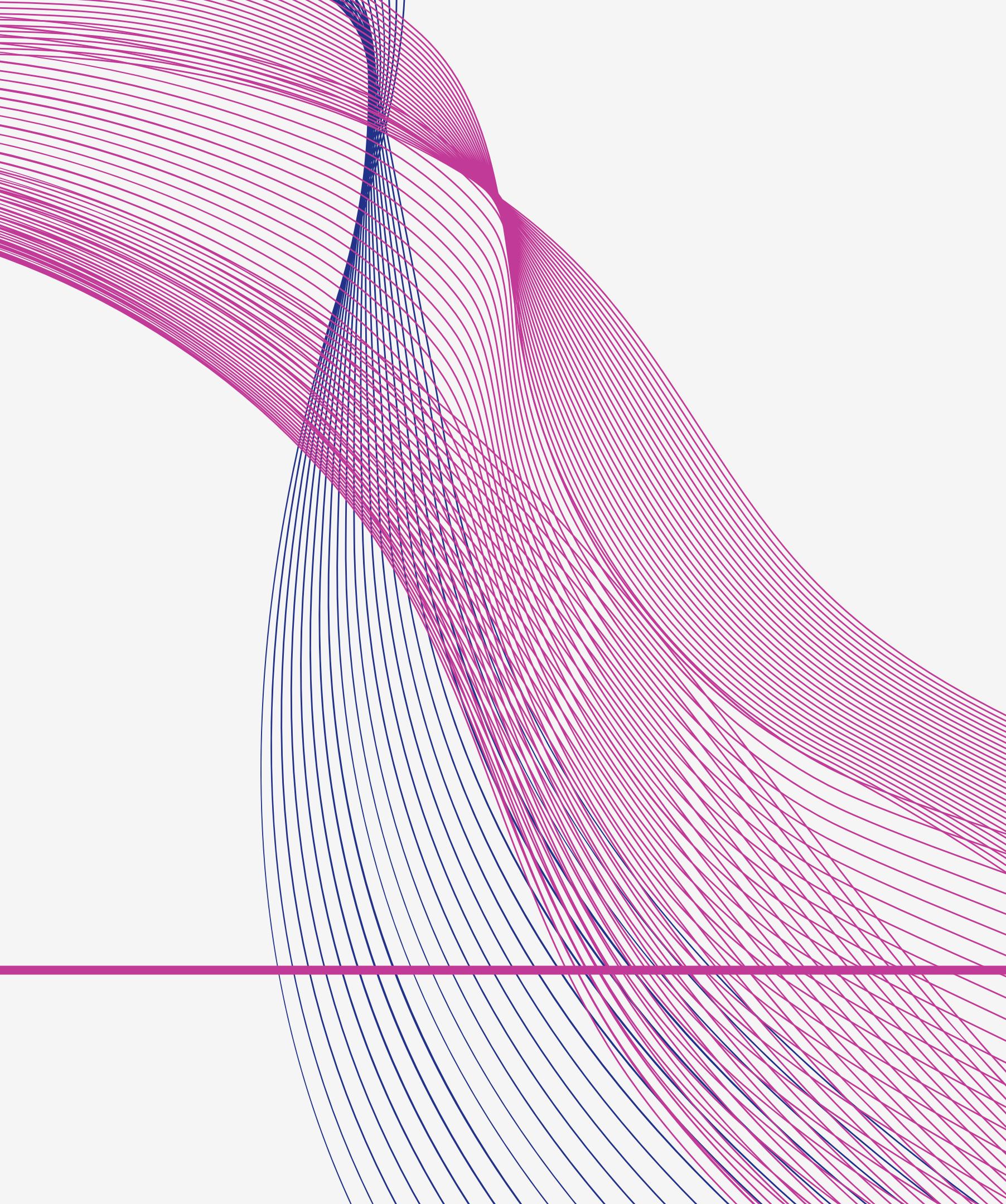




Aircraft Evaluation for ROYAL AIR

www.github.com/Luwate



OVERVIEW

Royal Air is a modern airliner, which takes a novel approach to airlines. Ditching the notion that an airline must either target the private or commercial space, Royal Air has carved a niche for itself by effectively serving both sets of clients. As a result of this, the airline has seen rapid growth and now seeks to grow its fleet of aircraft in order to scale operations.

PROBLEM STATEMENT

Due to the growing demand Royal air has experienced, there is a need to acquire more aircraft, for both its commercial and private operations, in order to match this demand. This project aims to analyse accident data and through this, determine which aircraft would be the most appropriate option based on safety criteria.

EXPECTED BENEFITS

Through the successful completion of this project, Royal Air can expect to be able to make a data-driven decision when purchasing new aircraft which will be the most appropriate in terms of safety criteria.

THE DATA



The data available consists of aviation accidents between 1962 and 2023 collected by the National Transportation Safety Bureau (NTSB).



The most prominent risk of this project would be the scope. This is because the recommendation will be based solely on aircraft safety and does not include other factors which may be important. In addition, the data does not contain all aircraft in service. Therefore, there is the possibility that the most appropriate aircraft is one that is not in the data.



In order to mitigate this risk, further studies should be done to evaluate aircraft based on other metrics.

PROJECT GOALS

The project will be considered a success upon completion of analysis of the data and two aircraft are selected to satisfy both commercial and private aviation sides of the business and recommendations made.

GOAL 1

Clean data in order to remain with only relevant aircraft.

GOAL 2

Analyse the data based on safety criteria.

GOAL 3

Identify the safest aircraft and make final recommendations

DATA UNDERSTANDING



The data provided by the NTSB consists of 90348 rows and 31 columns. It contains features such as: Aircraft Make and Model, as well as information about casualties as a result of aircraft related Events (incidents or accidents).

