AVIATION INVESMENT RISK ANALYSIS

BACKGROUND

The company plans to diversify into the aviation industry by purchasing and operating aircraft but lacks experience in assessing aircraft safety risks. This project evaluates historical accident data to identify the lowest-risk aircraft and provide actionable insights to support informed aircraft purchasing decisions.

PROJECT GOALS

- Identifying aircraft with the lowest historical accident and fatality rates
- Understanding how accident severity differs across aircraft types and categories
- Evaluating trends in aviation safety over time

DISCUSSION

- This project applies data cleaning, imputation, analysis, and visualization techniques to deliver actionable insights for business stakeholders.

Tools

- Python (Google Colab)
- Tableau
- GitHub
- Visual Studio Code
- Canva
- HTML Color Codes

WEATHER CONDITIONS & FATALITY RISK

Key observation

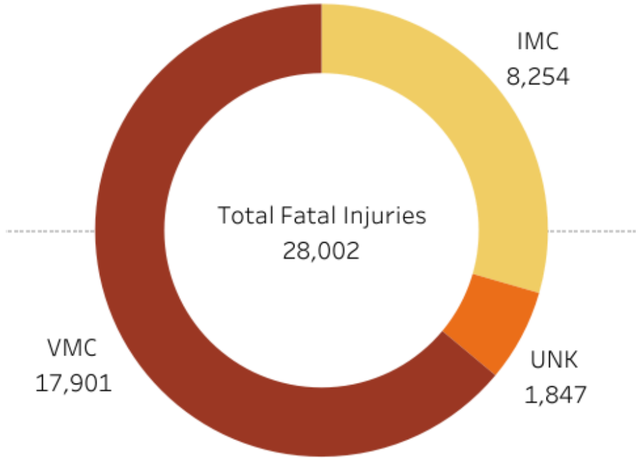
- IMC accidents show a higher fatality rate per incident than VMC
- Fewer IMC incidents result in more severe outcomes

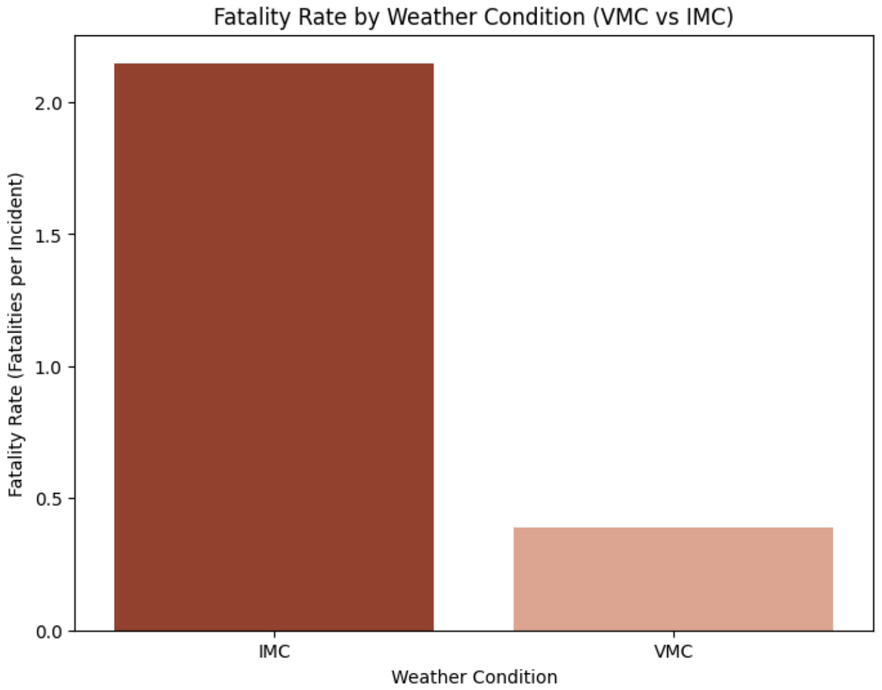
Conclusion

- Weather conditions significantly influence fatal risk
- IMC operations introduce elevated safety exposure

Recommendation

- Select aircraft with proven IMC performance
- Minimize early operations in high-risk weather conditions





