

# Aircraft Safety and Accident Analysis: Recommendations for New Acquisitions

Insights on Safety and Risk for Aircraft Purchases

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# Presentation Overview

- Content:
  - Business Problem
  - Data used in the analysis
  - Insights from the data used
  - Recommendations

# Business Problem



- The business is expanding into the aviation industry and needs to assess potential aircraft risks.
- We were tasked with analyzing aviation accident data to determine the safest aircraft for commercial or private use.

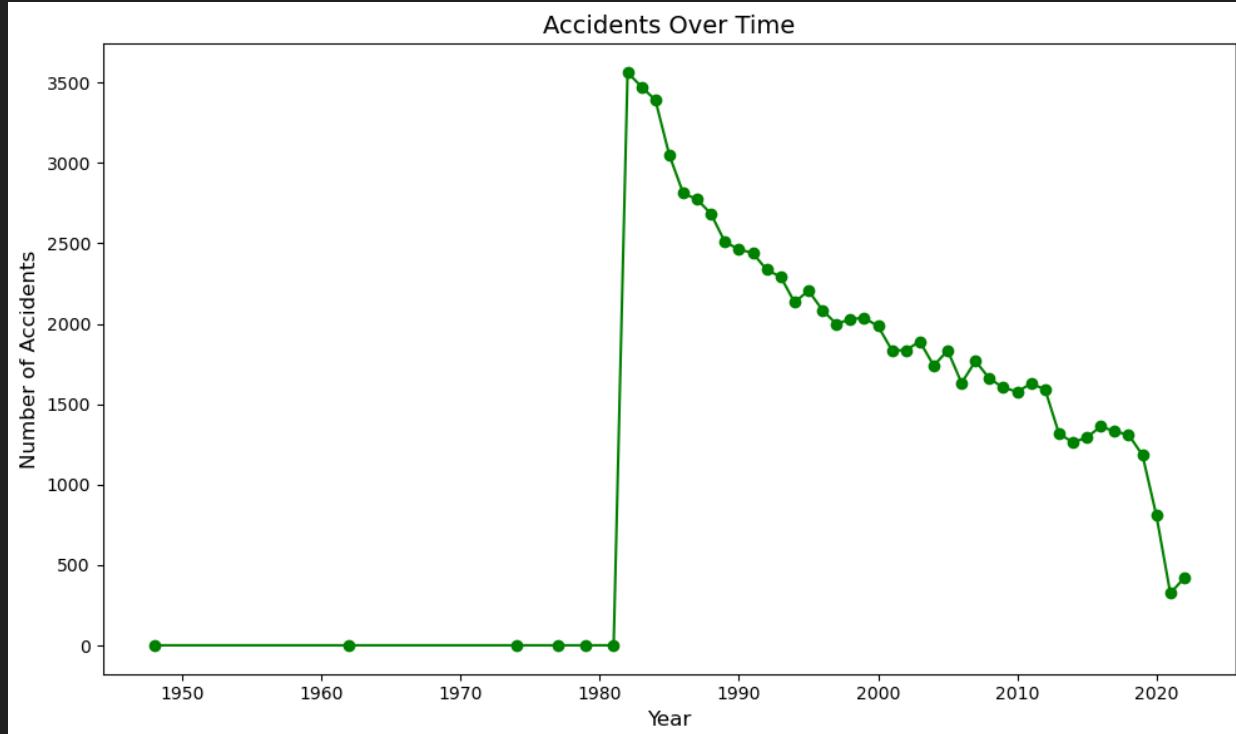
# Data used in the analysis

- **Source:** National Transportation Safety Board (NTSB) aviation accident data (1962-2023).
- **Key Columns used:**
  - Aircraft Make (Make\_Lower)
  - Accident Date (Event.Date)
  - Weather Conditions (Weather.Condition)
  - Injury Severity (Injury.Severity)
  - Aircraft Damage (Aircraft.damage)
  - Phases of Flight (Broad.phase.of.flight)

