Data-Driven Insights for Safe Entry into the Aviation Industry

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Introduction

The company is expanding in to new industries to diversify its portfolio. Specifically, they are interested in purchasing and operating airplanes for commercial and private enterprises. I was charged with determining which aircraft are the lowest risk for the company to start this new business Endeavor.

Goal

The goal is to translate my findings into actionable insights that the head of the new aviation division can use to help decide which aircraft to purchase

Data

- The data used is from the National Transportation Safety Board that includes aviation accident data.

- From 1962 to 2023 about civil aviation accidents and selected incidents in the United States and international waters

Data Cont.

- **Preparation and Cleaning**

Explore data columns and rows using the appropriate codes in python

Columns with missing values more than 40% dropped :

- Schedule, Air.carrier, FAR.Description, Aircraft.Category, Latitude, Longitude, Airport.Code and Airport.Name

Data Cont.

- **Data Imputation**
  - The data had many duplicated rows and inconsistencies corrected using appropriate codes
  - Filled missing values with 0.0 since no data might mean no injuries
  - Filled categorical values with unknown

Data Cont.

- **Data Imputation Cont.**
  - 1461 missing dates replaced with 2000-01-01
  - All other inconsistencies corrected

Methodology

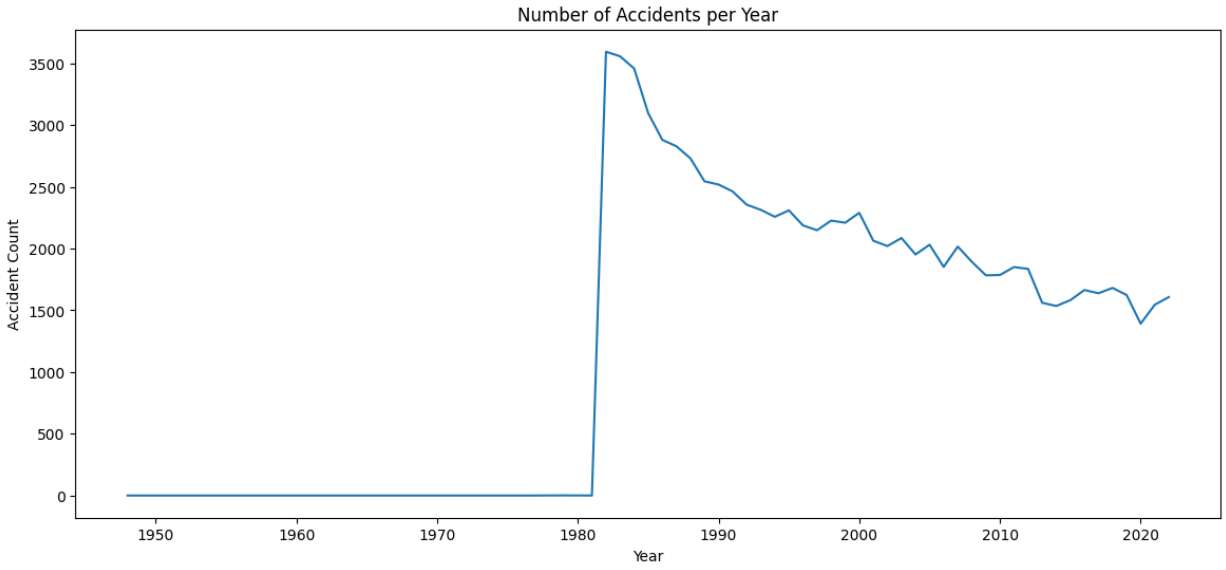
- **Data Analysis**

TableauViz and charts used to aid in the simplification of the data and its analysis

- Investigation by make and model
- KPI for the best make model
- Count of injuries severity and Air craft damage

