Risk Analysis of the Aviation Industry

By: Nechama Borisute, Julie Leung, John Streaman

Who we are/Business Understanding

The Data Science department at “Company X” tasked with:

- Analyzing risk of entering the aviation industry
- Figuring out which airplane Make/ Model to invest in

Three actionable recommendations for the head of the Aviation team:

- Whether to expand & diversify portfolio via aviation industry
- Airplanes for private and/or commercial enterprises

Data Sources

- Aviation data from the National Transportation Safety Board
- Aviation accident data from 2008 to 2022 in U.S. and international waters.
- For best aircraft investment based on the potential risk, we focused on:
    - Investigation Type
    - Make, Model
    - Injuries
    - Report Status
- For more additional information regarding the data:

  https://www.kaggle.com/datasets/khsamaha/aviation-accident-database-synopses/data

Main Safety Metrics

- Accident versus Incident
  - Incident - An event where something goes wrong but there are sufficient safety measures to avoid escalation.
  - Accident - An incident with insufficient safety measures that results in injuries and/or fatalities.
- Pilot Negligence versus Engine Failure
  - ~76% likelihood of a human error vs ~24% of a mechanical error
- Risk of Personal Injury

Accident versus Incident

- Formula: accidents / accidents + incidents

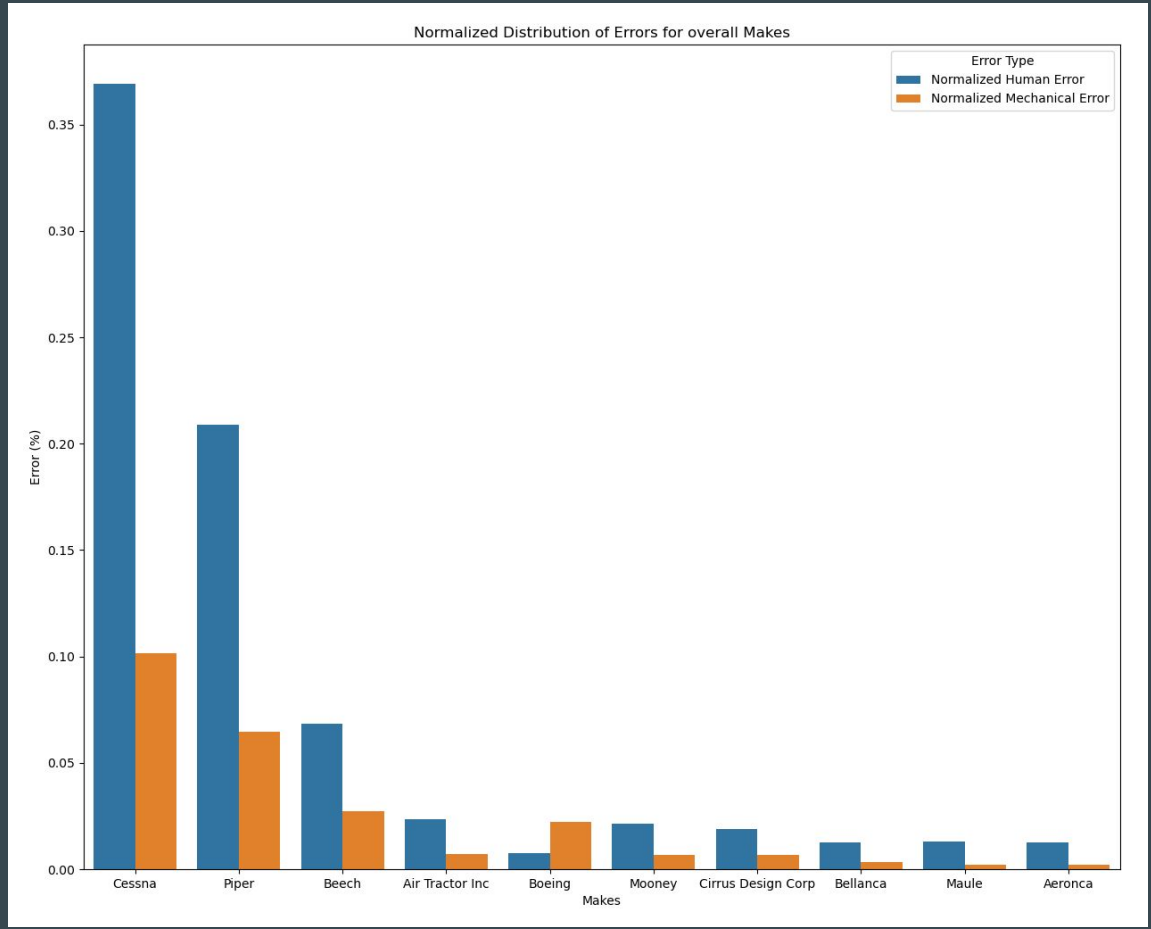
  Values range between 0 and 1

  0 = lower frequency of accidents

  1 = higher frequency of accidents

Make	Accident	Incident	Ratio Value
Boeing	212	79	0.728
Cirrus Design Corp	159	10	0.940
Beech	918	17	0.981
