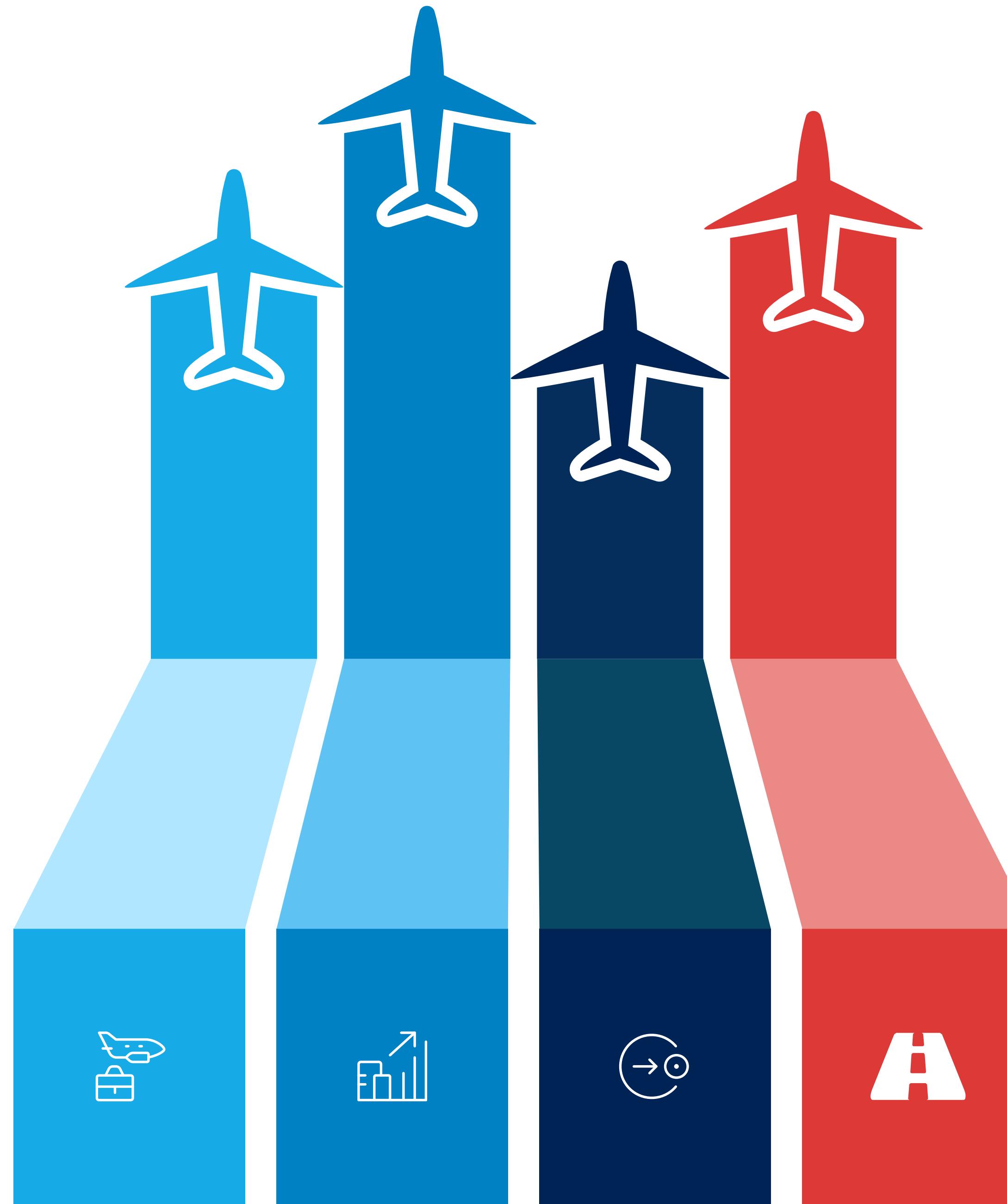




# AIRCRAFT SAFETY

AN ANALYSIS BY JAKE MCCAIIG



# Business Understanding

As our business begins exploring the possibilities of entering the aviation industry, we must conduct research into which aircraft are the safest to invest in for our expanding fleet. As such, there are a few factors to take into account.

 **BUSINESS NEED**

 **RESEARCH**

 **RECOMMENDATIONS**

 **NEXT STEPS**



## SIZE

- 31 Columns
- 90,348 Rows
- 2,800,788 possible data points



## FEATURE TYPES

- 5 Numerical columns
- 26 Categorical columns



## CLEANLINESS

- 1,390 duplicate rows
- 568,561 missing values

# DATA UNDERSTANDING

Our dataset comes from the NTSB and contains information about aircraft incidents and accidents. The dates range from 1948 through 2022.

