

Phase 1 Project

This project marks the end of Phase 1 part of the Moringa Data Science Program. In it, we have been given a data set to analyse with several expectations as below:

1. Overview

This overview has been borrowed from the Canvas assignment:

Our company is planning to diversify into the aviation business and plans to purchase and operate aircrafts for both commercial and private enterprises. Since the industry carries a lot of safety, financial and operational risks, the leadership wants to identify which aircraft models have the lowest risk investment while balancing safety, reliability and cost-effectiveness.

2. Business Understanding

Our company aims to:

Objectives:

To determine:

1. Different aircraft make and models and categorize based on aircraft category and purpose of flight.

Within each category, to determine the relation between Airplane Make and:

1. Operational cost effectiveness (Engine type).
2. Safety risk (injury severity, total fatal injuries, total serious injuries).
3. Mechanical reliability and environmental susceptibility of the aircraft (aircraft damage).

To determine success, this will be measured by delivering clear data presenting recommendations to guide procurement of the most suitable Aircraft Makes.

3. Data Understanding

Data Source

The data we will be using was sourced from the National Transportation Safety Board.

Data Description

The data includes aviation accident data from 1962 to 2023 about civil aviation accidents and selected incidents in the United States and international waters and it captures the following:

Event.Id

Investigation.Type

Accident.Number
Event.Date
Location
Country
Latitude
Longitude
Airport.Code
Airport.Name
Injury.Severity
Aircraft.damage
Aircraft.Category
Registration.Number
Make
Model
Amateur.Built
Number.ofEngines
Engine.Type
FAR.Description
Schedule
Purpose.of.flight
Air.carrier
Total.Fatal.Injuries
Total.Serious.Injuries
Total.Minor.Injuries
Total.Uninjured
Weather.Condition
Broad.phase.of.flight
Report.Status
Publication.Date

This marks the end of the Data Preparation and Cleaning.

4. Data analysis

We will need several libraries for the following purposes:

1. Pandas - to read, edit and save our python files.
2. Numpy - for statistical computations for measures of central tendency and dispersion.
3. Matplotlib and seaborn - for visualizations.

4.1 Data Preparation

We shall first start off with data cleaning

```
In [1]: # importing necessary Libraries
```

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
```

```
In [2]: # read into our aviation csv data using pandas and save it as variable name - aviati
```

```
aviation_data = pd.read_csv('Aviation_Data.csv')
```

```
c:\Users\PC\anaconda3\envs\learn-env\lib\site-packages\IPython\core\interactiveshell.py:3145: DtypeWarning: Columns (6,7,28) have mixed types.Specify dtype option on import or set low_memory=False.
has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

```
In [3]: # read into our first 5 rows to understand how the data is organized
```

```
aviation_data.head()
```

```
# Lets look at the columns we have to define further our data requirements
```

```
aviation_data.columns
```

```
Out[3]: Index(['Event.Id', 'Investigation.Type', 'Accident.Number', 'Event.Date',
              'Location', 'Country', 'Latitude', 'Longitude', 'Airport.Code',
              'Airport.Name', 'Injury.Severity', 'Aircraft.damage',
              'Aircraft.Category', 'Registration.Number', 'Make', 'Model',
              'Amateur.Built', 'Number.of.Engines', 'Engine.Type', 'FAR.Description',
              'Schedule', 'Purpose.of.flight', 'Air.carrier', 'Total.Fatal.Injuries',
              'Total.Serious.Injuries', 'Total.Minor.Injuries', 'Total.Uninjured',
              'Weather.Condition', 'Broad.phase.of.flight', 'Report.Status',
              'Publication.Date'],
              dtype='object')
```

```
In [4]: #Let us check the total length of the data frame, rows, columns and missing entries
```

```
aviation_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 90348 entries, 0 to 90347
Data columns (total 31 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   Event.Id                             88889 non-null  object
1   Investigation.Type                    90348 non-null  object
2   Accident.Number                      88889 non-null  object
3   Event.Date                           88889 non-null  object
4   Location                             88837 non-null  object
5   Country                             88663 non-null  object
6   Latitude                             34382 non-null  object
```

```

7  Longitude          34373 non-null object
8  Airport.Code       50249 non-null object
9  Airport.Name       52790 non-null object
10 Injury.Severity    87889 non-null object
11 Aircraft.damage    85695 non-null object
12 Aircraft.Category  32287 non-null object
13 Registration.Number 87572 non-null object
14 Make              88826 non-null object
15 Model             88797 non-null object
16 Amateur.Built     88787 non-null object
17 Number.of.Engines  82805 non-null float64
18 Engine.Type       81812 non-null object
19 FAR.Description    32023 non-null object
20 Schedule          12582 non-null object
21 Purpose.of.flight  82697 non-null object
22 Air.carrier        16648 non-null object
23 Total.Fatal.Injuries 77488 non-null float64
24 Total.Serious.Injuries 76379 non-null float64
25 Total.Minor.Injuries 76956 non-null float64
26 Total.Uninjured    82977 non-null float64
27 Weather.Condition  84397 non-null object
28 Broad.phase.of.flight 61724 non-null object
29 Report.Status      82508 non-null object
30 Publication.Date    73659 non-null object
dtypes: float64(5), object(26)
memory usage: 21.4+ MB