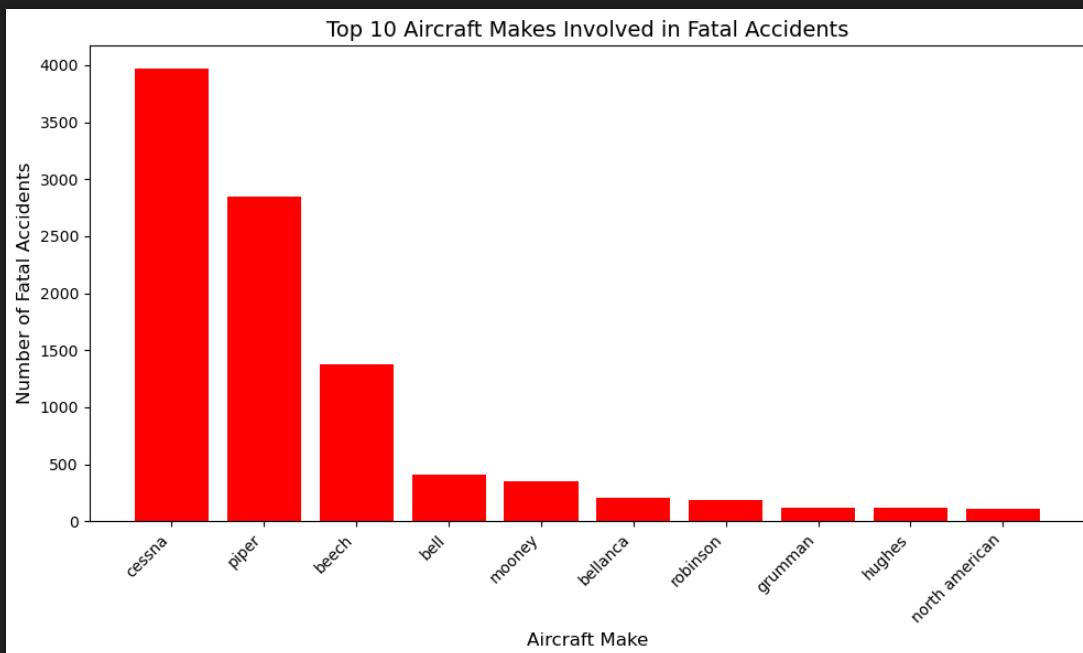
| nes | Engine.Type   | Event.Date | Location         | Country       | Injury.Severity | Aircraft.damage | Total.Fatal.Injuries | Total.Serious.Injuries | Total.Minor.Injuries | Total.Uninjured | Weather.Condition | Broad.phase.of.flight | Report.Status  | Make_Lower       |
|-----|---------------|------------|------------------|---------------|-----------------|-----------------|----------------------|------------------------|----------------------|-----------------|-------------------|-----------------------|----------------|------------------|
| 1.0 | Reciprocating | 1948-10-01 | MOOSE CREEK,     | United States | Fatal           | Destroyed       | 2.0                  | 0.0                    | 0.0                  | 0.0             | UNK               | Cruise                | Probable Cause | stinson          |
| 1.0 | Reciprocating | 1962-07-19 | BRIDGEPORT, CA   | United States | Fatal           | Destroyed       | 4.0                  | 0.0                    | 0.0                  | 0.0             | UNK               | Unknown               | Probable Cause | piper            |
| 1.0 | Reciprocating | 1974-08-30 | Saltville, VA    | United States | Fatal           | Destroyed       | 3.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Cruise                | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1977-06-19 | EUREKA, CA       | United States | Fatal           | Destroyed       | 2.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Cruise                | Probable Cause | rockwell         |
| 2.0 | Turbo Fan     | 1979-05-17 | BOSTON, MA       | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 1.0                  | 44.0            | VMC               | Climb                 | Probable Cause | monstell douglas |
| 1.0 | Reciprocating | 1981-08-01 | COTTON, MN       | United States | Fatal           | Destroyed       | 4.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Unknown               | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1982-01-01 | PULLMAN, WA      | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 2.0             | VMC               | Takeoff               | Probable Cause | cessna           |
| 2.0 | Reciprocating | 1982-01-01 | EAST HANOVER, NJ | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 2.0             | IMC               | Landing               | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1982-01-01 | JACKSONVILLE, FL | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 3.0                  | 0.0             | IMC               | Cruise                | Probable Cause | north american   |
| 1.0 | Reciprocating | 1982-01-01 | HOBBS, NM        | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 1.0             | VMC               | Approach              | Probable Cause | piper            |
| 1.0 | Reciprocating | 1982-01-01 | TUSKEGEE, AL     | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 1.0             | VMC               | Landing               | Probable Cause | beech            |
| 1.0 | Reciprocating | 1982-01-02 | HOMER, LA        | United States | Non-Fatal       | Destroyed       | 0.0                  | 0.0                    | 1.0                  | 0.0             | IMC               | Cruise                | Probable Cause | bellanca         |
| 1.0 | Reciprocating | 1982-01-02 | HEARNE, TX       | United States | Fatal           | Destroyed       | 1.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Takeoff               | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1982-01-02 | CHICKASHA, OK    | United States | Fatal           | Destroyed       | 1.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Cruise                | Probable Cause | navion           |
| 1.0 | Reciprocating | 1982-01-02 | LITTLE ROCK, AR  | United States | Fatal           | Destroyed       | 2.0                  | 0.0                    | 0.0                  | 0.0             | IMC               | Cruise                | Probable Cause | beech            |
| 1.0 | Reciprocating | 1982-01-02 | MIDWAY, UT       | United States | Non-Fatal       | Destroyed       | 0.0                  | 0.0                    | 0.0                  | 1.0             | IMC               | Taxi                  | Probable Cause | enstrom          |
| 1.0 | Reciprocating | 1982-01-02 | SKWENTA, AK      | United States | Fatal           | Destroyed       | 3.0                  | 0.0                    | 0.0                  | 0.0             | VMC               | Unknown               | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1982-01-02 | GALETON, PA      | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 1.0             | VMC               | Taxi                  | Probable Cause | cessna           |
| 1.0 | Reciprocating | 1982-01-02 | MIAMI, FL        | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 2.0             | VMC               | Cruise                | Probable Cause | smith            |
| 1.0 | Reciprocating | 1982-01-02 | YPSILANTI, MI    | United States | Non-Fatal       | Substantial     | 0.0                  | 0.0                    | 0.0                  | 1.0             | VMC               | Takeoff               | Probable Cause | cessna           |