Injury.Severity	Aircraft.damage	Aircraft.Category	Registration.Number	Make	Model	Amateur.Built	Number.of.Engines	Eng
Fatal(2)	Destroyed		NC6404	Stinson	108-3	No	1.0	Rec
Fatal(4)	Destroyed		N5069P	Piper	PA24-180	No	1.0	Rec
Fatal(3)	Destroyed		N5142R	Cessna	172M	No	1.0	Rec
Fatal(2)	Destroyed		N1168J	Rockwell	112	No	1.0	Rec
Fatal(1)	Destroyed		N15NY	Cessna	501	No		
Non-Fatal	Substantial	Airplane	CF-TLU	McDonnell Douglas	DC9	No	2.0	Turb
Fatal(4)	Destroyed		N4988E	Cessna	180	No	1.0	Rec
Non-Fatal	Substantial	Airplane	N2482N	Cessna	140	No	1.0	Rec
Non-Fatal	Substantial	Airplane	N7967Q	Cessna	401B	No	2.0	Rec
Non-Fatal	Substantial		N3906K	North American	NAVION L-17B	No	1.0	Rec
Non-Fatal	Substantial		N44832	Piper	PA-28-161	No	1.0	Rec
Non-Fatal	Substantial		N4275S	Beech	V35B	No	1.0	Rec
Non-Fatal	Destroyed	Airplane	N14779	Bellanca	17-30A	No	1.0	Rec
Fatal(1)	Destroyed	Airplane	N758SK	Cessna	R172K	No	1.0	Rec
Fatal(1)	Destroyed	Airplane	N4876K	Navion	A	No	1.0	Rec
Fatal(2)	Destroyed	Airplane	N9779L	Beech	19	No	1.0	Rec

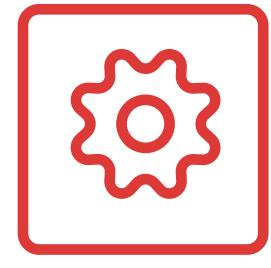
# DATA LIMITATIONS

Some of the limiting factors in answering the business question with this dataset:



## DATA CLEANING

The dataset has a large number of unnecessary columns as well as missing values



## WHAT IS SAFE?

I'll need to determine somewhat arbitrarily what makes an aircraft safe.



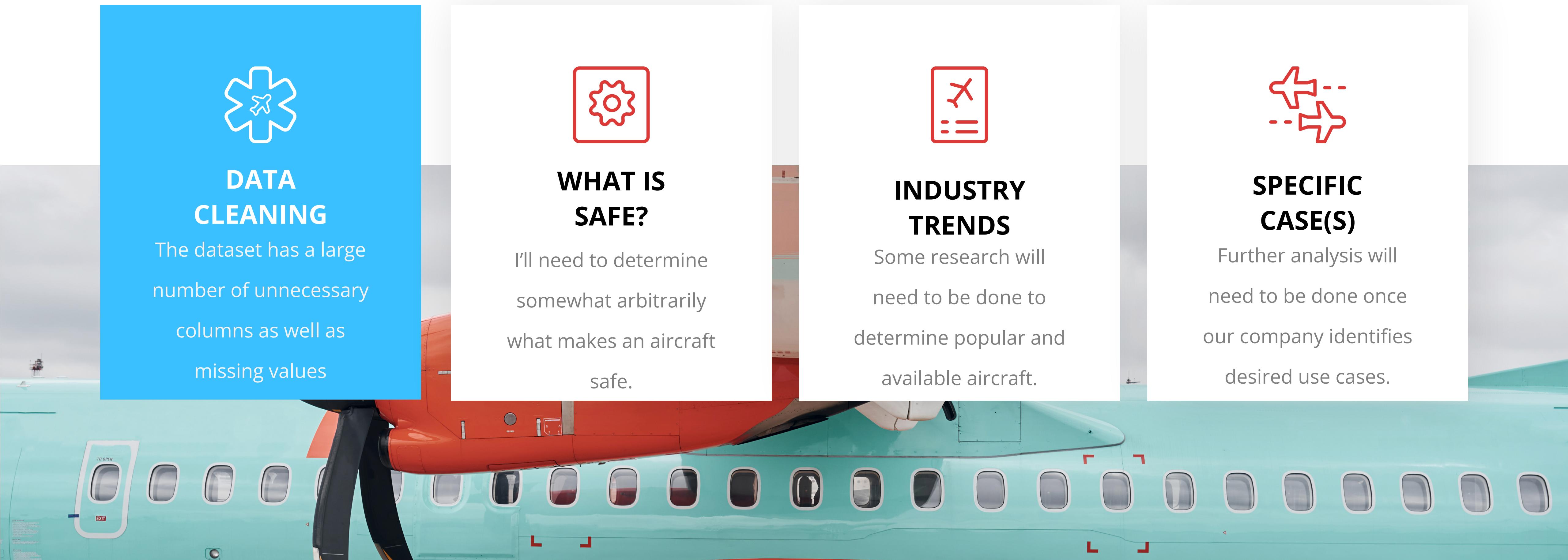
## INDUSTRY TRENDS

Some research will need to be done to determine popular and available aircraft.