Mooney	234	4	0.983
Cessna	4580	58	0.987
Piper	2670	21	0.992
Bellanca	158	1	0.993
Air Tractor Inc	191	1	0.994
Maule	150	0	1.000
Aeronca	144	0	1.000

Pilot's Negligence or Engine Failure?



	Makes	Human Error	Mechanical Error	Ratio of Human Error	Ratio of Mechanical Error
0	Cessna	3656	1006	0.369	0.102
1	Piper	2068	639	0.209	0.065
2	Beech	676	272	0.068	0.027
3	Air Tractor Inc	234	70	0.024	0.007
4	Boeing	73	222	0.007	0.022
5	Mooney	213	65	0.022	0.007
6	Cirrus Design Corp	188	67	0.019	0.007
7	Bellanca	125	34	0.013	0.003
8	Maule	128	22	0.013	0.002
9	Aeronca	126	19	0.013	0.002

Make	Model	source_cause	Count of Errors
Boeing	737	Mechanical	24
Boeing	737 7H4	Mechanical	16
Boeing	767	Mechanical	13
Boeing	757	Mechanical	12
Boeing	737-7H4	Mechanical	9
Boeing	747	Mechanical	7
Boeing	737-700	Mechanical	6
Boeing	757-222	Mechanical	5
Boeing	737-8H4	Mechanical	5
Boeing	737-3H4	Mechanical	4
Boeing	737 3H4	Mechanical	4
Boeing	737-823	Mechanical	4
Boeing	757-223	Mechanical	3
Boeing	737-832	Mechanical	3
Boeing	787	Mechanical	3
Boeing	717-200	Mechanical	3
Boeing	777 - 236	Mechanical	2
Boeing	767 332	Mechanical	2
Boeing	737 824	Mechanical	2
Boeing	737 76N	Mechanical	2
Boeing	737-7H4	Human	2
Boeing	737-724	Mechanical	2
Boeing	757 232	Mechanical	2
Boeing	757 223	Mechanical	2
Boeing	757-232	Human	2
Boeing	737-300	Mechanical	2
Boeing	757-232	Mechanical	2
Boeing	777	Mechanical	2
Boeing	737 832	Mechanical	2

BOEING MODELS

- Model 737 has the highest number of mechanical error (24).
- Second with Model 737 7H4 which has 16 mechanical errors.
- The models following the top 4 models all have fewer than 10 instances of mechanical or human error.