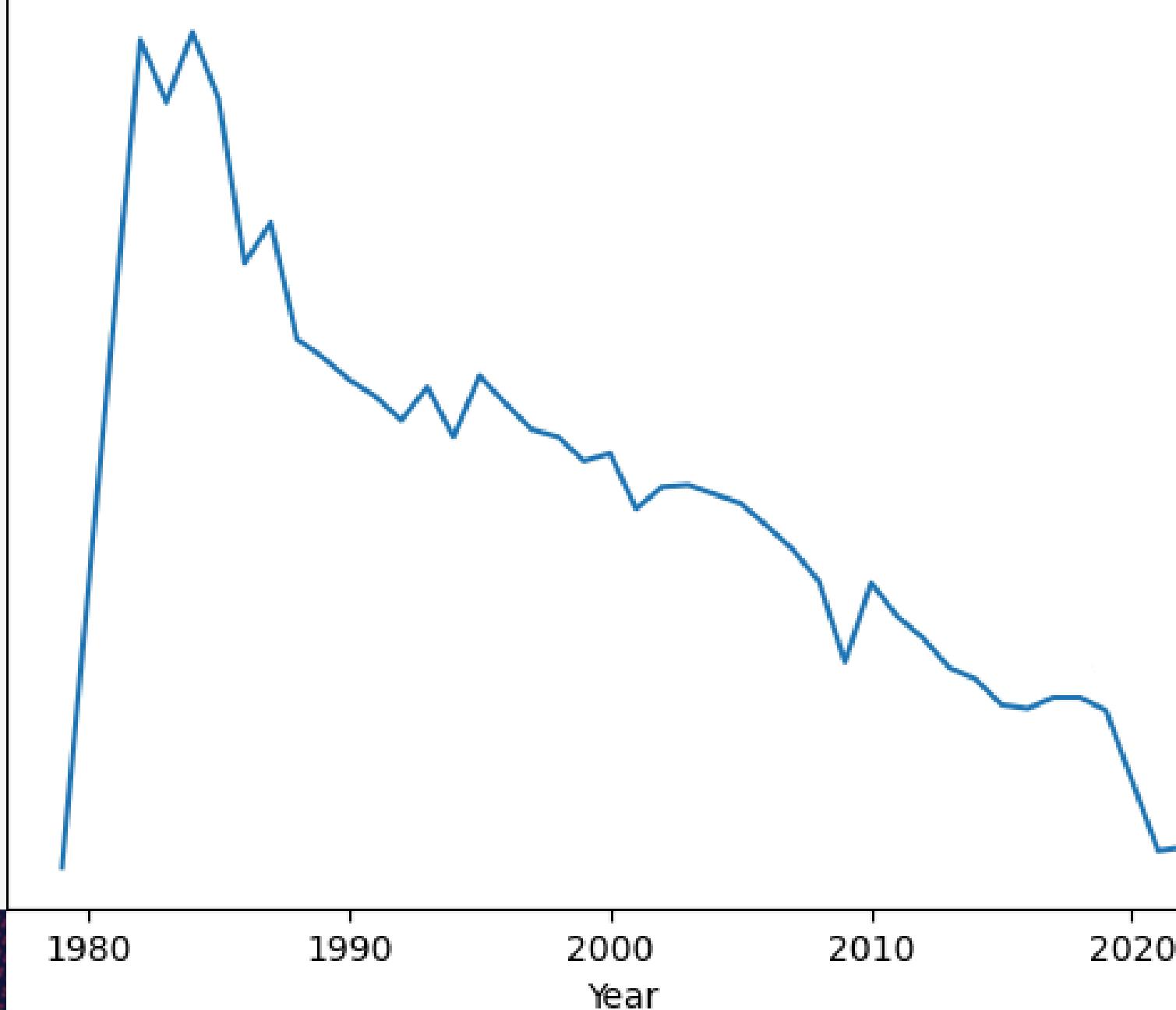


Missing values will be dealt with using techniques such as imputation and dropping of values



Similar aircraft will also be grouped together in order to aggregate data. New columns will be added to represent total souls (people on-board) and survivability has been calculated which is a ratio of non-fatal injuries to total souls.

Events per Year



DATA ANALYSIS

Aviation safety has constantly improving over the past four decades, with a record low for Events (Incidents and Accidents) being set in 2020 and the figure has stayed low ever since..

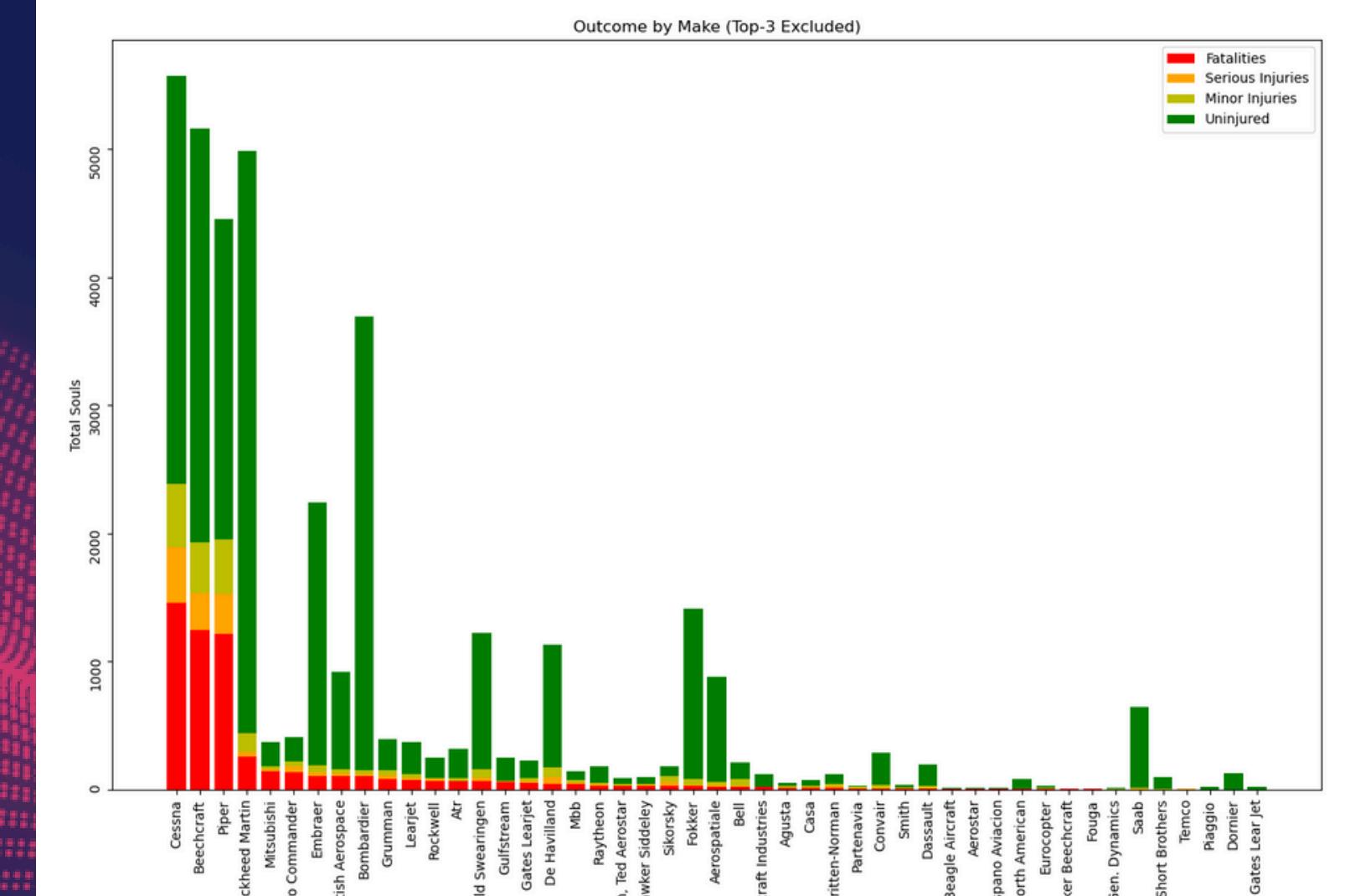
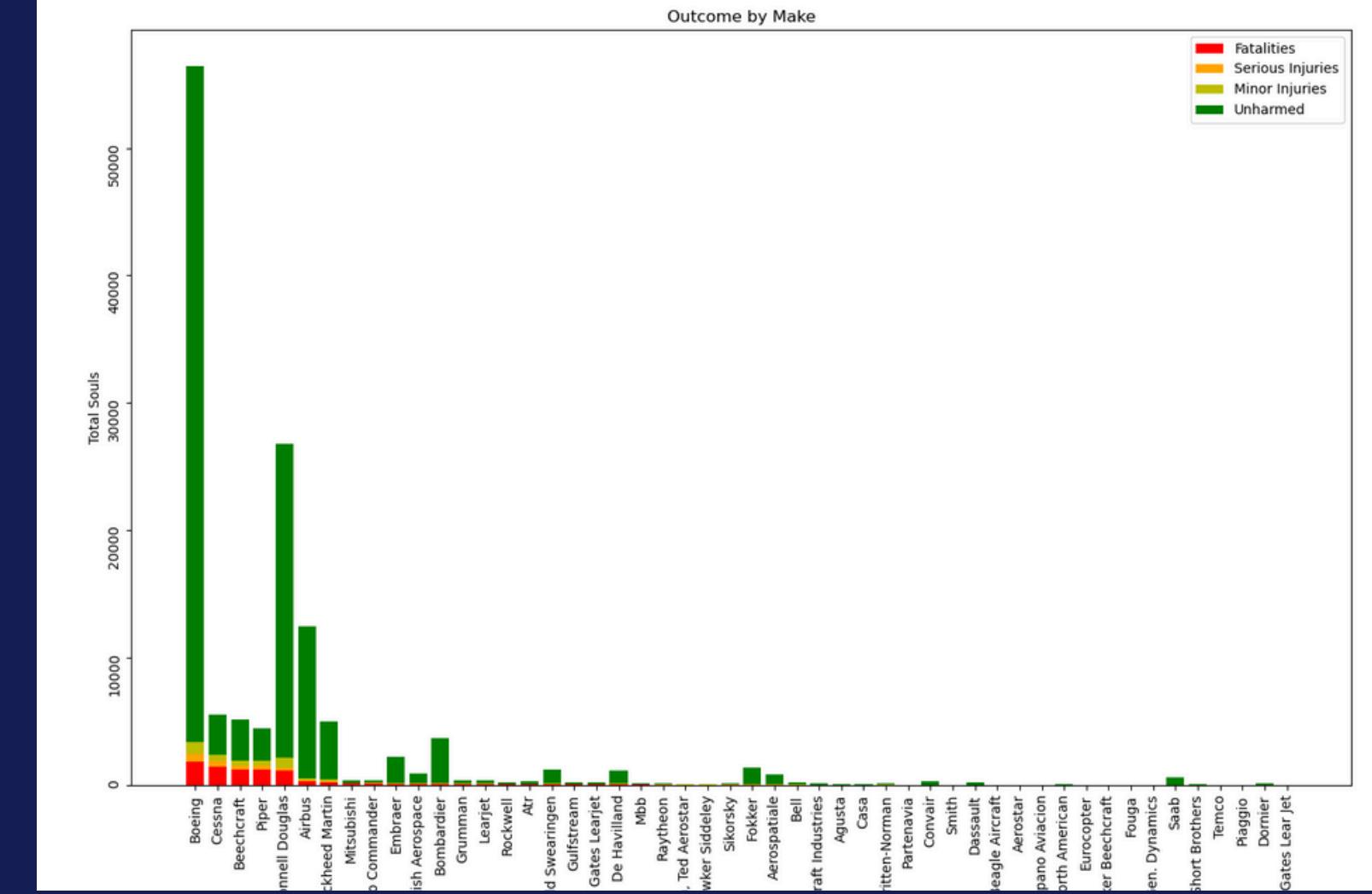
Aircraft COMMERCIAL