## SPECIFIC CASE(S)

Further analysis will need to be done once our company identifies desired use cases.



# DATA ANALYSIS STEPS

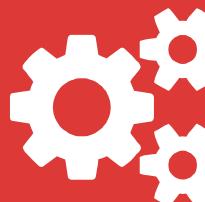
- Bringing in the data and studying its initial state
- Removing duplicate and unnecessary data and filling in missing data
- Creating new data points for analysis, i.e., Fatality/Survivability rates
- Searching for correlations, and patterns in the data

IMPORT

CLEANING &  
OPTIMIZATION

FEATURE  
ENGINEERING

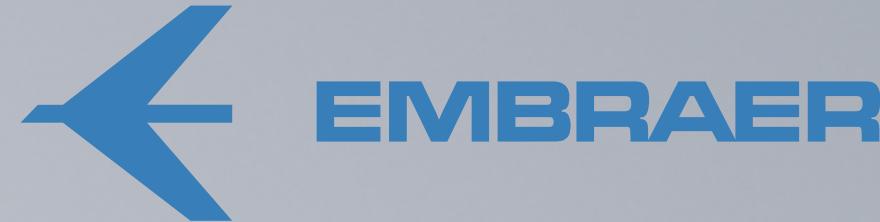
ANALYSIS



# POPULAR AIRCRAFT

According to Assets America and General Aviation News, these manufacturers produced the most popular aircraft in the last decade based on sales. I will base my analysis on this information.