AIRCRAFT MODELS – FATAL INJURY RISK

Key observation

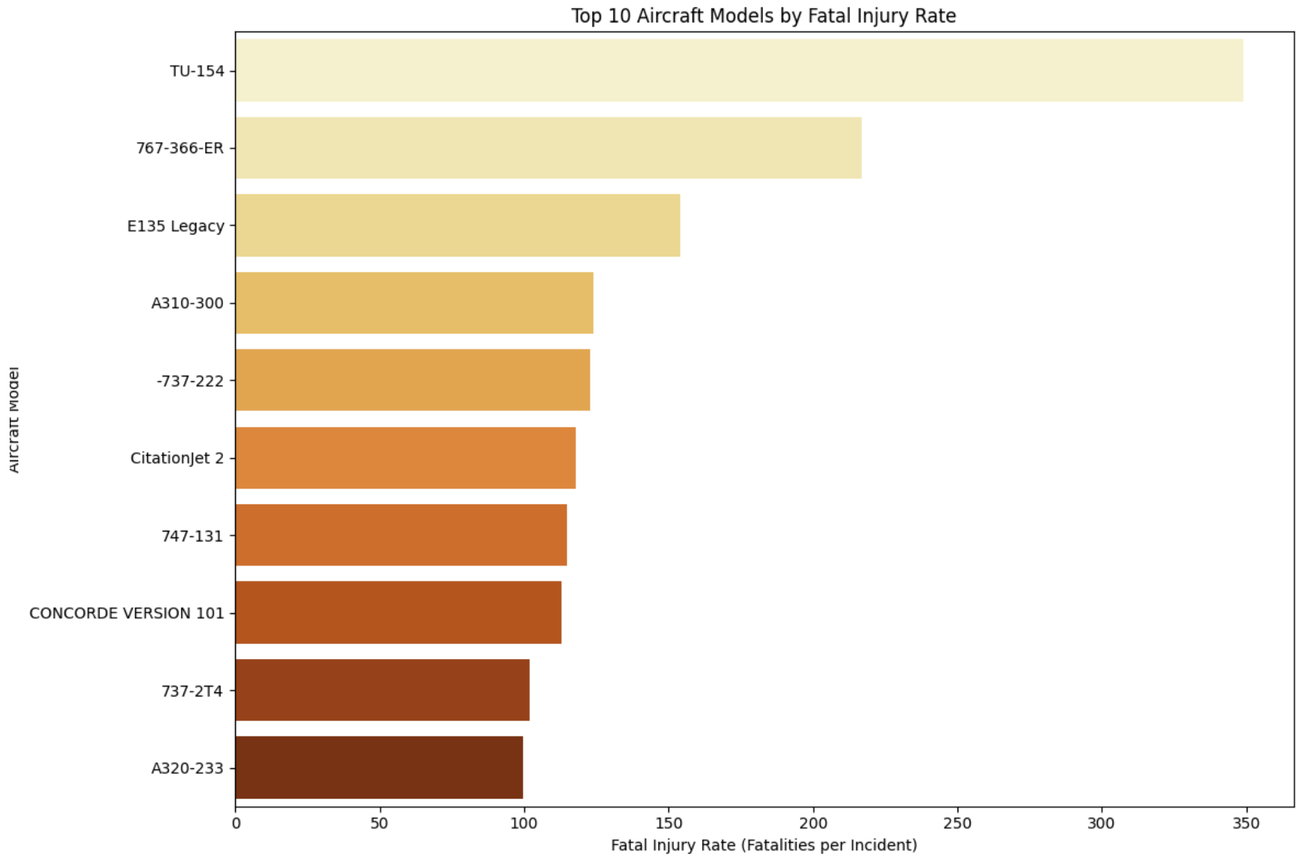
- A small number of aircraft models have very high fatal injuries per incident
- High fatal injury rates occur regardless of how frequently the model appears

Conclusion

- Accident frequency alone does not indicate safety
- Severity per incident is a critical risk indicator

Recommendation

- Avoid aircraft models with consistently high fatal injury rates
- Use fatal injuries per incident as a primary acquisition filter