Make by Personal Injury Risk: Ratios

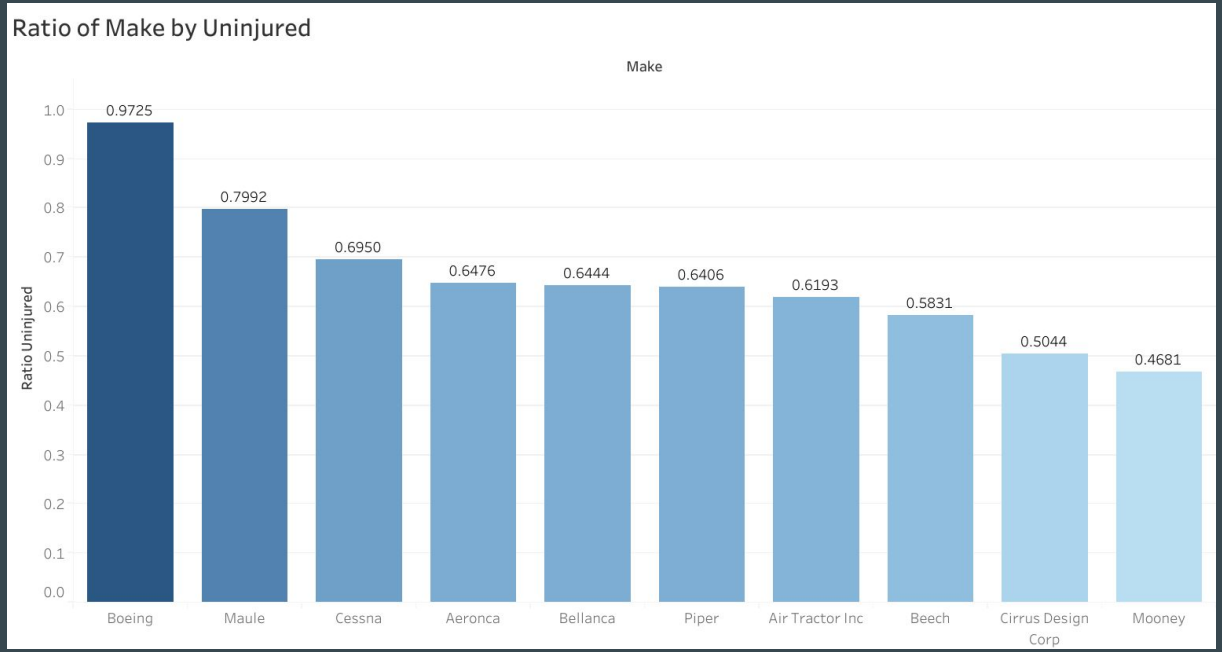
Uninjured

Highest

- Boeing: 0.9725

Lowest

- Mooney: 0.4681



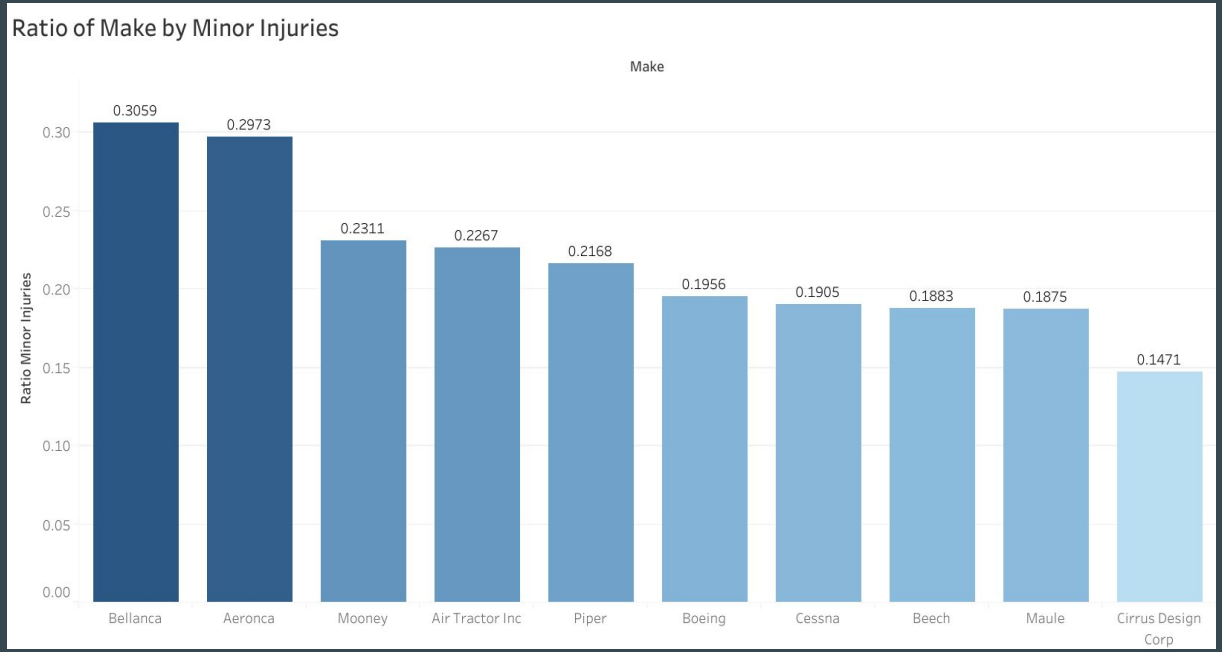