**AIRBUS**



COMMERCIAL

**Cessna** The Cessna logo, featuring a red stylized 'C' with a white tail section.

**BOMBARDIER**



**Gulfstream**

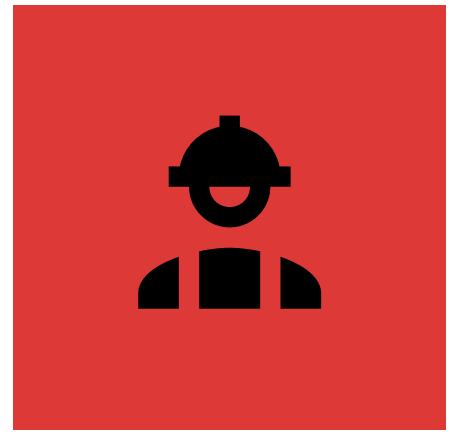
**PILATUS**

**Beechcraft**

PRIVATE



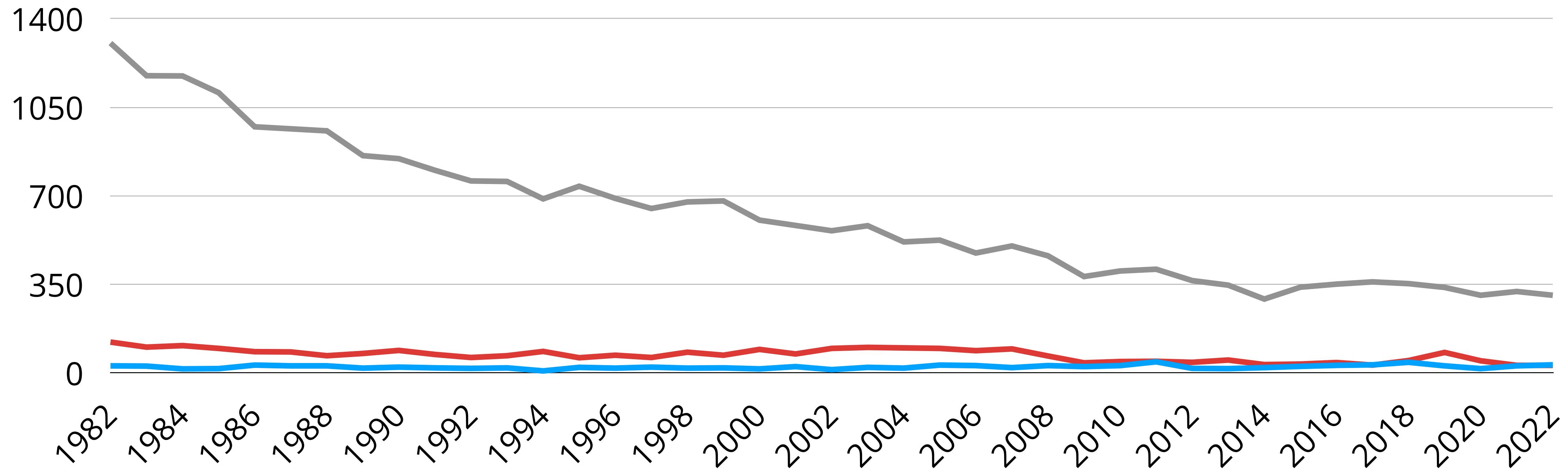
HELICOPTER



**OUR MEASURE OF SAFETY  
WILL BE 'FATALITY RATE'**

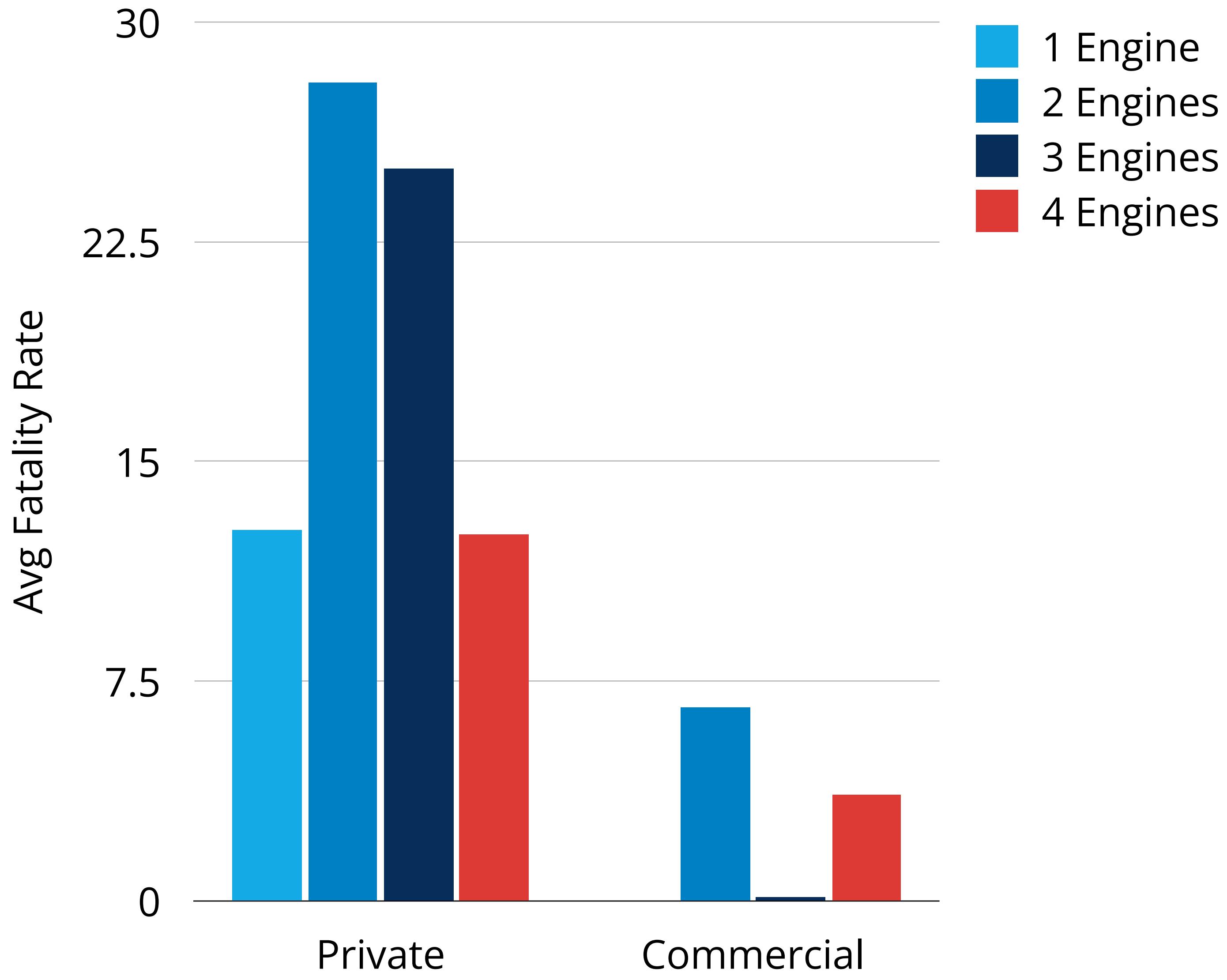


# AIRCRAFT INCIDENTS OVER TIME



All aircraft types are involved in fewer incidents per year over the last 40 years.