By Make OUTCOME

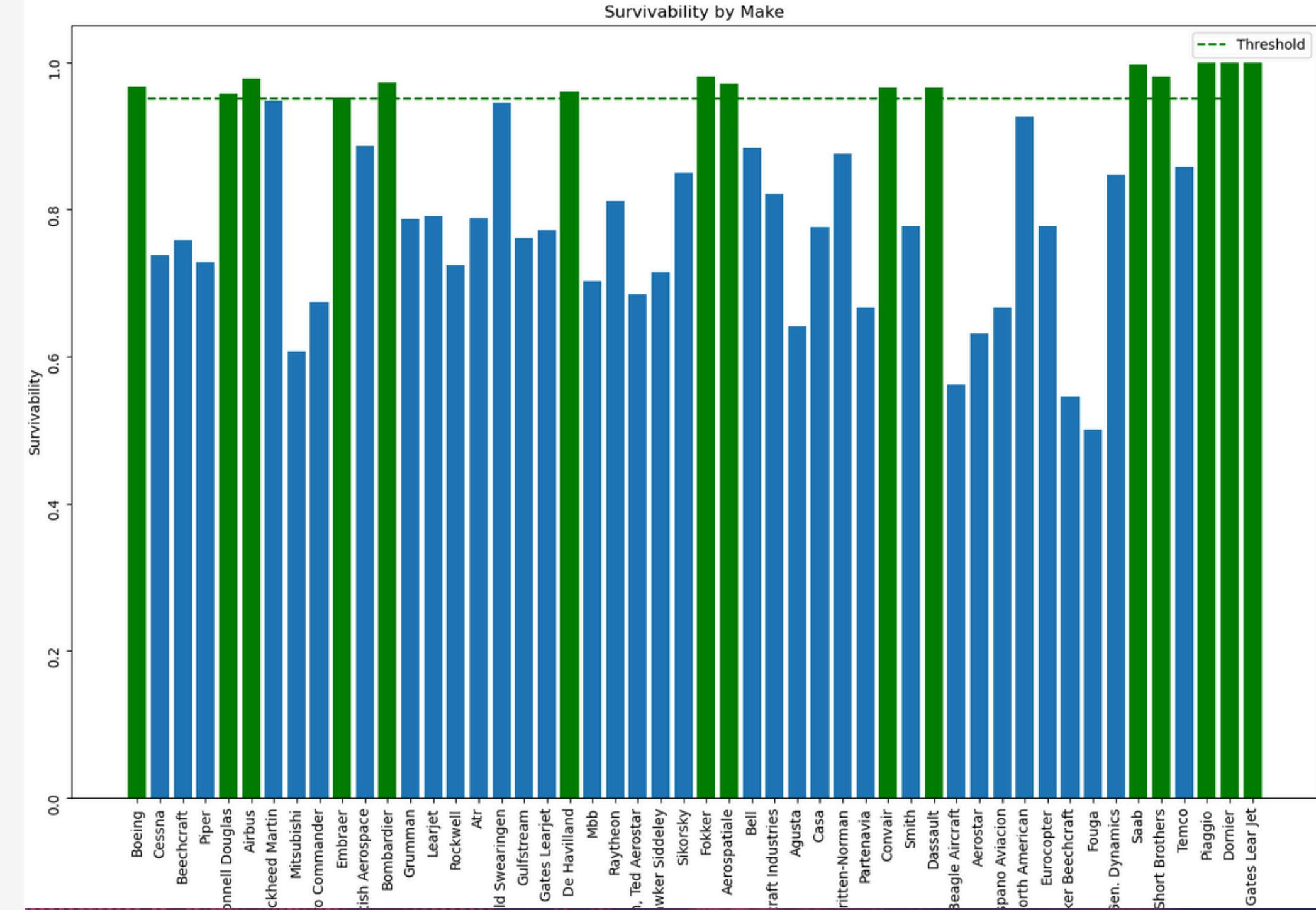
Due to the global popularity of Boeing, Airbus and McDonnell Douglas in the past, it is not surprising that they have had significantly greater Total Souls than the other manufacturers

Cessna seems to have very high fatalities, however, this is offset by high total souls. On the contrary, Temco has nearly zero fatalities but also has very few total souls. In order to properly evaluate makers, a supporting graph is required.