## Accidents Over Time: Trends

- The line chart shows the number of accidents from **1962 to 2023**.
- The graph clearly shows that the data was well collected after 1980
- There was quite a number of accidents that have significantly reduced over time possibly due to improved safety regulations.



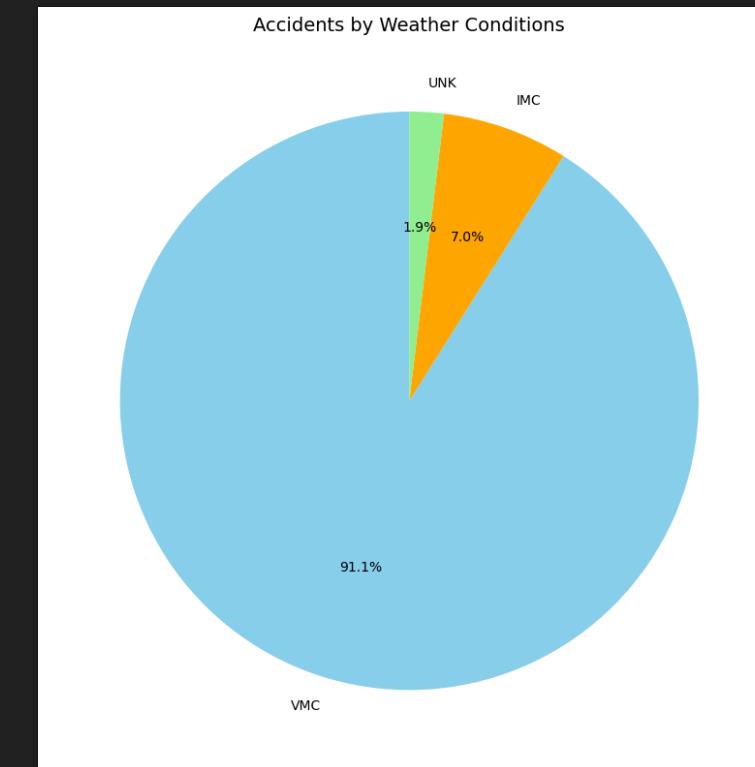
# Top Aircraft Makes Involved in Accidents