40 years ago, private aircraft would likely not be recommended, however, it appears that aviation regulations have improved the safety of operating these aircraft.



# ENGINE COUNTS

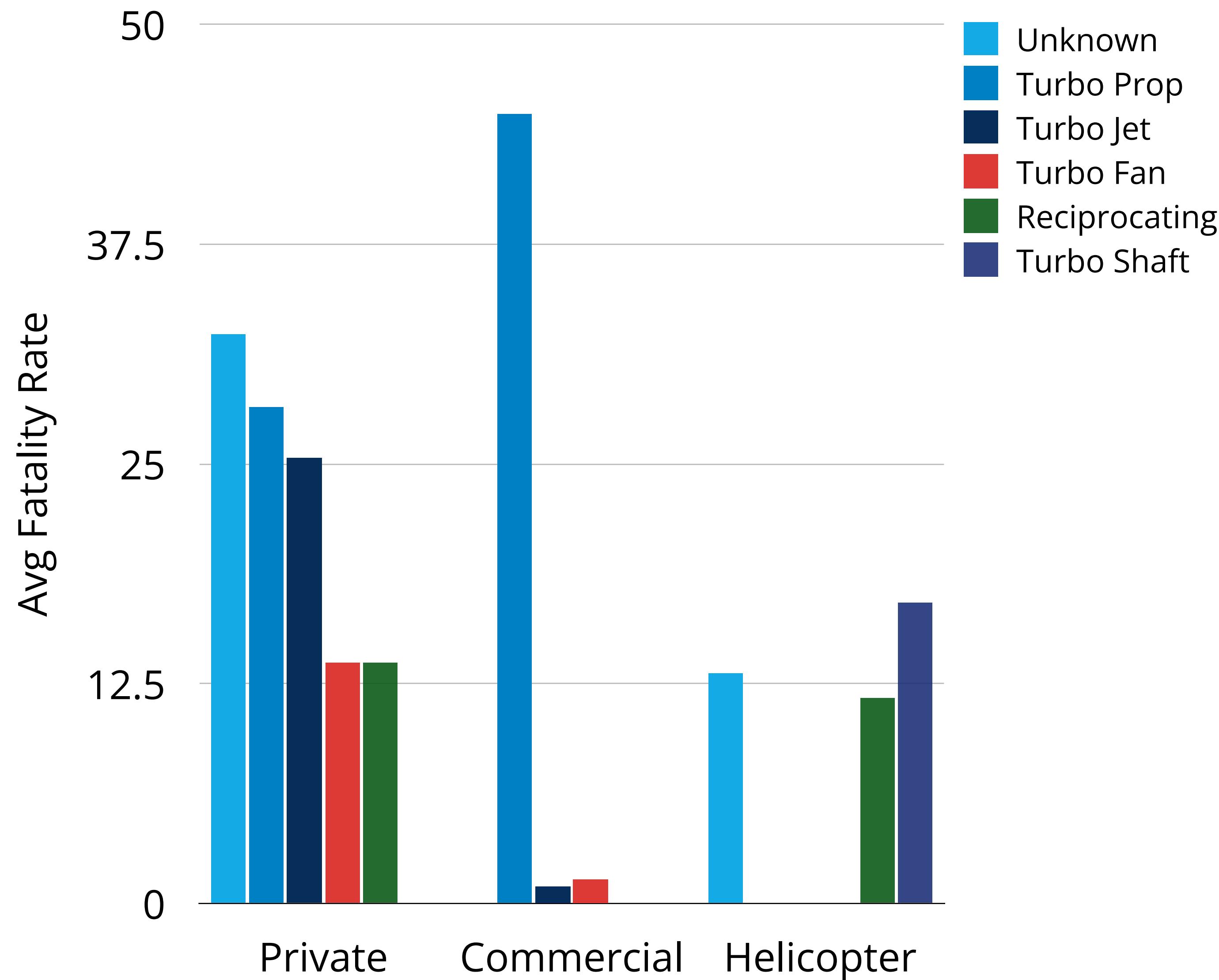
- Single engines in private aircraft are safest.
- While dual engine commercial aircraft have least safe in category.



