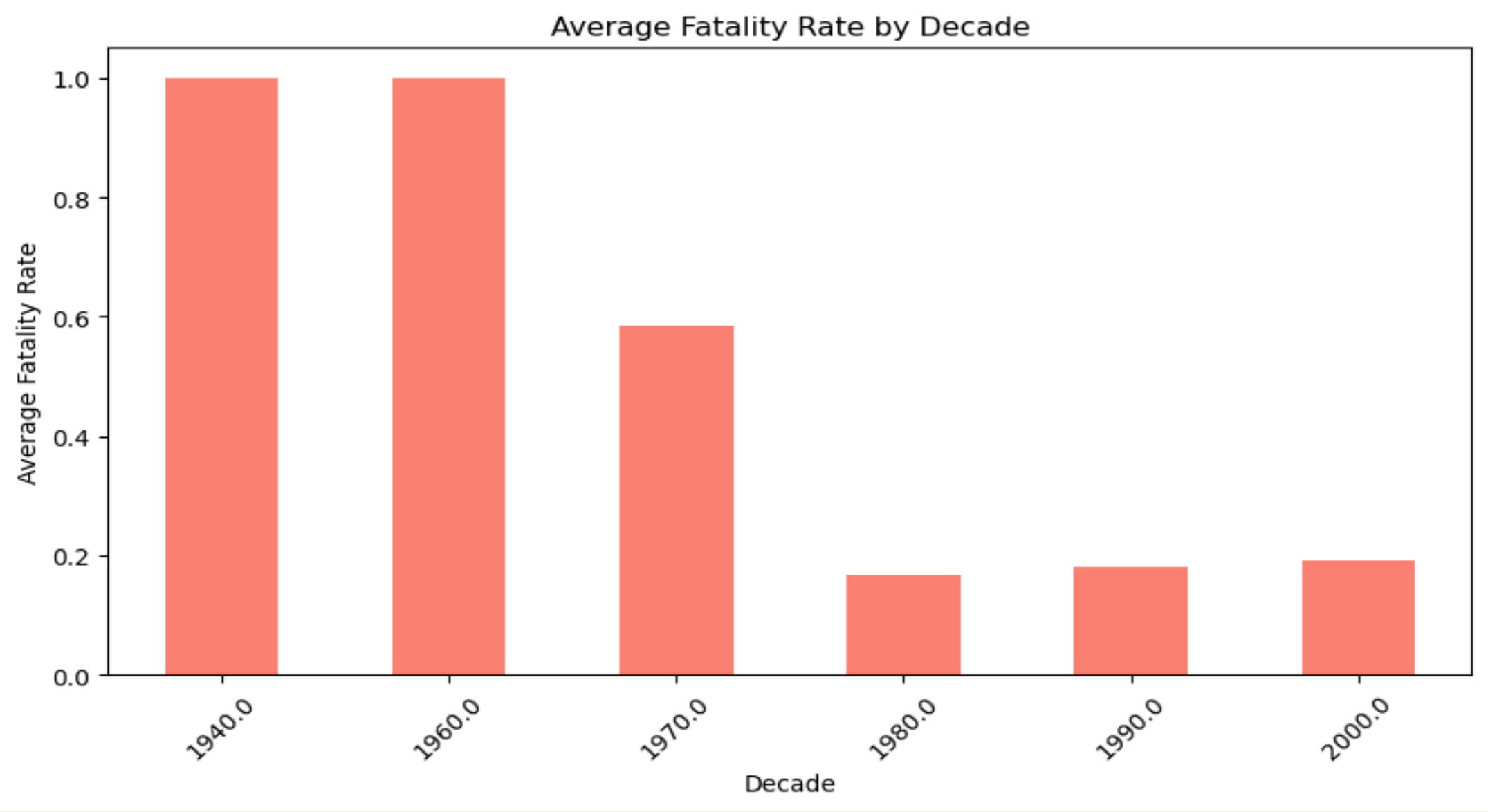