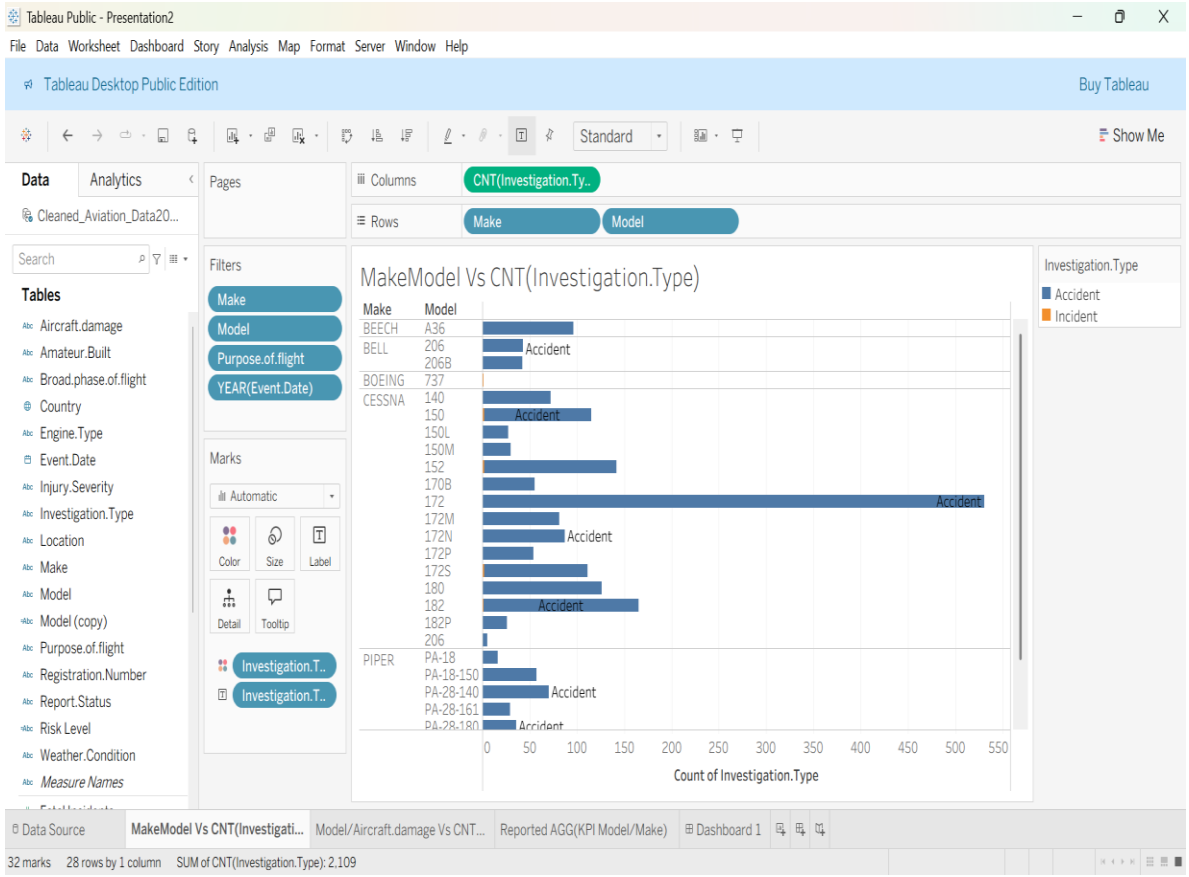
Results

The line graph shows number of accidents declining over time from 1981



Find 1:Model Vs Make Analysis

Visualization



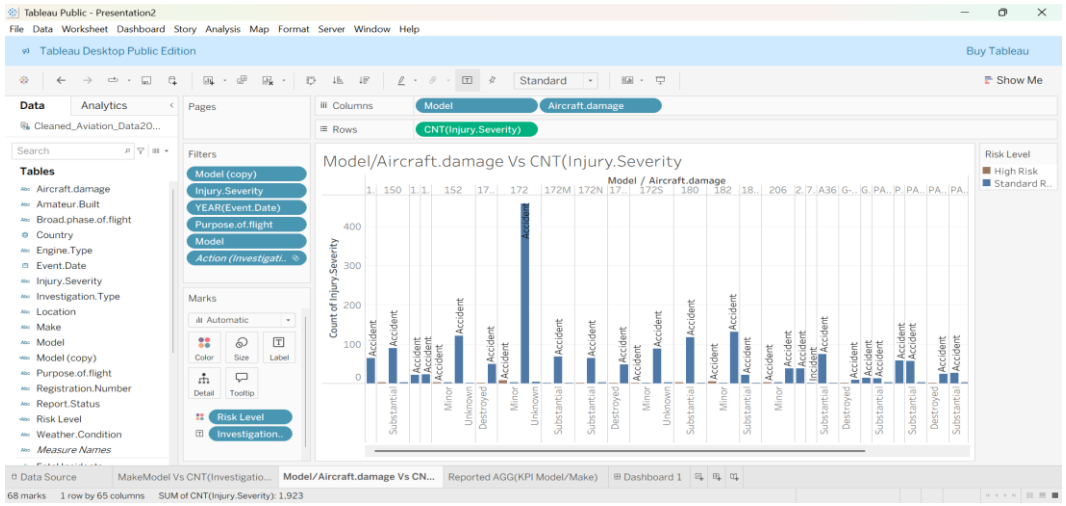
Findings

From Top 20 Risky Models Analysis:

- Cessna 152: 94 incidents
- Cessna 172: 178 incidents
- Piper PA-28-140: 33 incidents