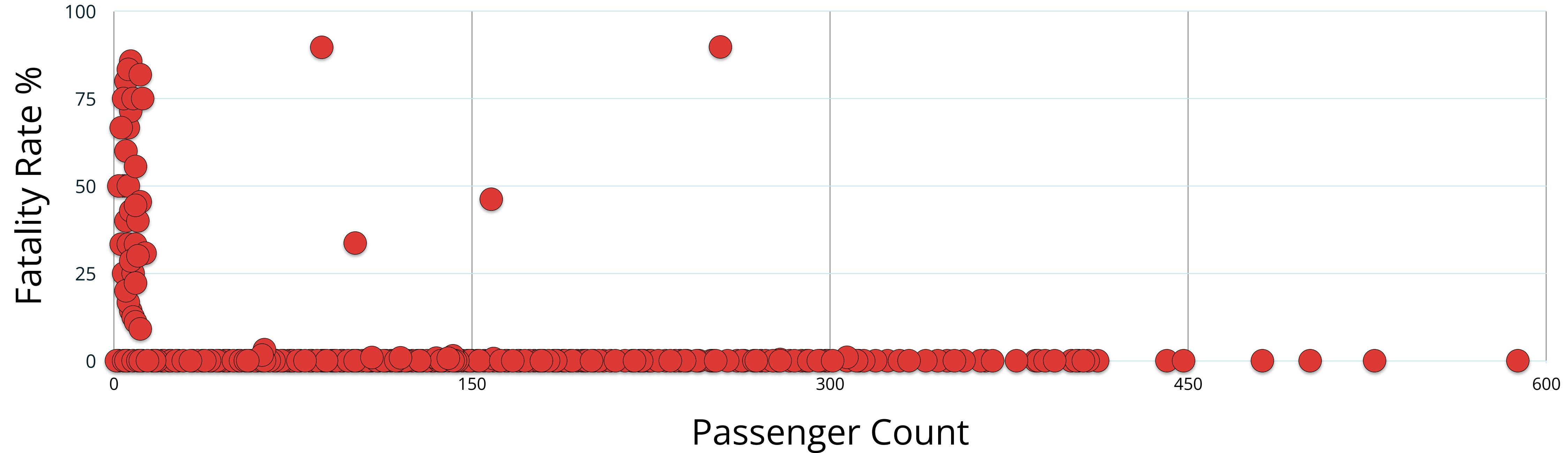
Credit: Textron

# ENGINE TYPES

- Turbo Prop engines tend to have higher average fatality rates
- Turbo Fan, Turbo Jet, and Reciprocating engines are generally safer
- In helicopters, Turbo Shaft and Reciprocating engines make up about equal parts of the market and are generally equally safe.

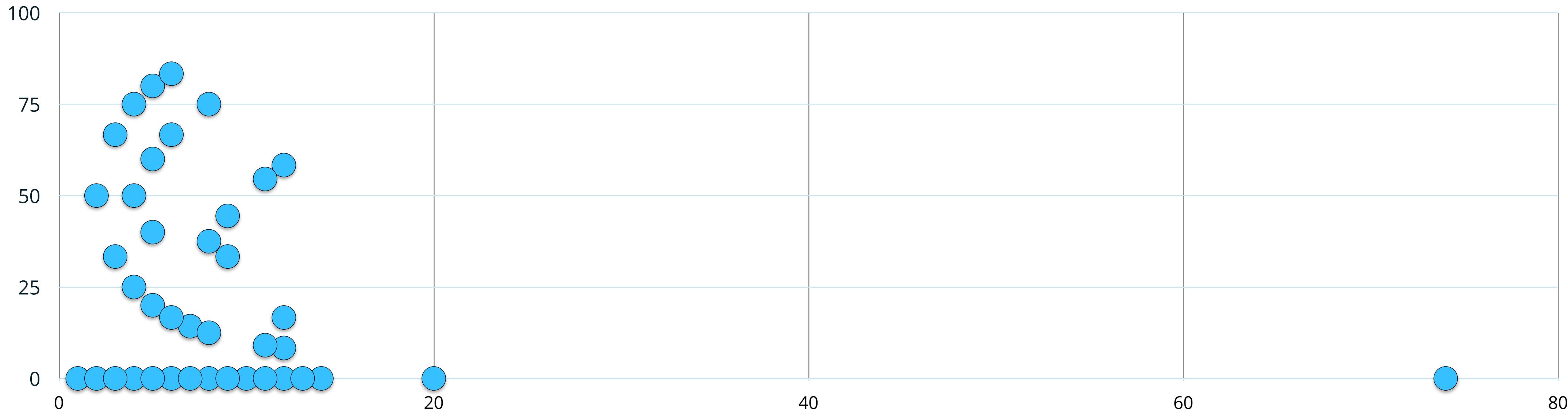


# PASSENGER COUNT VS FATALITY RATE - AIRPLANES



Majority of fatalities appear to happen in aircraft carrying fewer passengers.  
Larger aircraft appear to have a safer track record.