By Make SURVIVABILITY

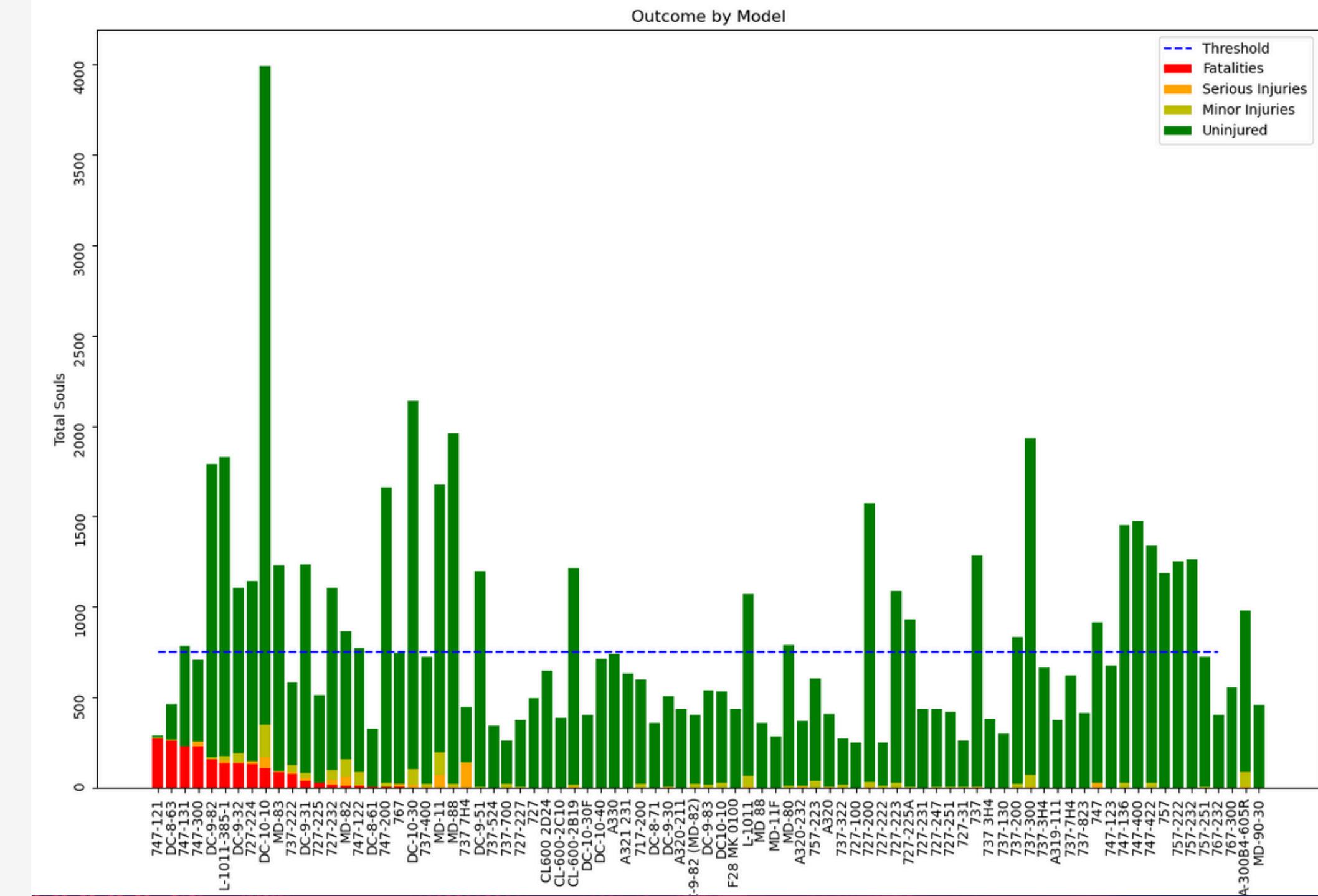
Using this and the previous graph together, manufacturers with high survivability across their fleet can be selected. A threshold score of **0.95** for survivability is used in conjunction with a requirement for at least **240** total souls. The selected manufacturers are: *Boeing, McDonnell Douglas, Airbus, Lockheed Martin, Embraer, De Havilland, Fokker, Aerospatiale, Saab, Dornier, Bombardier, Convair, and Dassault*.



By Model OUTCOME

In order to find the safest commercial aircraft, all models from the selected manufacturers are compared against each other. A threshold of **750** total souls is set.

This is once again used in combination with a survivability graph.



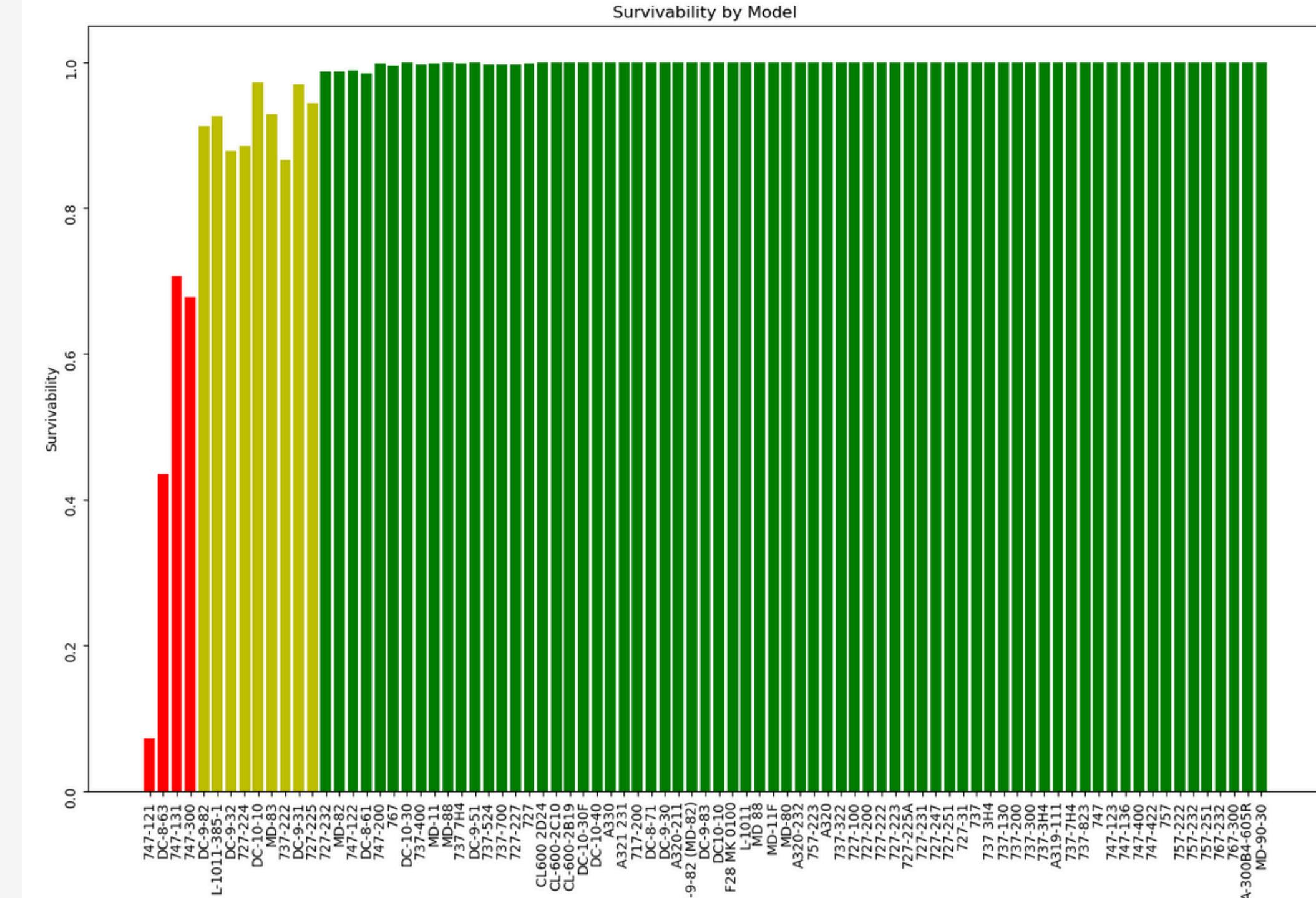
By Model SURVIVABILITY

Aircraft that have a significant presence in the red-zone(survivability < 0.8) in the graph below are automatically excluded.

From the examination of both graphs, 6 aircraft stand out: **757, 727, 737, A300, A320, L-1011**.