Minor Injuries

Highest

- Bellanca: 0.3059

Lowest

- Cirrus Design Corp.: 0.1471



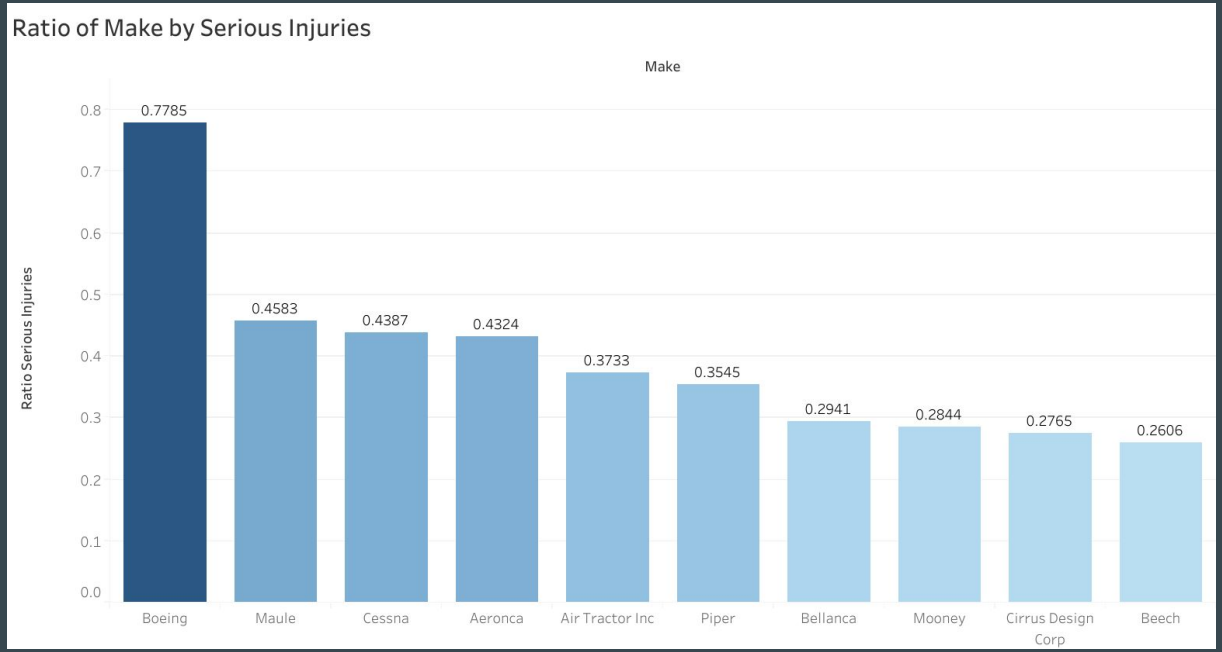
Serious Injuries

Highest

- Boeing: 0.7785

Lowest