# PASSENGER COUNT VS FATALITY RATE - HELICOPTERS



There is no apparent correlation between passenger counts and fatality rate.

This is likely due to the fact that very few helicopters in existence carry a large number of passengers.

# RECOMMENDATIONS

A few aircraft models that fit the recommended criteria are:

- Private
  - Cessna (Skyhawk, C-150, Skylane, Skywagon)
  - Bombardier (Challenger 600)
  - Embraer (EMB-145)
- Commercial
  - Boeing (All models except 707, 767)
  - Airbus (All models)
  - Embraer (All models)
- Helicopter
  - Bell (206)
  - Robinson (R-22, R-44)

## GENERAL

- **More PAX generally mean lower fatalities**
- **Turbo props should be approached with caution**

## PRIVATE

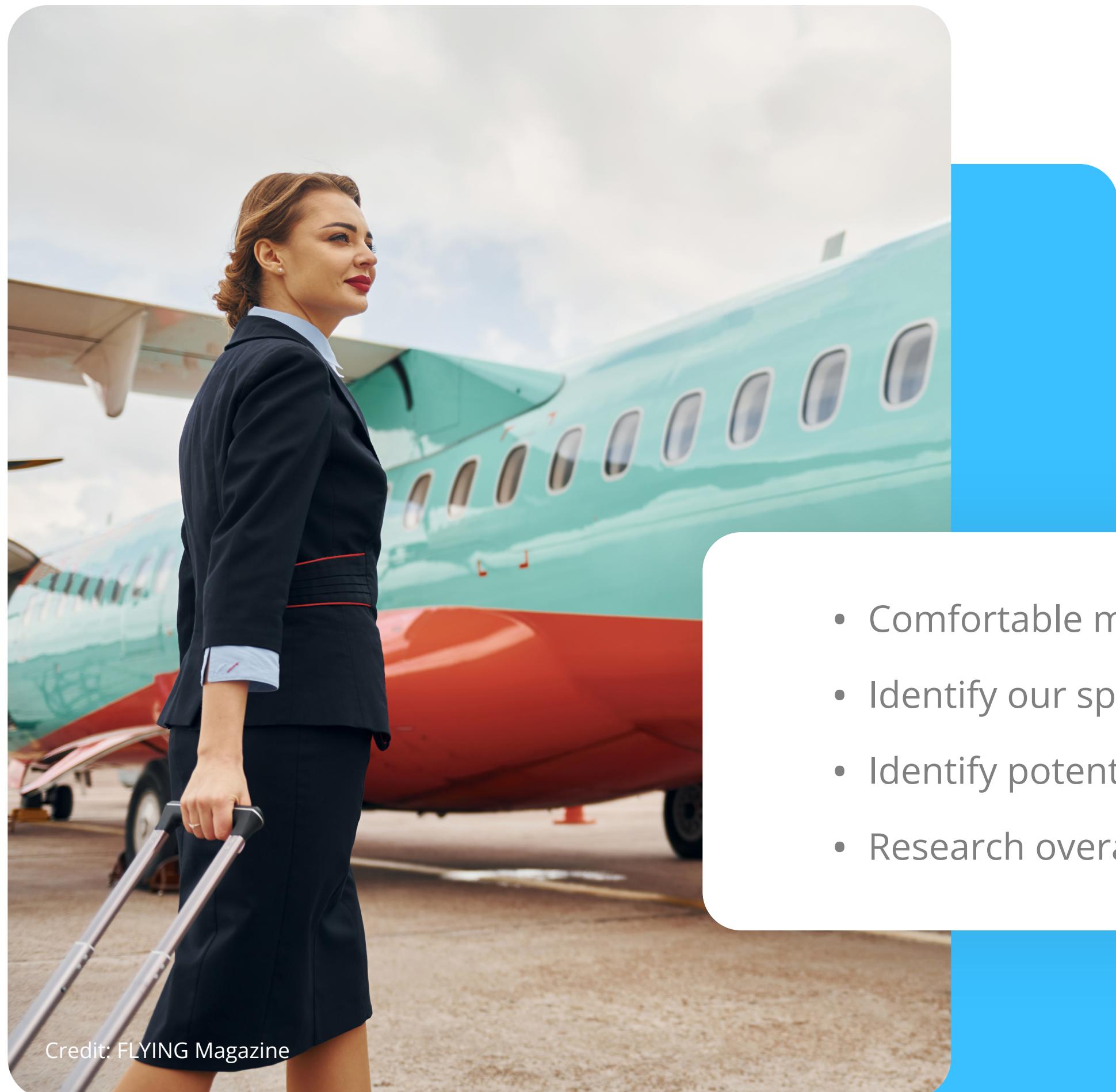
- **Single-engine aircraft preferred**

## COMMERCIAL

- **Dual-engine aircraft preferred**

## HELICOPTER

- **Both reciprocating and turbo shaft engines acceptable**



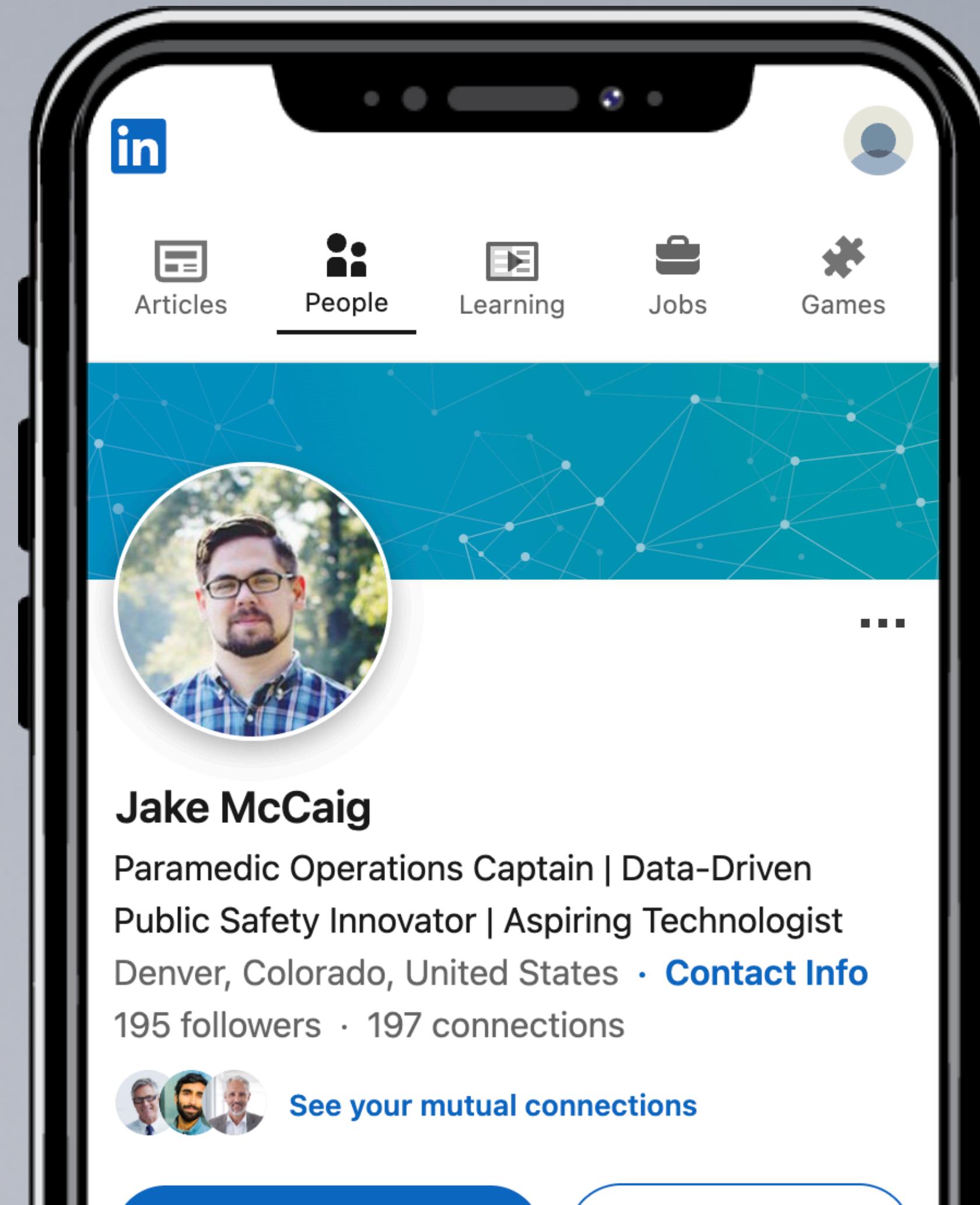
## NEXT STEPS

- Comfortable moving forward?
- Identify our specific use cases.
- Identify potential airframes.
- Research overall flight safety rather than incident data only



Credit: FLYING Magazine

# QUESTIONS?



## THANK YOU



in/JakeMcCaig



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