ENGINE TYPE & SAFETY OUTCOMES

Key Observations

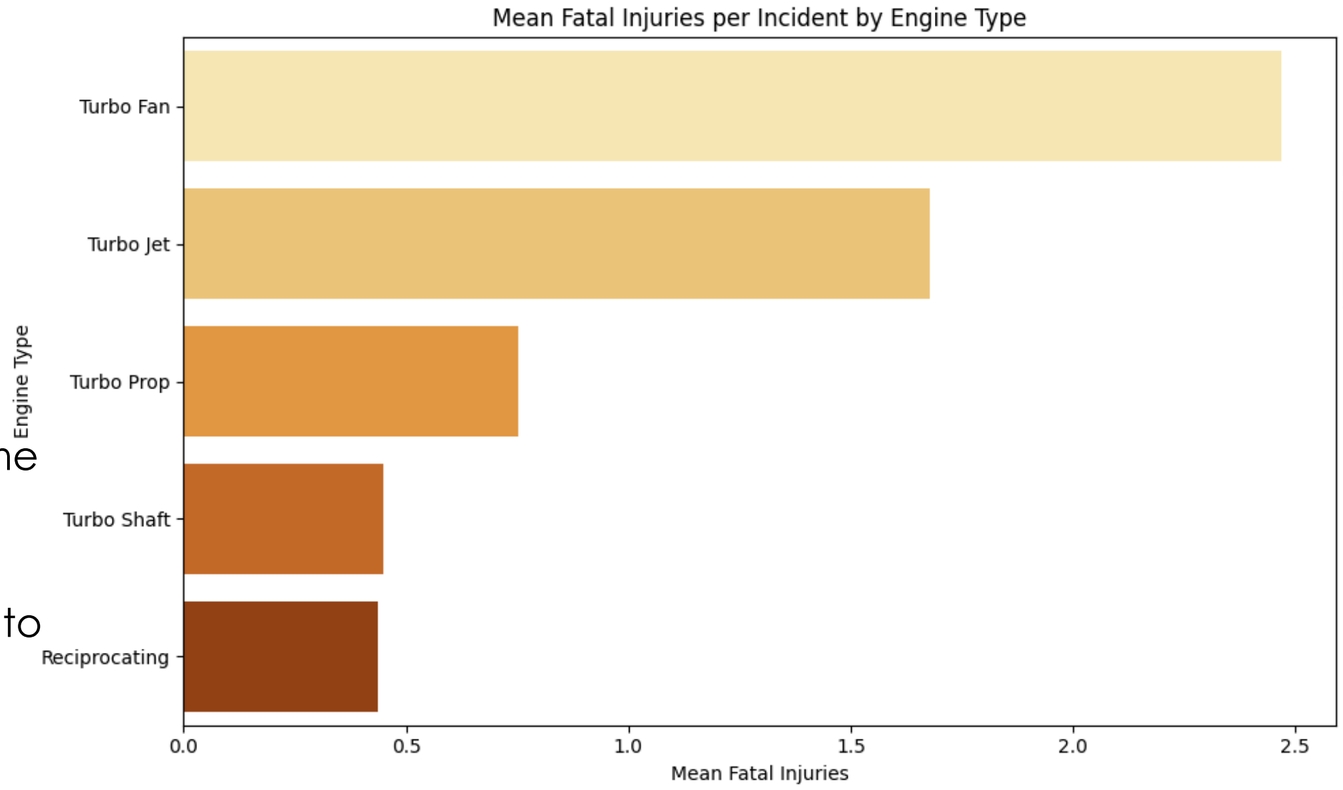
- Mean fatal injuries vary significantly by engine type
- Some engine types show higher average fatalities per accident

Conclusion

- Engine type materially affects accident severity
- Not all engine technologies carry the same safety risk

Recommendation

- Prioritize aircraft with engine types linked to lower mean fatalities
- Include engine type in the risk scoring framework