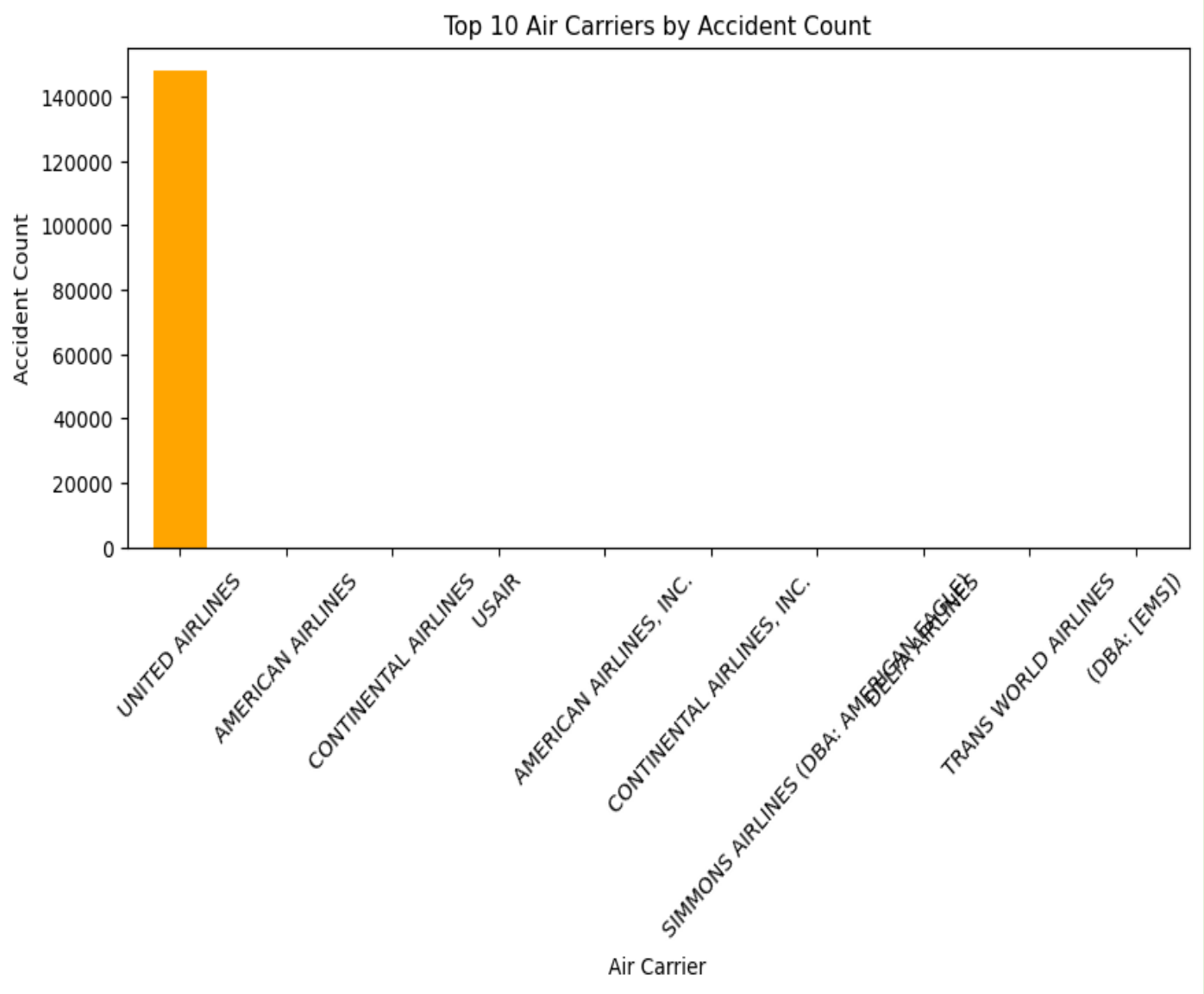