```

The dataset had a total of 90,348 rows (entries) and 31 columns. Out of the many columns in the previous cell, we need to define the ones we will be using for our analysis. The project expects us to determine the best aircraft based on accidents profile. Therefore the following columns may be necessary. Out of the 31 columns, we have selected the 12 below to answer our objectives that were listed above:

1. Event Date
2. Total Fatal Injuries
3. Total Serious Injuries
4. Total minor injuries
5. Injury Severity
6. Aircraft Damage
7. Make - type of aircraft 8 Model - type of the model of the make
8. Engine type
9. Aircraft Category
10. Purpose of flight
11. Air carrier

```

In [5]: # Let us create a variable name 'selected_columns' which has the columns we purposef
selected_columns = ['Event.Date', 'Injury.Severity', 'Aircraft.damage', 'Aircraft.Ca
'Purpose.of.flight', 'Air.carrier', 'Total.Fatal.Injuries',
'Total.Serious.Injuries', 'Total.Minor.Injuries']

```

```

In [6]: # Let us re-create our aviation_data dataset with only the selected columns:
aviation_data = aviation_data[selected_columns]

```

```

In [7]: # Let us check out the column names to confirm that we only have the selected column
aviation_data.columns, len(aviation_data.columns)

```

```

Out[7]: (Index(['Event.Date', 'Injury.Severity', 'Aircraft.damage', 'Aircraft.Category',
'Make', 'Model', 'Engine.Type', 'Purpose.of.flight', 'Air.carrier',
'Total.Fatal.Injuries', 'Total.Serious.Injuries',
'Total.Minor.Injuries'],

```

```
dtype='object'),
12)
```

Handling missing data

```
In [8]: # Let us go through each of the selected columns again and determine their data type
aviation_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 90348 entries, 0 to 90347
Data columns (total 12 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   Event.Date                            88889 non-null  object
1   Injury.Severity                       87889 non-null  object
2   Aircraft.damage                       85695 non-null  object
3   Aircraft.Category                     32287 non-null  object
4   Make                                  88826 non-null  object
5   Model                                 88797 non-null  object
6   Engine.Type                           81812 non-null  object
7   Purpose.of.flight                     82697 non-null  object
8   Air.carrier                           16648 non-null  object
9   Total.Fatal.Injuries                  77488 non-null  float64
10  Total.Serious.Injuries                 76379 non-null  float64
11  Total.Minor.Injuries                  76956 non-null  float64
dtypes: float64(3), object(9)
memory usage: 8.3+ MB
```

```
In [9]: # Before we can do an analysis on our data, we first need to fill in the missing val
# We have 5 columns that are float data type (numeric) and 11 that are object (non-n
# Let us create a for loop to determine how many missing values first in the float64
for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        print (column, aviation_data[column].isna().sum())
```

```
Total.Fatal.Injuries 12860
Total.Serious.Injuries 13969
Total.Minor.Injuries 13392
```

```
In [10]: # Let us do the same but now for the object column:
for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        print (object_column, aviation_data[object_column].isna().sum())
```

```
Event.Date 1459
Injury.Severity 2459
Aircraft.damage 4653
Aircraft.Category 58061
Make 1522
Model 1551
Engine.Type 8536
Purpose.of.flight 7651
Air.carrier 73700
```

```
In [11]: # Now that we have both the numeric as well as the non numeric information with miss
# Let us first start by filling in the missing values in the numeric column.
# We will begin by first getting the measures of central tendencies of the data

aviation_data.describe()
```

```
Out[11]:
```