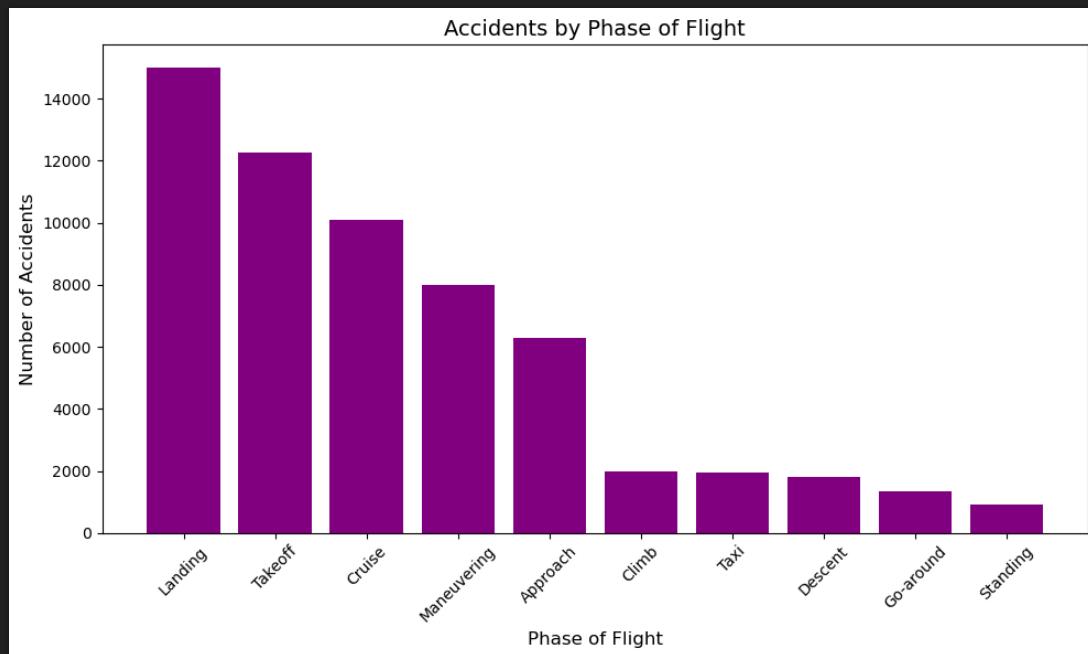
- **Cessna, Piper, and Beechcraft** have the highest number of accidents in the dataset.
- This could be related to their prevalence in the market (e.g., Cessna is one of the most widely produced aircraft).
- Cessna and Piper are the most common aircraft in accidents, but this might be due to their large market share.

# Accidents by Weather Condition

- Accidents occur more frequently in **Visual Meteorological Conditions (VMC)** than in **Instrument Meteorological Conditions**.
- This may be due to increased accuracy of the equipment used hence an overall reduction of accidents over time as technology improves.



# Accidents by Phase of Flight



- **Landing** and **Takeoff** phases have the highest accident rates.
- However, accidents during the **En Route** phase tend to be more severe, often involving fatalities.