Which Means that

Finding 2:Injuries Severity vs Model Analysis



Model	Risk Level / Aircraft.damage / Investigation.Type High Risk Destroyed Accident	Standard Risk Minor Accident	Minor Incident	Substantial Accident
150	2			90
150L				21
150M				23
152	2		2	121
172	7	3		458
172M		1		68
172N	1			65
172P	1			48
180	3			118
182	5		1	131
206B				38
737			1	
PA-18				12
PA-18-150				58
PA-28-140				57
PA-28-161	1			24
PA-28-180				27
PA-28-181	1			22
PA-38-112				5
Unknown				2

Point to note :

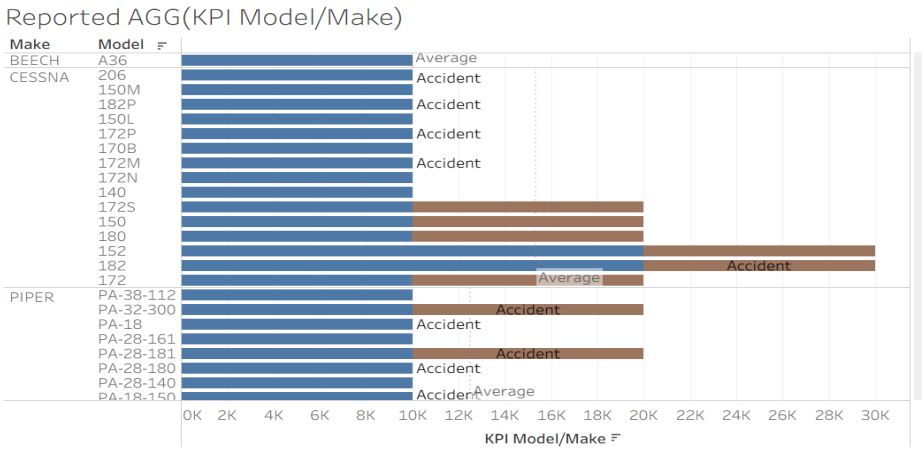
Some models frequently result in total losses

(35% for Cessna 152) 35% of accidents from Cessna 152 result in total loss.

Hence:

Piper PA-28-140: 99.7% severe damage rate

Finding 3:Key Performance Indicators



Reported AGG(KPI Model/Make)

Model	Risk Level / Investigation.Type: High Risk Accident	Standard Risk Accident	Standard Risk Incident
140		9,996.41	
150	9,999.87	9,994.75	
150L		9,998.94	
150M		9,999.14	
152	9,999.87	9,993.16	9,999.93
170B		9,997.48	
172	9,999.60	9,972.31	
172M		9,997.14	
172N		9,996.75	
172P		9,997.87	
172S	9,999.93	9,996.35	
180	9,999.80	9,993.16	
182	9,999.67	9,992.03	9,999.93
182P		9,999.00	
206		9,999.73	
A36		9,997.21	
PA-18		9,999.67	
PA-18-150		9,998.14	
PA-28-140		9,998.21	
PA-28-161		9,999.27	

Cessna 152: 9,990.77 score but 1,883 severe accidents (Sheet 2).)

Conclusion

- **Safety Score vs. Reality**:
- Highest-Risk Models implies Deceptively High Scores:Cessna 152: Scores 9,873-9,989.8 has 1,883 severe accidents (Sheet 2)
- Piper PA-28-140: Scores 9,958-9,994 has 635 severe accidents and Safest Models Validate Scores
- Cessna 206B: 9,999.7 score aligns with 92% minor damage rate
- Boeing 737: 9,999.3 score matches minimal incident history
- The Training Aircraft ParadoxProblem:Cessna 150/172 and Piper PA-28 series dominate flight training → artificially inflate accident countsScores may normalize for flight hours, masking true risk for new operatorsEvidence:Cessna 172 has 1,346 accidents (Sheet 2) but 9,909.6-9,993.8 scoresSafety scores don't reflect 99%+ severe damage rates for these models

Recommendations

- For optimal safety and operational efficiency I recommend the following fleet strategy:Immediate Buysing of Cessna 206B: Prioritize acquisition due to its proven safety record with the lowest damage rates in our analysis
- Commercial Option:Boeing 737 - Ideal for passenger routes through leasing arrangements, offering validated safety performance at scale.
- Conditional Use: Cessna 152/172 - Consider only through flight school partnerships where risk can be shared, as these models show higher incident rates despite their common use in training.

Recommendations

The following are Manufacturers with reliable safety records:

- International inc
- American blimp corp
- American legend aircraft co
- Arrow falcon
- Exporters inc avid aircraft
- Bennett
- Boeing company
- British aircraft corp. (bac)
- Bucker flugzeugbau
- Centrair

Questions Prompt

"Which aircraft aligns best with our risk appetite and business goals as we expand into aviation?

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