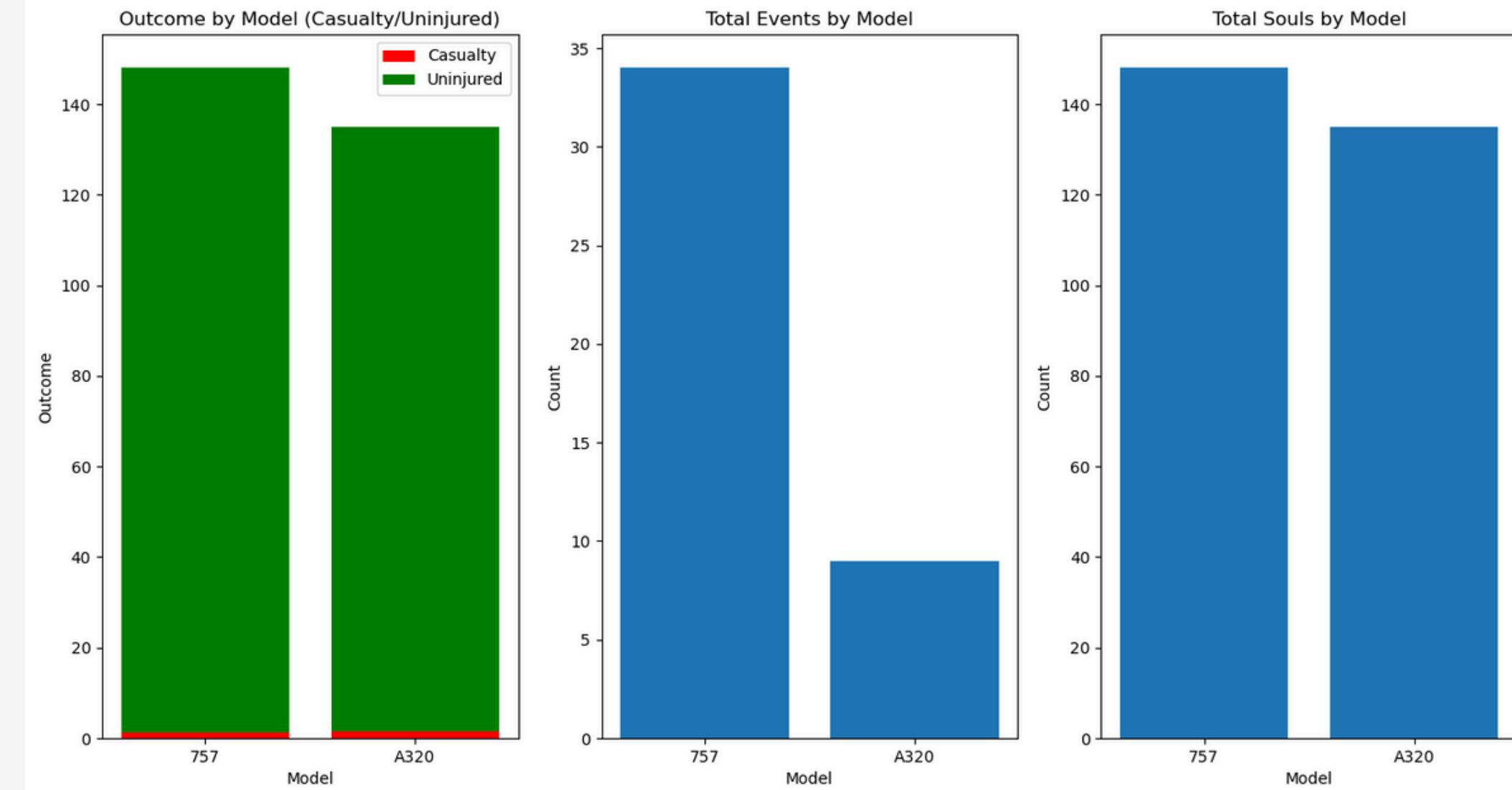
The median accident year is then taken from these aircraft and a cut-off year of 2000 is set. This is as flying in the 20th century was considerably more dangerous.

The remaining aircraft are: **757 and A320**.



Final CANDIDATES

The final decision is a deadlock between the 757 and A320. These aircraft are very similarly matched. The 757 has a marginally better ratio of Total Uninjured to Total Souls, however, the A320 has had fewer Events, which implies safety as it is involved in less events. In addition, the A320 can be inferred to be a slightly newer jet given its median accident year is 7 years ahead of the 757 and thus can take advantage of safety improvements. Moreover, the 757 can on average carry about 13 more passengers than the A320, which will be beneficial for the airline.



Decision BOEING 757

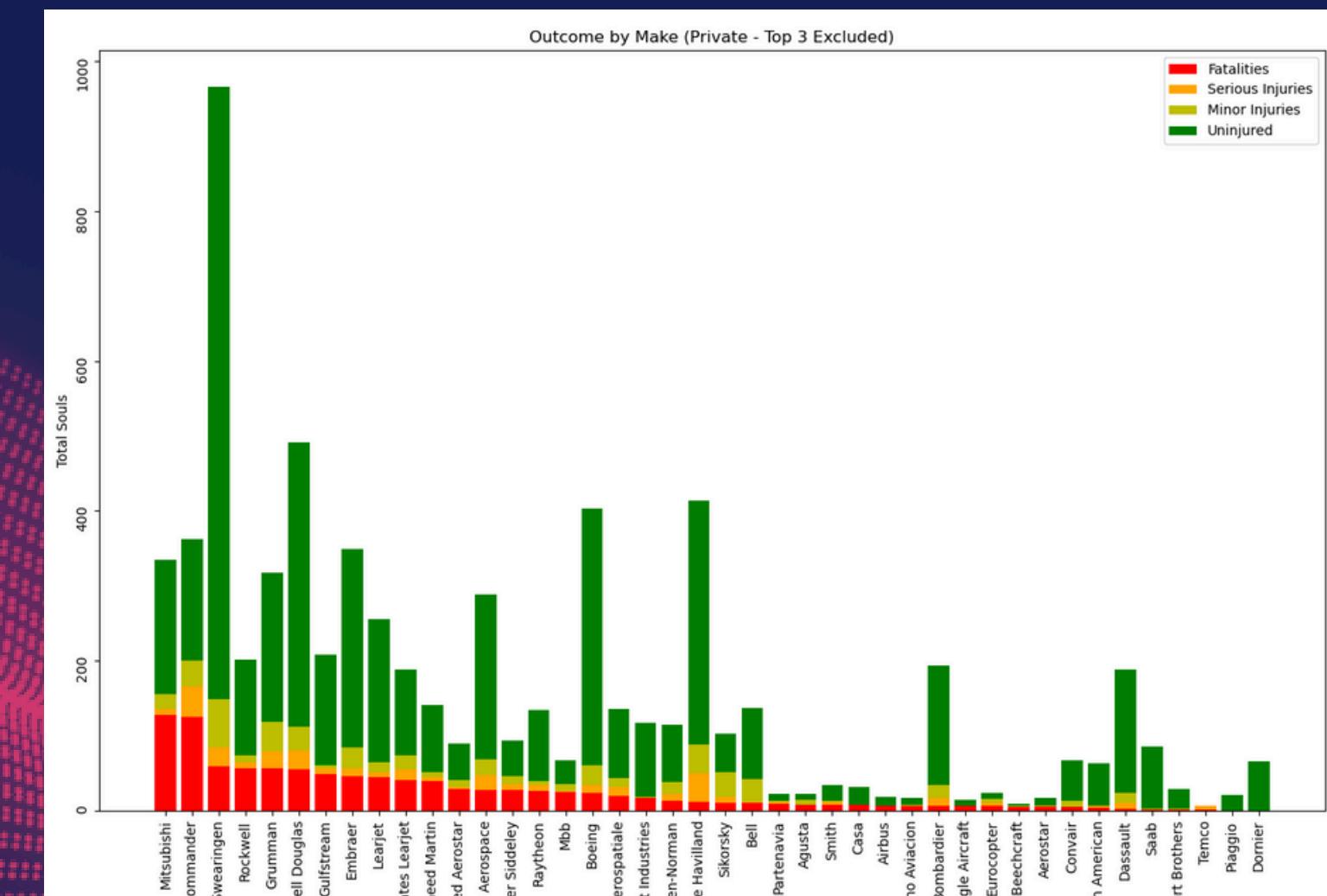
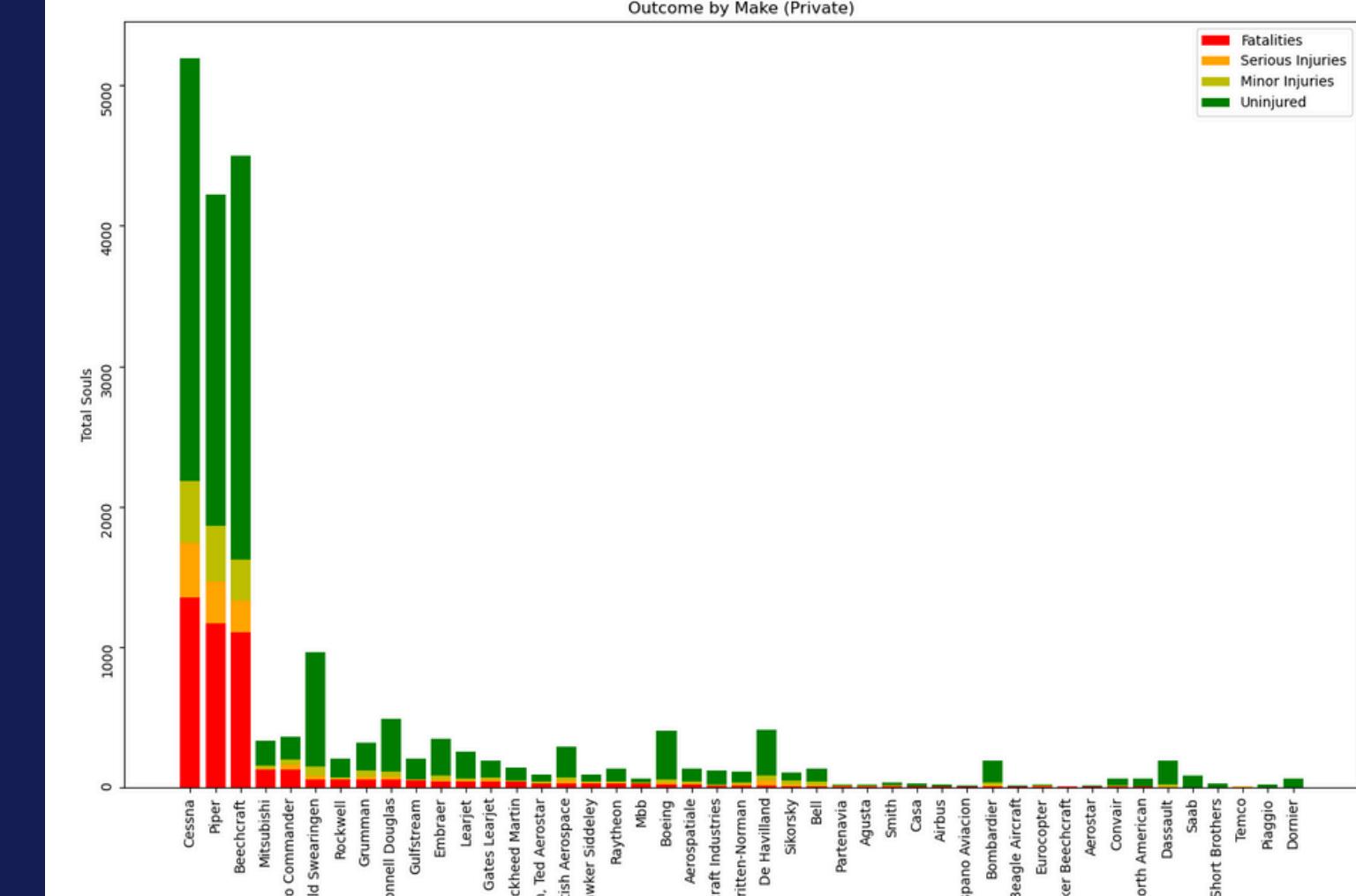
Ultimately the airline should select the Boeing 757 for commercial use. From a safety perspective, it is battle-tested. It has been involved in more Events than the A320 and has had less serious injuries on average. In addition, the A320 having fewer Events does not guarantee its safety. This is because the lower figure may be as a result of the aircraft being newer and having lower adoption rates than the 757.