	Total.Fatal.Injuries	Total.Serious.Injuries	Total.Minor.Injuries
count	77488.000000	76379.000000	76956.000000
mean	0.647855	0.279881	0.357061
std	5.485960	1.544084	2.235625

	Total.Fatal.Injuries	Total.Serious.Injuries	Total.Minor.Injuries
min	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.000000
50%	0.000000	0.000000	0.000000
75%	0.000000	0.000000	0.000000
max	349.000000	161.000000	380.000000

In [12]: *# For the remaining numerical data, they have wide range of observations between 0 t*
Let us look at the median
using a for loop

```
for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        print (column, aviation_data[column].median())
```

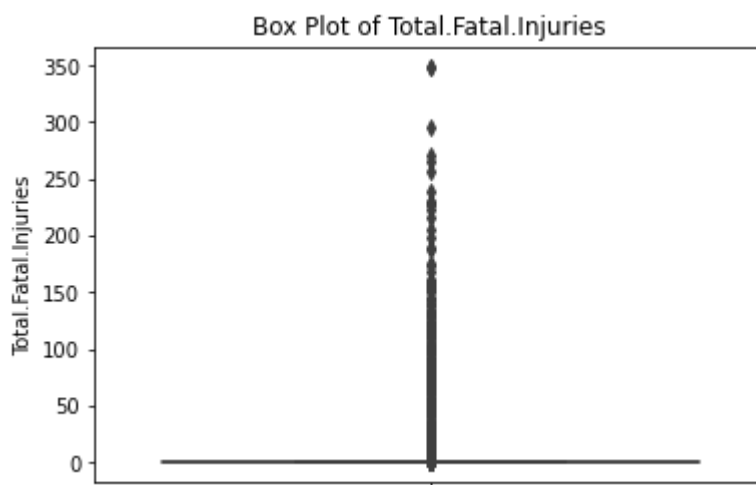
Total.Fatal.Injuries 0.0
 Total.Serious.Injuries 0.0
 Total.Minor.Injuries 0.0

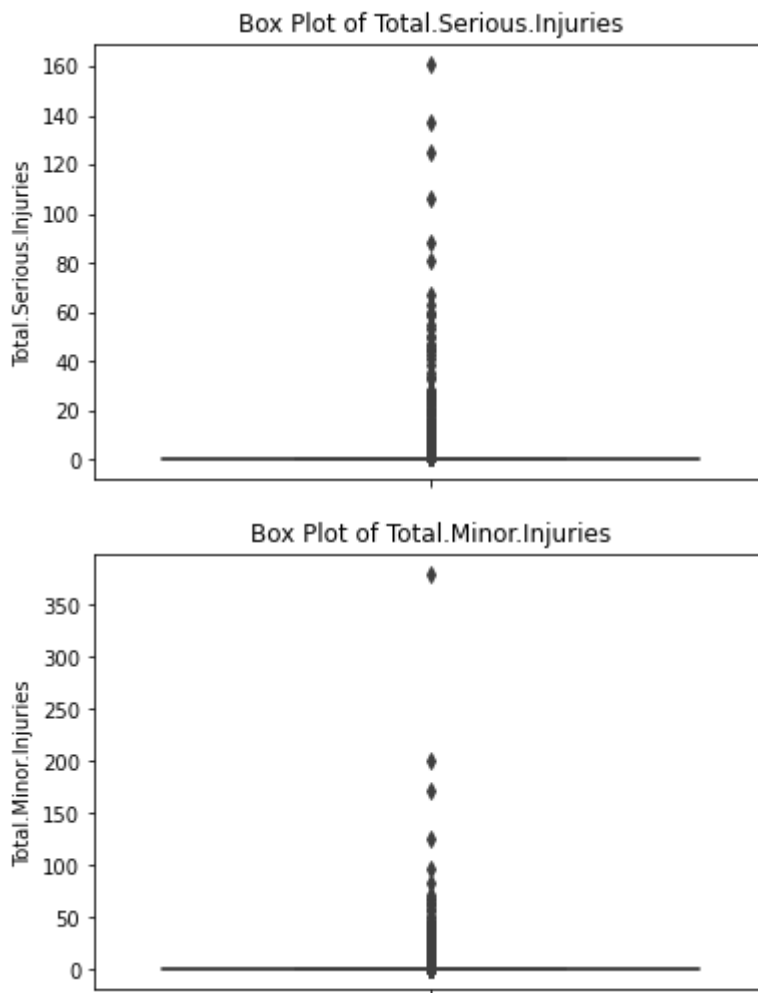
In [13]: *# It looks like in many injuries, the majority of the number of injuries per acciden*
Let us create a function that will do this for each of the numeric data

```
def box_plot_data(column):
    """
    Plots a box plot of the column so that we can visually see the spread of the dat
    """
    return sns.boxplot(column)
```