Average Fatality Rate by Decade

Fatality rates have significantly declined over the decades, indicating steady improvement in aviation safety.



Top 10 Air carriers by Accident Count

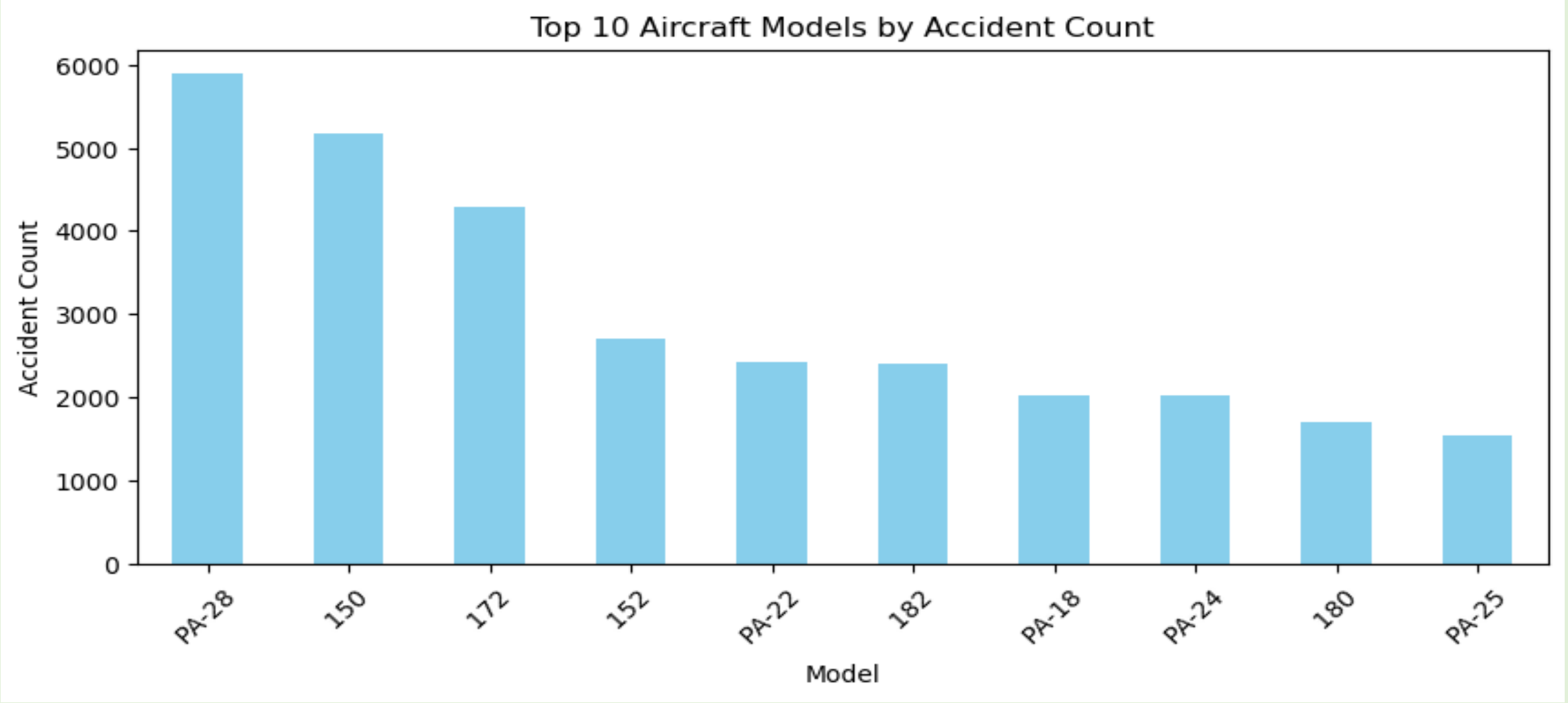


Summary observation on Top 10 Air Carriers by Accident Count

- ✓ A small number of air carriers account for a majority of recorded accidents, suggesting variation in safety performance and operational practices.
- ✓ Older or high-frequency carriers (those operating for many decades or with massive global fleets) tend to have higher accident counts, often reflecting exposure volume rather than poor safety alone.
- ✓ Carriers with modern fleets and stricter maintenance standards generally appear lower on the list, highlighting the importance of technology upgrades and safety culture.
- ✓ Some airlines show repeated involvement in incidents, indicating potential areas for operational safety review and stricter regulatory oversight.