Aircraft PRIVATE



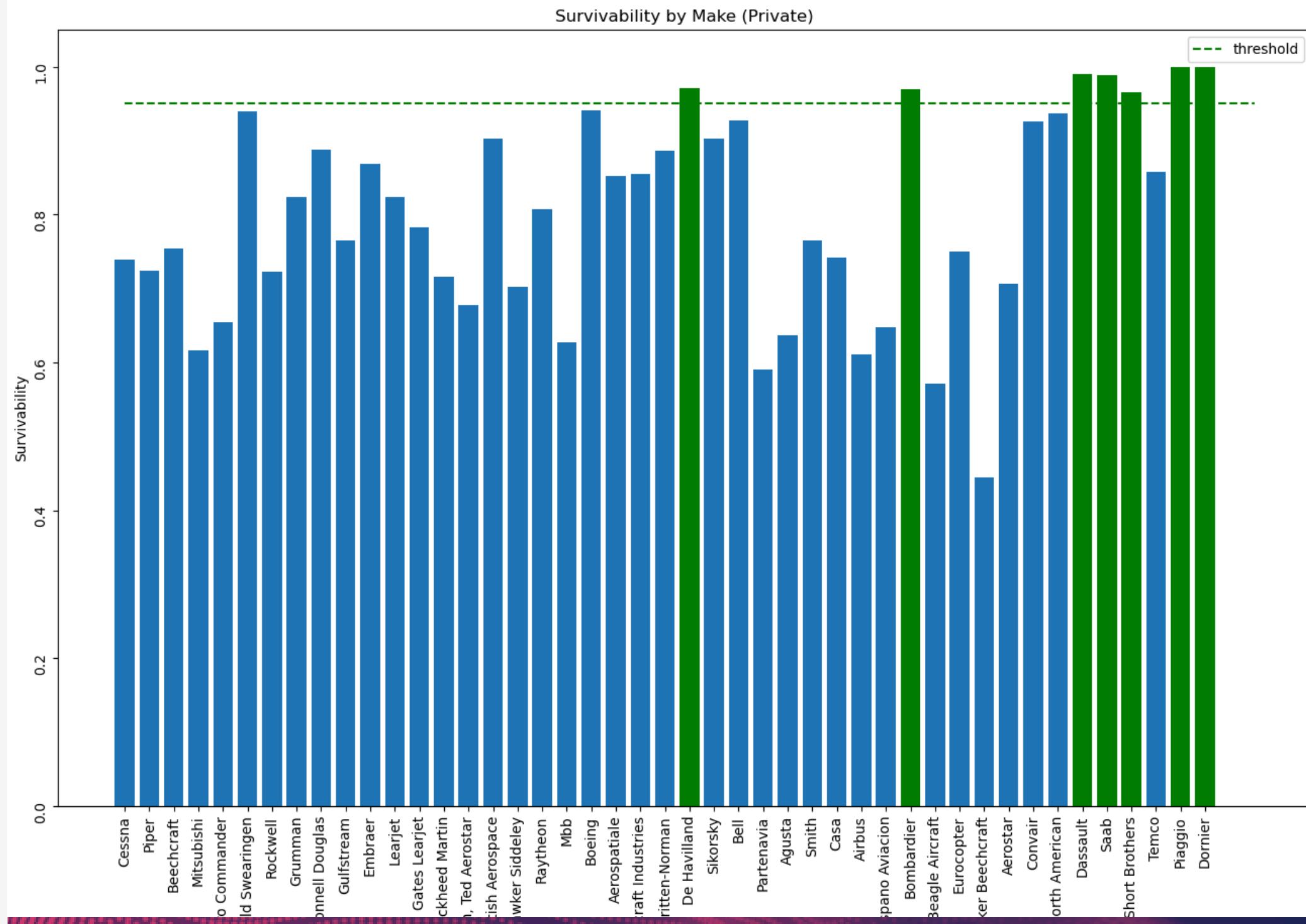
By Make OUTCOME

The most popular private aircraft seem Cessna, Piper and Beechcraft and while these manufacturers have large total souls, they also have a large number of total fatalities. Thus they may not be appropriate