PHASE OF FLIGHT RISK

Key Observations

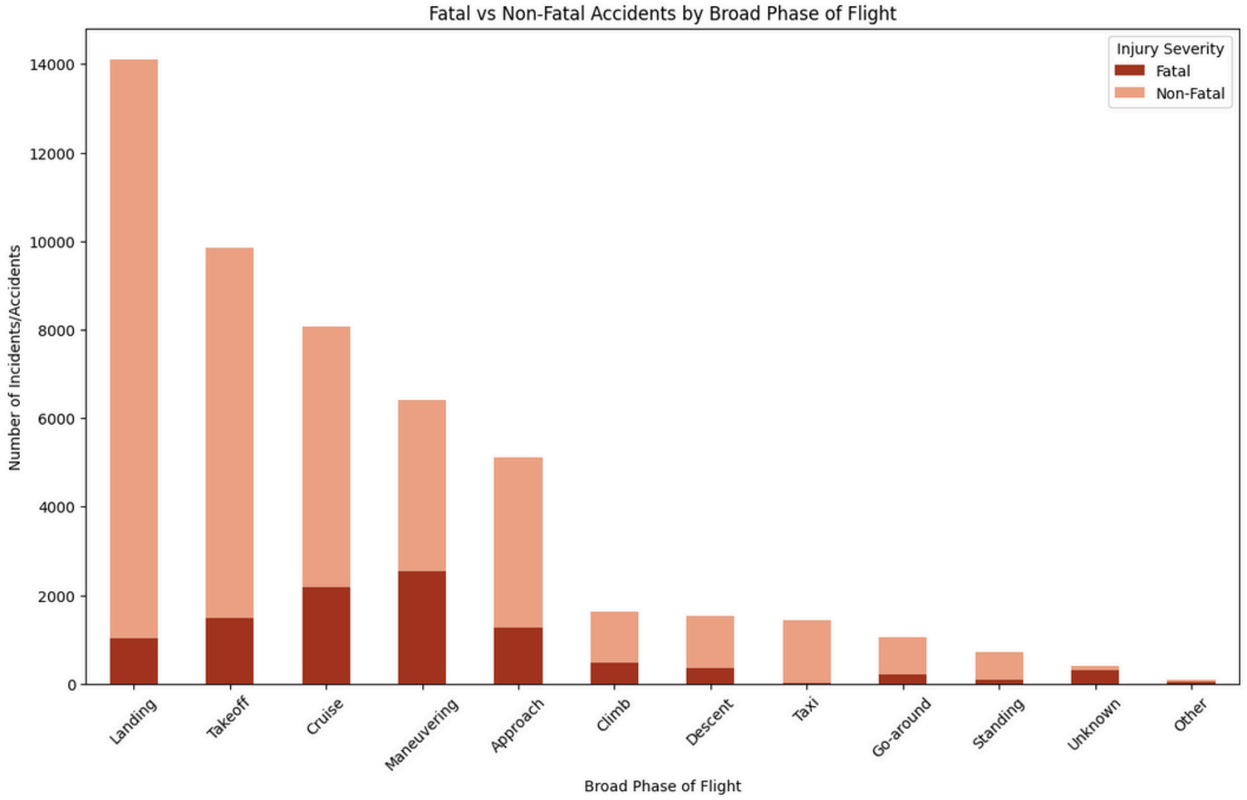
- Fatal accidents are concentrated in specific flight phases
- Non-fatal incidents dominate overall, but not uniformly across phases

Conclusion

- Accident severity is phase dependent
- Certain operational moments carry higher fatal risk

Recommendation

- Favor aircraft with strong safety records in high-risk flight phases
- Emphasize operational controls around these phases