- Beech.: 0.2606



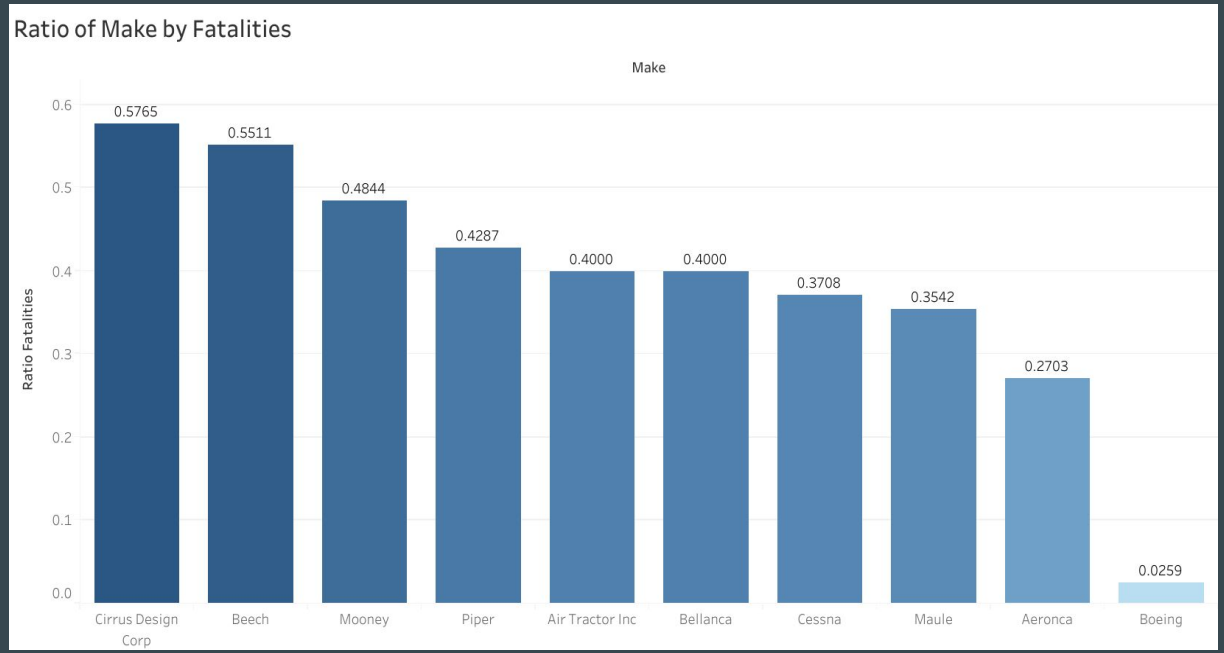
Fatalities

Highest

- Cirrus Design Corp.: 0.5765

Lowest

- Boeing: 0.0259



Boeing Models

Most Assoc. w/ Serious Injury:

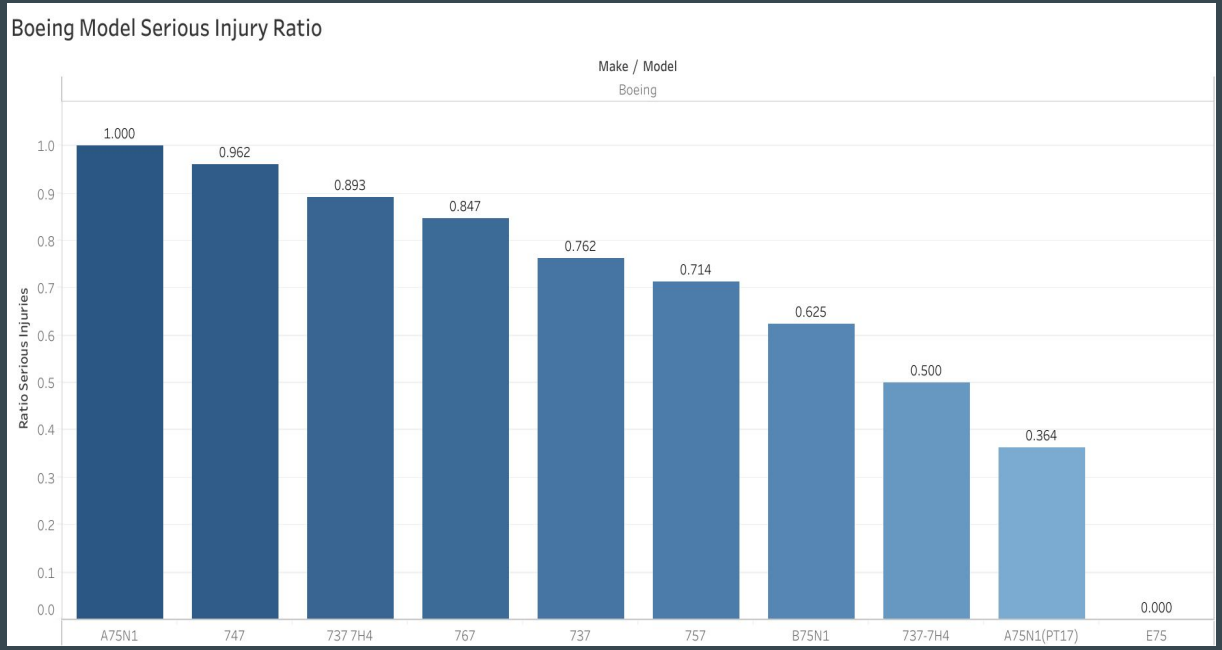
- A75N1

Least Assoc. w/ Serious Injury:

- **E75**

Sample Size: 112

- **Limited to top 10 models**



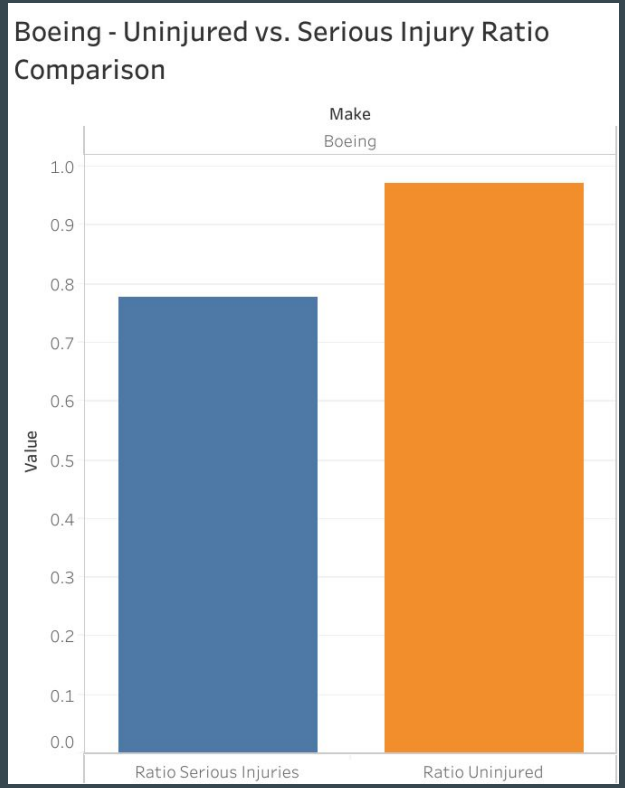
Uninjured vs. Serious Injury

To reiterate:

Serious Injury Ratio - 0.7785

Uninjured Ratio - 0.9725

Odds are, you are safest on a Boeing!



Based on our analysis we recommend the following three strategies:

1. Invest in Boeing airplanes
    a. Lowest ratio of accidents to events
    b. A lower chance of both injury and fatality when flying.
2. Any Boeing model except for model 737.
    a. If we invest, we need to consider the following:
        i. Boeing is the only outlier with more mechanical error than human error.
        ii. There needs to be an investment on a high quality maintenance team.
3. Commercial aircraft over private
    a. Most accidents occur on smaller private aircrafts (one-engine/reciprocating engine).
    b. i.e. Cessna (High human errors with insufficient safety measures)

Thank You!