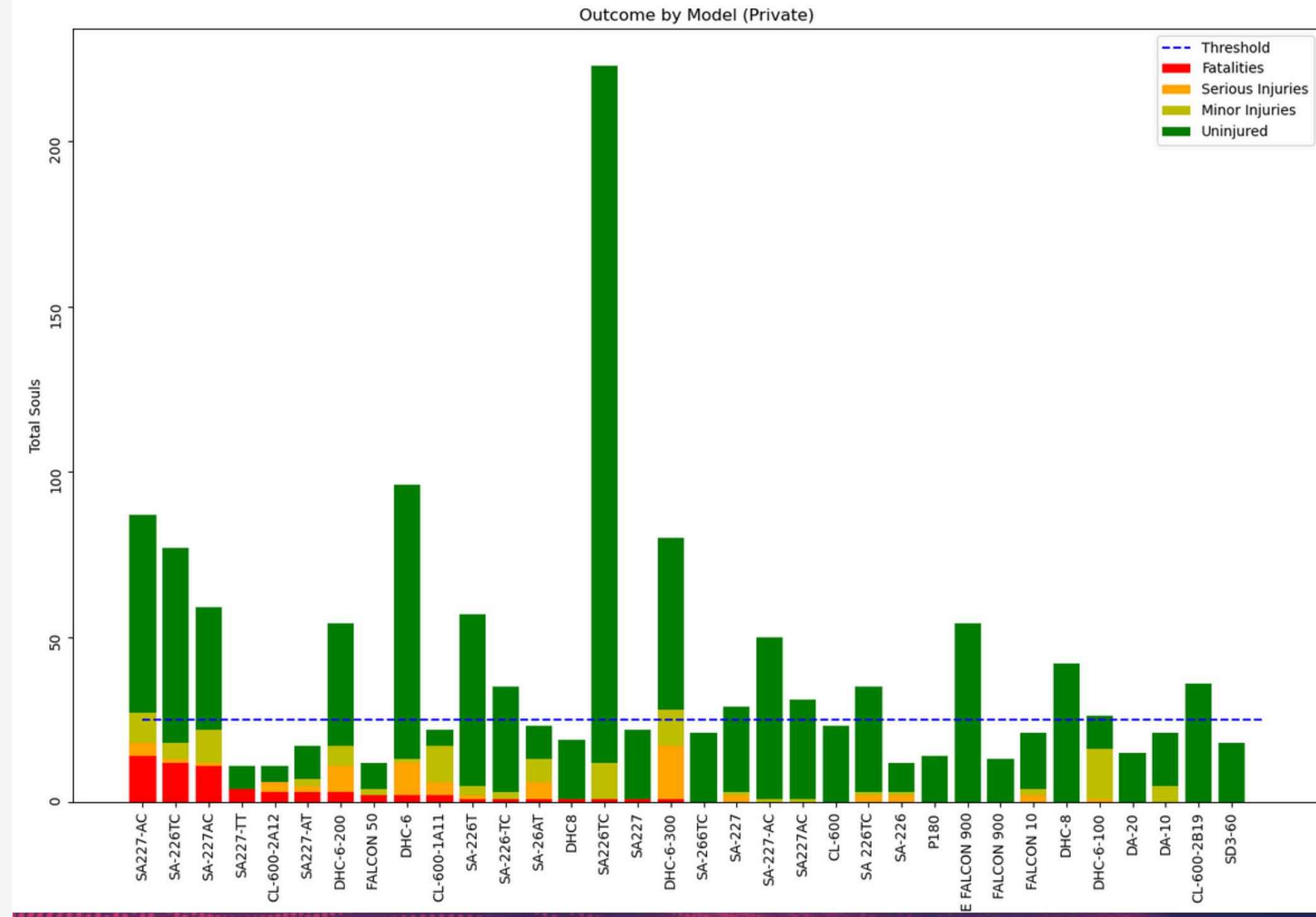
By Make SURVIVABILITY

Using a survivability graph with a threshold set at **0.95**, it can be established that the following makes are the safest: *De Havilland, Bombardier, Dassault, Fairchild Swearingen, Short Brothers, Piaggio, Dornier.*



By Model OUTCOME

The models from each maker are compared with each other with a threshold of **10 souls** and a minimum of **2 events**



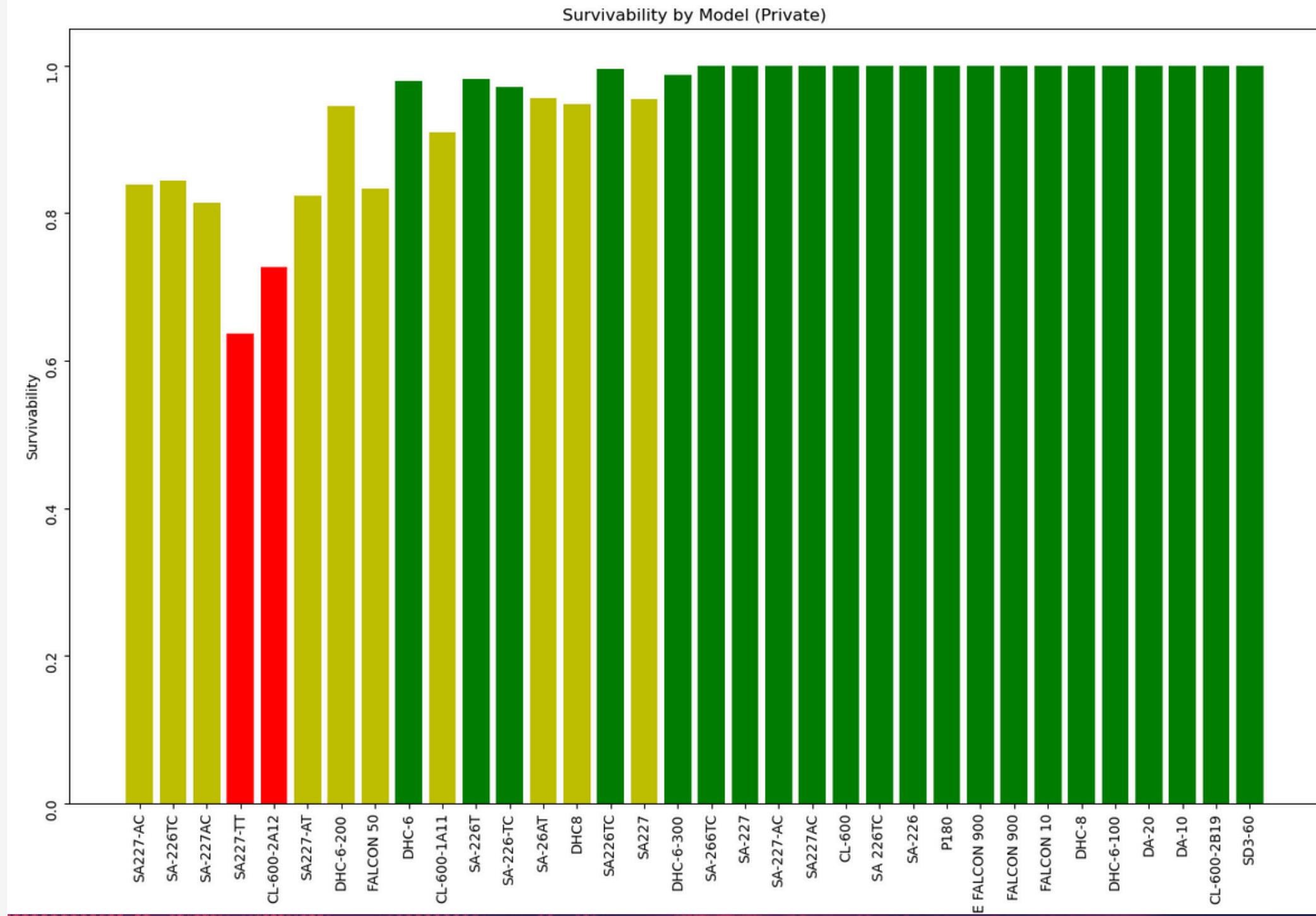
By Model SURVIVABILITY

Aircraft that have a significant presence in the red-zone(survivability < 0.8) in the graph below are automatically excluded.