In [14]: *# Let us employ the 'box_plot_data' function in a for loop*

```
for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        plt.figure(figsize=(6, 4))
        sns.boxplot(y=aviation_data[column])
        plt.title(f"Box Plot of {column}")
        plt.show()
```





```
In [15]: # The boxplots shown above have alot of outlier values. In our filling of missing va
# We will not opt to fill with mean since outliers might inflate the mean
# We will therefore fill in with the median instead
# Again, we will use a for loop and set argument inplace = True to save our changes

for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        aviation_data[column].fillna(aviation_data[column].median(), inplace = True)
```

```
In [16]: # Let us confirm that we have filled in our missing numerical values with their medi
for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        print(column, aviation_data[column].isna().sum())
```

```
Total.Fatal.Injuries 0
Total.Serious.Injuries 0
Total.Minor.Injuries 0
```

```
In [17]: # Let us now go back to the categorical columns which also had missing values
# copying the code we used:
```

```
for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        print (object_column, aviation_data[object_column].isna().sum())
```

```
Event.Date 1459
Injury.Severity 2459
Aircraft.damage 4653
Aircraft.Category 58061
Make 1522
Model 1551
Engine.Type 8536
```

Purpose.of.flight 7651
Air.carrier 73700

```
In [18]: # our total data length was 90,348. Some of our categorical values seem to be largely
# Despite the fact that all accidents matter, trying to fill in these missing values
# We will therefore opt to fill in the columns with less than 10% missing values with

for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        if aviation_data[object_column].isna().sum() < 9035:
            aviation_data[object_column].fillna(aviation_data[object_column].mode()[0])
        else:
            aviation_data.dropna(subset = [object_column], inplace = True)
```

```
In [19]: # Let us confirm that our missing categorical values are dropped and that there are no
for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        print (object_column, aviation_data[object_column].isna().sum())
```

Event.Date 0
Injury.Severity 0
Aircraft.damage 0
Aircraft.Category 0
Make 0
Model 0
Engine.Type 0
Purpose.of.flight 0
Air.carrier 0

```
In [20]: # Let us now check the number of entries we are working with:
len(aviation_data) # unfortunately, we have dropped from 90348 entries to 3488 due to
```

Out[20]: 13625

Handling Duplicates

```
In [21]: # Before we wind up on Data cleaning and go on to analysis, Let us check if there are
aviation_data.duplicated().sum()

# there are only 3 duplicate entries. We opt to drop them

aviation_data.drop_duplicates(inplace = True)

# Let us recheck that duplicates are dropped
aviation_data.duplicated().sum() # The duplicates are all dropped.
```

Out[21]: 0

Standardize and confirm uniqueness of value counts of Categorical Variables

```
In [22]: # Let us check the output of value counts in the categorical variables using a for loop
for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        print (object_column, '\n', aviation_data[object_column].value_counts())
```