# Recommendations for Aircraft Acquisition

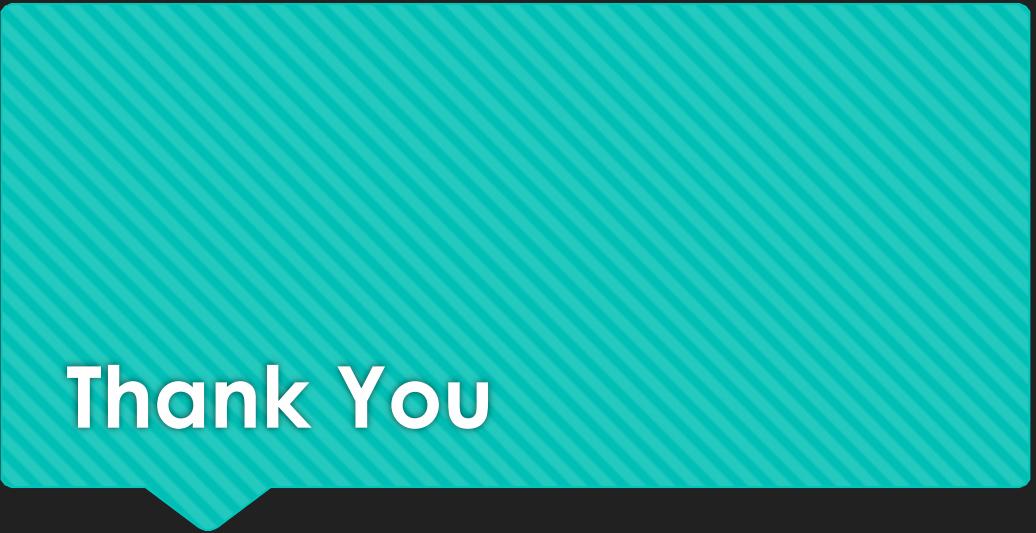
- **Cessna and Piper:** Despite their accident rates, these aircraft are widely produced and known for reliability. Consider models with strong safety records. The ratio of units sold to accidents may need to be established before ruling them out.
- **Avoid Aircraft in Poor Weather:** Aircraft operating in **IMC conditions** need stricter regulations and better training. The business should also research on the routes of operation to have better choice of aircraft to purchase.
- **Focus on Safe Phases:** Ensure operations are in airports with proper air traffic control and wide experience in handling all types of aircrafts.

# Next Steps for Business Implementation

- Further analysis on **specific aircraft makes and models** with more detailed safety features. The number of units sold overall would help to get the ratio of accidents to make.
- Of the IMC accidents there needs to be a check on weather those models made any changes to their instrumentation to improve on the aircraft performance in harsh weather conditions.
- The pilots selection should be very strict and their knowledge of the aircrafts and number of flight hrs experience will need to be heavily scrutinized.

# Conclusion

- **Aircraft Makes:** Our analysis revealed that the most common aircraft involved in accidents are **Cessna**, **Piper**, and **Beechcraft**. However, this can be attributed to their larger market share rather than indicating they are inherently unsafe. More focus should be placed on investigating specific models with poor safety records.
- **Weather Conditions:** Accidents predominantly occur in **Visual Meteorological Conditions (VMC)**, largely because flights are more common in these conditions. However, **Instrument Meteorological Conditions (IMC)** show a higher proportion of **fatal accidents**, suggesting that adverse weather conditions significantly increase the severity of accidents. This underscores the importance of safety measures in poor weather.
- **Phases of Flight:** The majority of accidents occur during **landing** and **takeoff**, which are naturally high-risk phases of flight. Interestingly, accidents occurring **en route** tend to have more severe outcomes, often involving multiple fatalities. This highlights the need for increased safety measures, particularly during landing and takeoff phases.
- **Injury Severity and Aircraft Damage:** The analysis shows a clear correlation between **aircraft damage** and **injury severity**. Aircraft that were **destroyed** during accidents had a higher likelihood of resulting in **fatal** outcomes, while those with **minor** or **substantial** damage typically resulted in **non-fatal** injuries. This confirms that the level of damage is a strong indicator of the severity of the accident.



**Thank You**

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