From the examination of both graphs, 6 aircraft stand out: SA 226, CL 600, DHC-6, SA 227, Falcon 900, DHC-8.

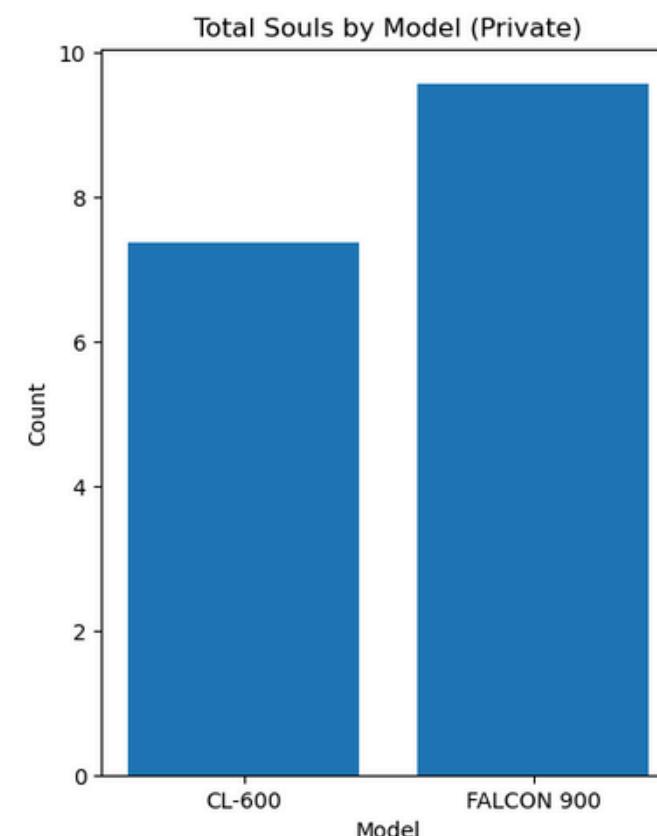
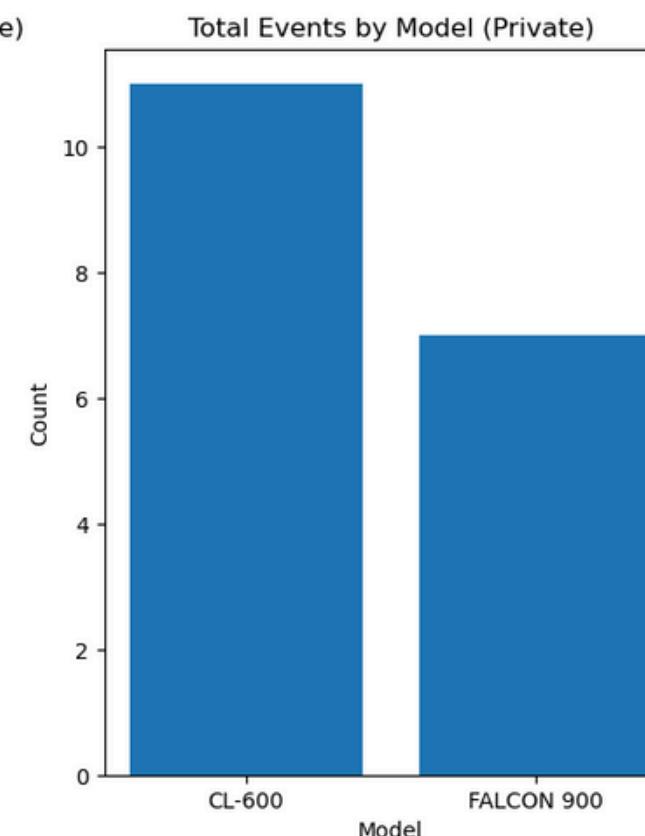
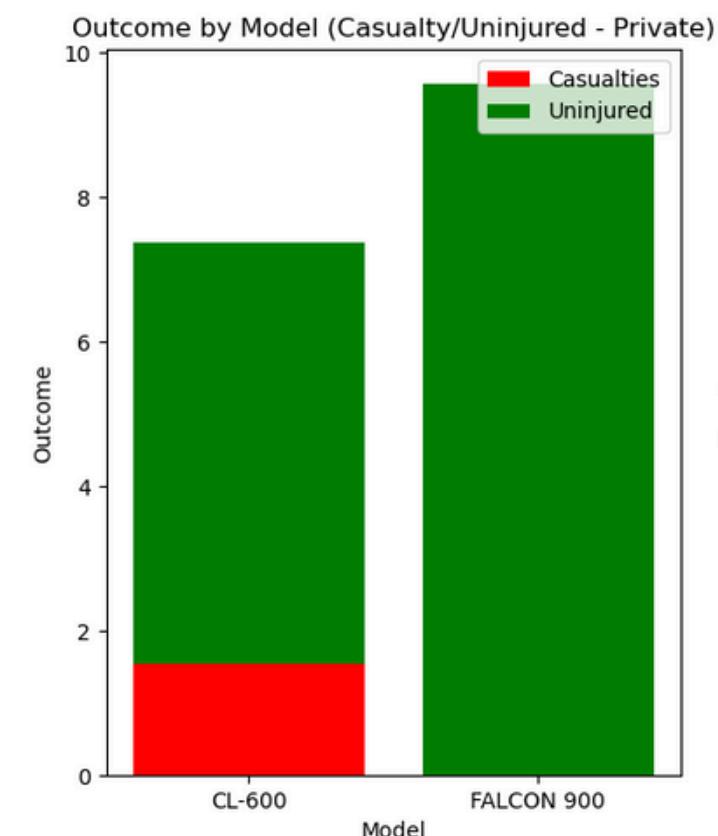
Candidate aircraft that use turbo-prop engines are excluded as they are not widely recognized as private jets, due to the lack of prestige

The remaining aircraft are: **FALCON 900** and **CL-600**.



Final CANDIDATES

While neither jet has had any fatality as a result of an accident, the CL-600 tends to have a smaller proportion of individuals coming away from an Event uninjured, thus docking some points from its safety rating. In addition to this, the Falcon 900 has had less Events than the CL-600, which is indicative of a safer jet. Finally, from a business perspective, the Falcon 900 can carry on average, over 2 individuals more than the CL-600. This will allow the airline a greater level of flexibility with regards to passenger loads.



Decision

DASSAULT FALCON 900

While these two jets are similar with little to separate them, the airline should opt to add a **Dassault Falcon 900** to its private fleet as it is marginally safer than the CL-600.

Recommendations

While these findings form a good basis for safety evaluation, it must be noted that safety within the aviation industry has shifted from "walking away from a crash" to "not being involved in a crash in the first place", which is supported by the trends in the Event data on a year by year basis.

Recommendation 1

With safety as the primary consideration, the airline should purchase a **Boeing 757** for its **commercial fleet**. The aircraft has an average of zero fatalities and less serious injuries than its main competitor, the airbus A320, over significantly more events. The aircraft is battle-proven and for these reasons, it is the most compelling option.

Recommendation 2

For the **private aviation** arm of the airline, a **Dassault Falcon 900** should be acquired. This aircraft has not only never recorded a fatality as a result of an event, but it has never recorded a single injury as a result of an Event. This makes it an ideal choice when considering a private aircraft from a safety standpoint.

Recommendation 3

There could be aircraft which have had a large number of total souls and zero casualties. This could be considered safer than an aircraft that has been involved in numerous events, even though it may have identical survivability. Thus additional studies are **strongly recommended**.

FURTHER READING

[Github Repository](#)



[Associated Article](#)



[Tableau Dashboard](#)





THANK YOU