Top 10 Aircraft Models by Accident Count

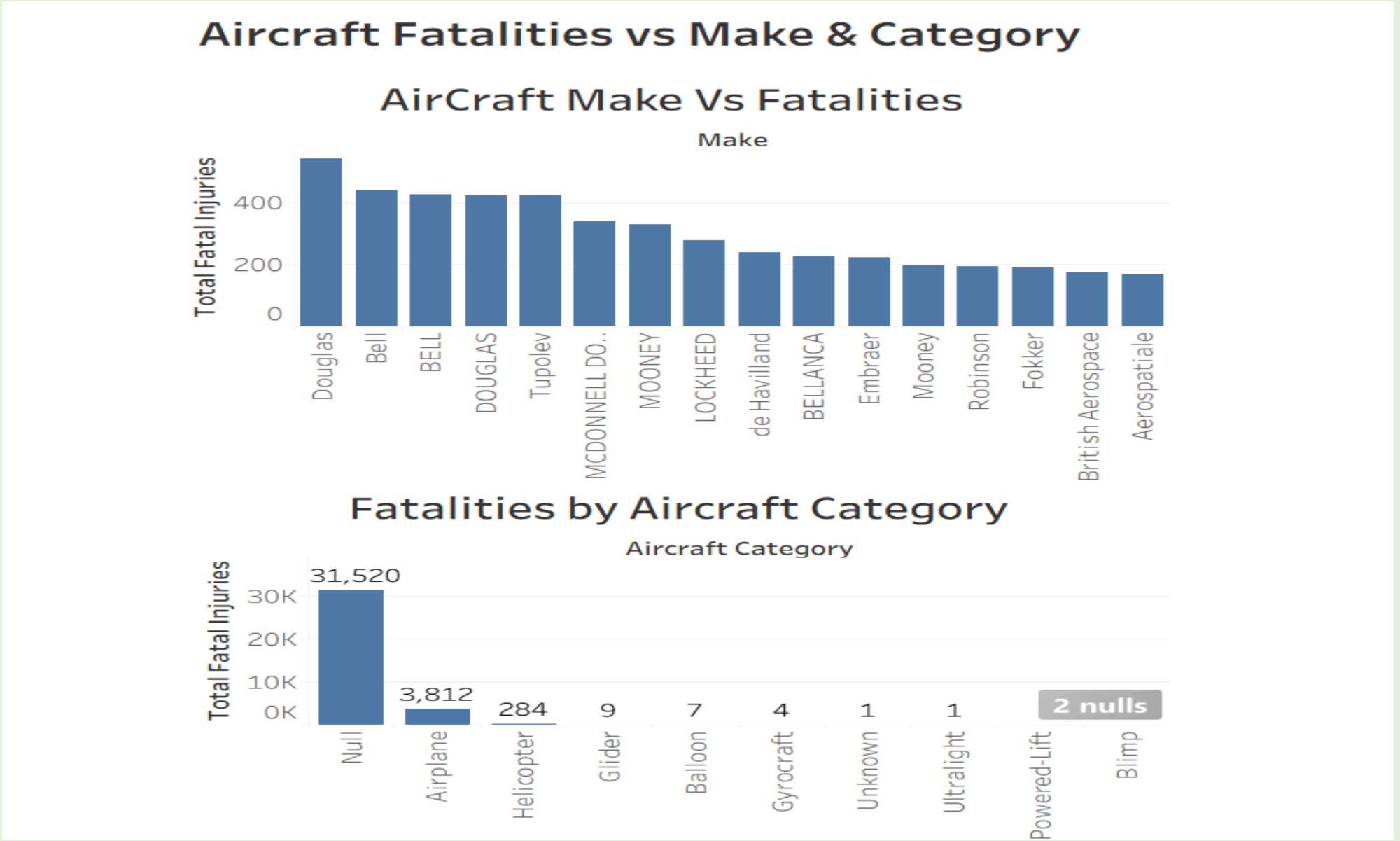
The “Top 10 Aircraft Models by Accident Count” analysis reveals that older and heavily utilized aircraft models dominate accident statistics, highlighting the impact of age, design generation, and maintenance intensity on risk. For new business ventures in aviation, prioritizing **modern, well-maintained, and technologically advanced aircraft models** significantly reduces operational risk and enhances safety reliability.