AIRCRAFT MAKE RISK

Key Observations

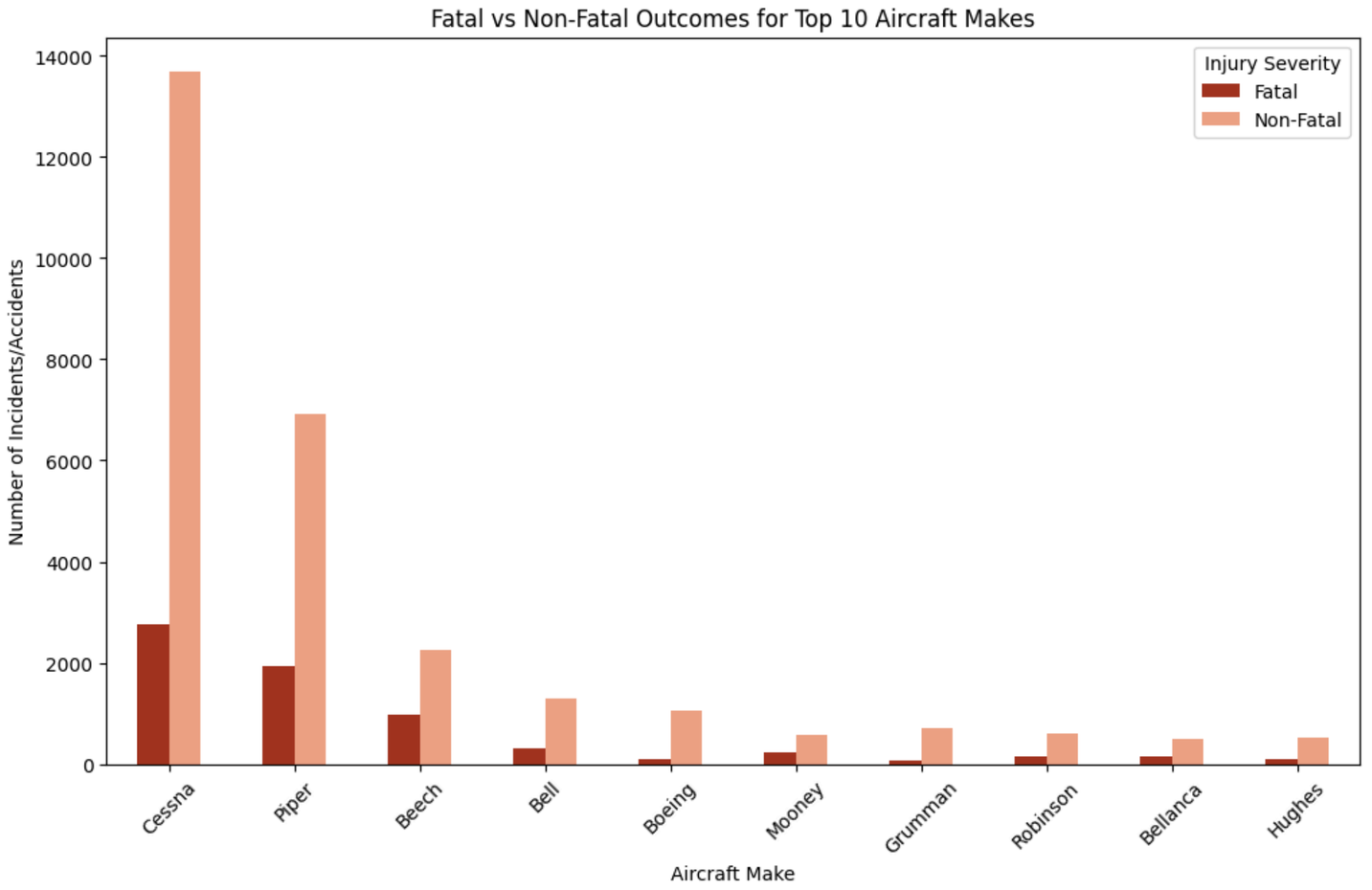
- Cessna and Piper record the highest number of incidents among the top manufacturers, but the majority are non-fatal, indicating high usage rather than high fatal risk.
- Boeing, Mooney, Grumman, and Bellanca show consistently lower fatal outcomes relative to non-fatal incidents, reflecting stronger safety performance.

Conclusions

- A high number of incidents does not automatically imply higher fatal risk; outcome severity provides a more accurate measure of aircraft safety.
- Manufacturers with low fatal-to-non-fatal ratios demonstrate more favorable safety profiles than those with fewer but more severe accidents.

Business Recommendations

- Prioritize aircraft manufacturers with low fatality proportions, even when total incident counts are high, to reduce safety and reputational risk.
- Use severity-based risk metrics (fatal vs non-fatal outcomes) alongside incident counts when making aircraft acquisition decisions.



ACCIDENT TRENDS OVER TIME

Key Observations

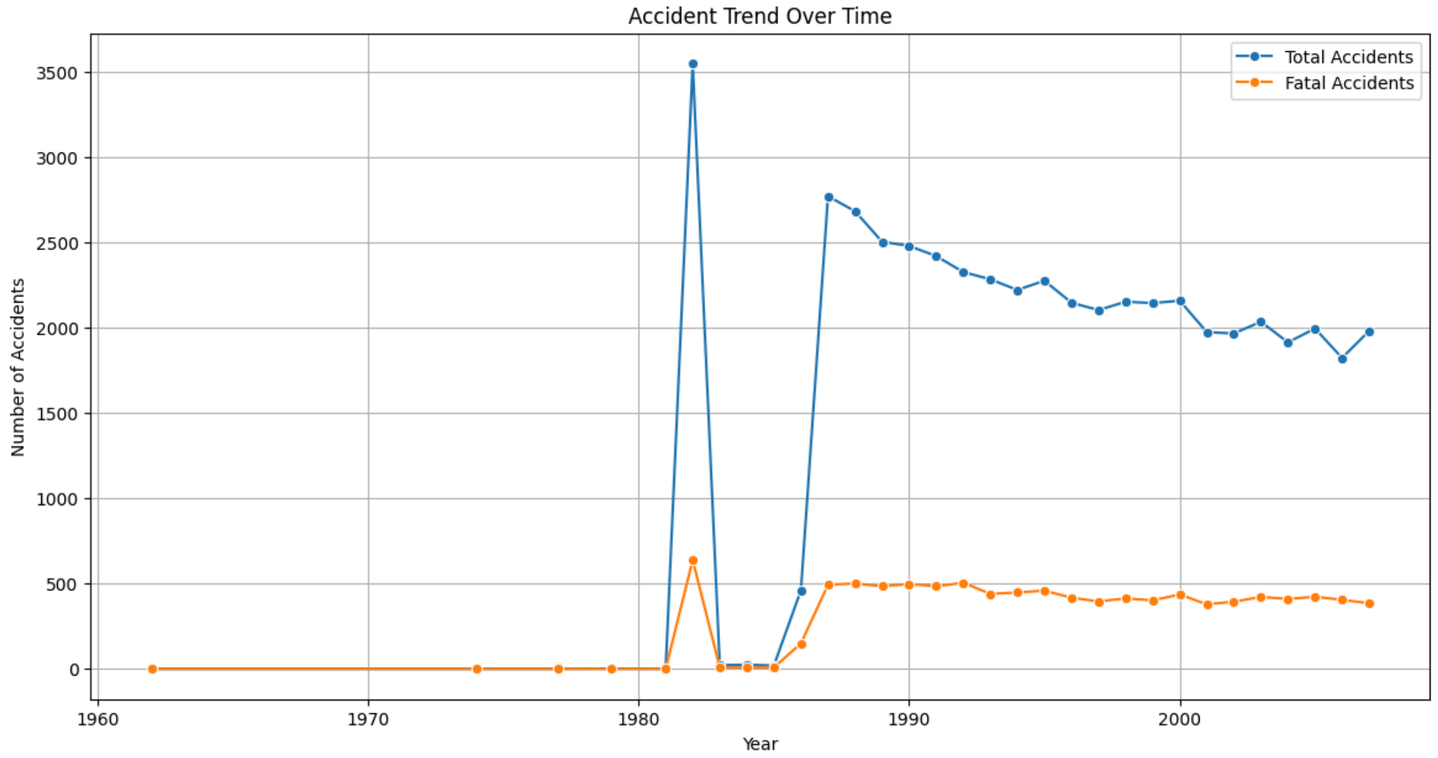
- Total accidents decline over time
- Fatal accidents also decline, but at a slower rate

Conclusion

- Aviation safety has improved, but fatal risk persists
- Older aircraft generations contribute more to historical risk

Recommendation

- Invest in newer generation aircraft
- Use long-term trends to guide strategic fleet decisions



ANALYSIS CONCLUSIONS

Fatal vs Non-Fatal Outcomes for Top 10 Aircraft Makes

- Aircraft manufacturer is associated not only with how often incidents occur, but with how severe those incidents tend to be. Manufacturers with lower fatal-to-non-fatal ratios present lower operational and financial risk, even if they appear frequently in accident data.

Top 10 Aircraft Models by Fatal Injury Rate

- Aircraft model choice has a direct and measurable impact on accident severity, making fatal injury rate a more relevant risk metric than raw accident counts.

Mean Fatal Injuries per Incident by Engine Type

- Engine type influences accident severity, not just aircraft performance, and should be treated as a core safety consideration in acquisition decisions

ANALYSIS CONCLUSIONS

Fatal vs Non-Fatal Accidents by Broad Phase of Flight

- Accident risk is not evenly distributed across flight operations specific phases represent concentrated points of failure.

Fatality Rate by Weather Condition (VMC vs IMC)

- Weather conditions strongly affect accident severity, with IMC operations posing outsized fatality risk.

Accident Trends Over Time

- Despite overall safety improvements, high severity accidents remain a business risk, reinforcing the need for careful aircraft and operational choices.

RECOMMENDATIONS

1. Purchase aircraft from manufacturers and models with low fatal injury rates per accident, not simply low accident counts.

2. Prioritize aircrafts with strong IMC-capable systems.

3. Reduce early stage exposure by limiting IMC operations and emphasizing training during high risk flight phases.

4. Prioritize aircraft with lower risk engine types that demonstrate lower mean fatal injuries per incident, especially for early stage fleet expansion.

5. Focus pilot training, standard operating procedures, and safety monitoring on high risk flight phases, particularly approach, landing and maneuvering.

QUESTIONS?

THANK YOU

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