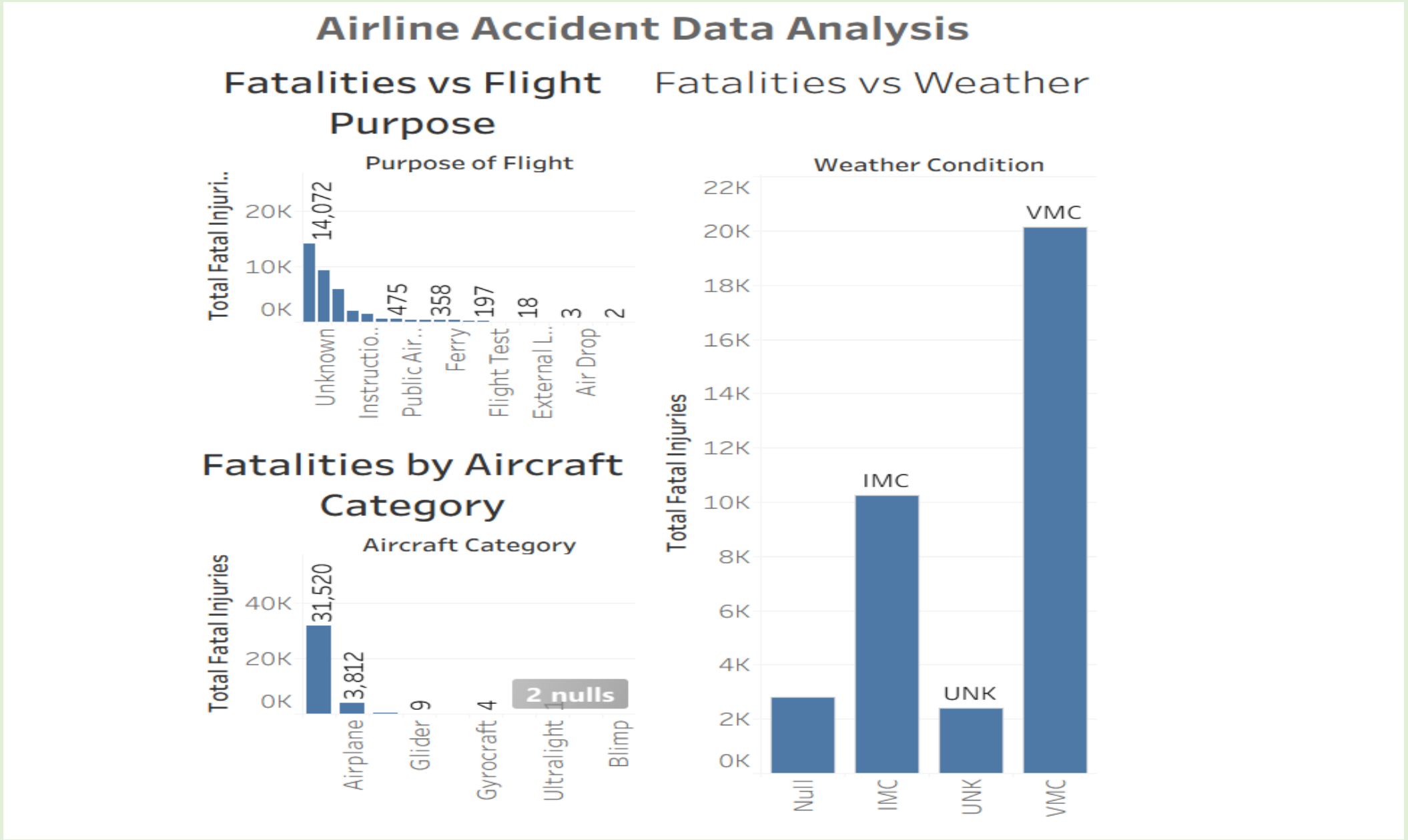
Methodology

- Tools: Python, Pandas, Matplotlib, Seaborn, Tableau
- Analytical approach:
  - Load and clean data
  - Group by aircraft type/manufacturer
  - Compute total accidents, fatalities, and frequency trends
  - Identify low-risk aircraft based on incident rate

Aircraft Fatalities vs Make & Category



Airline Accident Data Analysis



Recommendations

- Invest in Modern Aircraft Models - Focus on newer generation aircraft (e.g., Boeing 737NG/Max, Airbus A320neo) with strong safety records and advanced avionics. Retire or avoid older models with high historical accident rates.
- Prioritize Carriers with Proven Safety Culture - Partner with or acquire fleets from airlines that demonstrate consistent compliance with international aviation safety standards (ICAO, IATA).Review historical accident data before acquisition or lease.
- Implement Data-Driven Risk Monitoring - Continuously analyze flight, maintenance, and incident data using predictive analytics to identify potential risks early.
- Establish a real-time safety dashboard for ongoing performance tracking. Strengthen Maintenance and Quality Assurance Programs, Adopt proactive maintenance schedules (Condition-Based Maintenance).
- Work with certified maintenance providers and enforce strict inspection protocols. Enhance Pilot and Crew Training, Invest in simulator-based and recurrent training emphasizing human factors, decision-making, and emergency response. Encourage a “no-blame” safety culture where crew can report risks freely.
- Adopt a Phased Entry into Aviation - Start operations with low-risk aircraft models and expand gradually as operational expertise and data maturity grow.

Conclusion

- The analysis of aviation accident data demonstrates a clear decline in fatality rates over the decades, confirming that modern aircraft and technology have significantly improved flight safety.
- Accident frequency is concentrated among older aircraft models and legacy carriers, mainly due to longer service periods and operational exposure rather than purely poor safety performance.
- Data-driven evaluation of aircraft and operator risk provides valuable insights for investment and fleet acquisition decisions.
- To ensure a successful and sustainable entry into the aviation sector, the company should prioritize aircraft models with strong safety records, modern design, and reliable maintenance histories.
- Overall, the findings reinforce that strategic selection of aircraft, robust safety management, and continuous risk monitoring will minimize exposure, enhance operational reliability, and build a foundation for long-term growth in aviation.