Event.Date	2011-06-18	15
	2012-08-31	13
	2011-08-13	12
	2011-07-23	12
	2011-04-01	11
	..	
	1982-06-15	1
	2015-11-20	1
	2016-07-05	1


```

1993-12-12      1
2015-09-01      1
Name: Event.Date, Length: 4953, dtype: int64
Injury.Severity Non-Fatal    10850
Fatal           2478
Minor           88
Incident        77
Serious         76
Fatal(1)        17
Fatal(2)        16
Fatal(4)         6
Fatal(3)         6
Fatal(8)         2
Fatal(6)         2
Fatal(27)        1
Fatal(5)         1
Fatal(10)        1
Fatal(9)         1
Fatal(65)        1
Fatal(13)        1
Name: Injury.Severity, dtype: int64
Aircraft.damage Substantial    11586
Destroyed       1323
Minor           675
Unknown         40
Name: Aircraft.damage, dtype: int64
Aircraft.Category Airplane      11266
Helicopter       1914
Glider           190
Balloon          97
Weight-Shift     65
Powered Parachute 40
Gyrocraft        36
Ultralight       8
WSFT              3
Unknown          2
UNK              1
Blimp            1
Rocket           1
Name: Aircraft.Category, dtype: int64
Make CESSNA      2782
PIPER           1520
BOEING          717
BEECH           545
Cessna          507
...
TROMSNESS ENTERPRISES INC      1
WALLER CHARLES R               1
HAWKER BEECH                   1
Agusta/Westland                1
MONTE CLARK                    1
Name: Make, Length: 1958, dtype: int64
Model 172      418
737           264
R44           168
172S          167
152           163
...
PITTS S 2B      1
MT 7-235        1
BAE JETSTREAM 3101 1
B787-9          1
SKYCYCLE STING RAY 1
Name: Model, Length: 3531, dtype: int64
Engine.Type Reciprocating    10829
Turbo Prop      933
Turbo Shaft     919
Turbo Fan       783
Turbo Jet       109

```

```

Unknown          17
Geared Turbofan  12
None             11
Electric         6
LR              2
Hybrid Rocket    1
UNK             1
NONE            1
Name: Engine.Type, dtype: int64
Purpose.of.flight Personal      8241
Instructional      1961
Aerial Application  884
Unknown           421
Business          388
Positioning       353
Other Work Use    277
Aerial Observation 231
Flight Test       146
External Load     95
Executive/corporate 85
Skydiving         81
Public Aircraft - Federal 74
Ferry            67
Banner Tow       61
Public Aircraft - Local 59
Public Aircraft - State 47
Air Race show    43
Public Aircraft  36
Glider Tow       34
Firefighting     28
Air Drop         6
PUBS             3
ASHO             2
PUBL            1
Name: Purpose.of.flight, dtype: int64
Air.carrier Pilot      257
American Airlines     47
United Airlines       43
Delta Air Lines       42
SOUTHWEST AIRLINES CO 41
...
Bellair Inc           1
Oklahoma Aviation LLC 1
BOWERS JAMES H        1
AIR DAKOTA FLITE      1
Vidson Chan           1
Name: Air.carrier, Length: 11541, dtype: int64

```

```
In [23]: # from the above output, the value_counts of the 'injury-severity' has too many 'Fatal'
# Let us use the .replace() function to do this.
```

```

aviation_data['Injury.Severity'] = aviation_data['Injury.Severity'].replace(
    to_replace=r'Fatal.*',
    value='Fatal',
    regex=True,
)

```

```
In [24]: # Let us confirm that we have converted all 'Fatal's into one.
aviation_data['Injury.Severity'].value_counts()
```

```

Out[24]: Non-Fatal    10850
Fatal      2533
Minor      88
Incident   77
Serious    76
Name: Injury.Severity, dtype: int64

```

```
In [25]: # In the aviation['data'] Cessna is represented twice as cessna (in small letters) and
# Let us also edit the value_counts of these outputs by first stripping all the letters
aviation_data['Make'] = aviation_data['Make'].astype(str).str.strip().str.title()
```

```
In [26]: # Note that the data on purpose of flight has a lot of unknown values (2864)
# Remove rows where Purpose.of.flight is "Unknown"

aviation_data = aviation_data[aviation_data['Purpose.of.flight'].str.upper() != 'UNKNOWN']

# Check the result
aviation_data['Purpose.of.flight'].value_counts() # we have removed the large number
```

```
Out[26]: Personal      8241
Instructional    1961
Aerial Application    884
Business          388
Positioning        353
Other Work Use      277
Aerial Observation   231
Flight Test        146
External Load        95
Executive/corporate   85
Skydiving           81
Public Aircraft - Federal  74
Ferry               67
Banner Tow          61
Public Aircraft - Local  59
Public Aircraft - State  47
Air Race show        43
Public Aircraft       36
Glider Tow           34
Firefighting         28
Air Drop              6
PUBS                  3
ASHO                  2
PUBL                   1
Name: Purpose.of.flight, dtype: int64
```

4.2 Data Analysis

Now we can start the data analysis. In this section we aim to reiterate the objectives and do a:

1. Summary in measures of central tendency of both numerical (means and medians) as well as categorical variables (in value counts).
2. Do several plots (in line with the objectives) showing relation between:
 - ** Different aircraft make and purpose of flight
 - ** Different aircraft make and operational cost effectiveness: Engine type
 - ** Different aircraft make and Safety risk of the aircraft (injury severity, total fatal injuries, total serious injuries)
 - ** Different aircraft make and Mechanical reliability and environmental susceptibility of the aircraft (aircraft.damage)

Objective 1: Summary in measures of central tendency of both numerical (means and medians) as well as categorical variables (in value counts).

```
In [27]: # Summary data on the numerical data using a for loop

for column in aviation_data.columns:
    if aviation_data[column].dtype == 'float64':
        print(aviation_data[column].describe(), aviation_data[column].median(), avia
```

```
count      13203.000000
mean        0.628418
std         6.231879
min         0.000000
25%         0.000000
50%         0.000000
75%         0.000000
max         295.000000
Name: Total.Fatal.Injuries, dtype: float64 0.0 0    0.0
dtype: float64
count      13203.000000
mean        0.35242
std         2.73809
min         0.000000
25%         0.000000
50%         0.000000
75%         0.000000
max         161.000000
Name: Total.Serious.Injuries, dtype: float64 0.0 0    0.0
dtype: float64
count      13203.000000
mean        0.200182
std         0.889941
min         0.000000
25%         0.000000
50%         0.000000
75%         0.000000
max         50.000000
Name: Total.Minor.Injuries, dtype: float64 0.0 0    0.0
dtype: float64
```

From this numerical summary, we had 3485 accidents.

1. Most aircrafts had 1 engine.
2. The mean number of total Fatal injuries was 1.7 (+/- 13.6).
3. The mean number of total Serious injuries was 0.68 (+/- 5.32).
4. The mean number of total Minor injuries was 0.57 (+/- 7.57).
5. The mean number of total Uninjured was 35.5 (+/- 74.7).

```
In [28]: # Summary data for the categorical data.

for object_column in aviation_data.columns:
    if aviation_data[object_column].dtype == 'object':
        print(aviation_data[object_column].value_counts())
```

```
2011-06-18    15
2012-08-31    13
2011-08-13    12
2011-07-23    12
2011-04-01    11
..
2020-11-30     1
2017-01-16     1
2020-12-25     1
2008-11-21     1
2012-08-23     1
```

Name: Event.Date, Length: 4746, dtype: int64

Non-Fatal 10644

Fatal 2376

Minor 87

Serious 76

Incident 20

Name: Injury.Severity, dtype: int64

Substantial 11329

Destroyed 1212

Minor 622

Unknown 40

Name: Aircraft.damage, dtype: int64

Airplane 10937

Helicopter 1823

Glider 190

Balloon 97

Weight-Shift 65

Powered Parachute 40

Gyrocraft 36

Ultralight 7

WSFT 3

Unknown 2

UNK 1

Blimp 1

Rocket 1

Name: Aircraft.Category, dtype: int64

Cessna 3179

Piper 1711

Boeing 828

Beech 628

Bell 469

...

Sud Aviation 1

Steven Hardie 1

Clifton 1

Lake John K 1

Nicholson David F 1

Name: Make, Length: 1735, dtype: int64

172 410

737 264

172S 164

152 163

R44 159

...

AS 350 B2 ECUREUIL 1

J250 SP 1

LANCAIR IV-P TURBINE 1

LANCAIR LEGACY FG 1

SKYCYCLE STING RAY 1

Name: Model, Length: 3440, dtype: int64

Reciprocating 10560

Turbo Prop 881

Turbo Shaft 872

Turbo Fan 739

Turbo Jet 101

Unknown 16

Geared Turbofan 12

None 11

Electric 6

LR 2

Hybrid Rocket 1

UNK 1

NONE 1

Name: Engine.Type, dtype: int64

Personal 8241

Instructional 1961

Aerial Application 884

Business 388

Positioning 353

```

Other Work Use                277
Aerial Observation            231
Flight Test                   146
External Load                 95
Executive/corporate           85
Skydiving                     81
Public Aircraft - Federal     74
Ferry                         67
Banner Tow                    61
Public Aircraft - Local       59
Public Aircraft - State       47
Air Race show                 43
Public Aircraft               36
Glider Tow                    34
Firefighting                  28
Air Drop                      6
PUBS                          3
ASHO                          2
PUBL                          1
Name: Purpose.of.flight, dtype: int64
Pilot                         250
American Airlines             45
Delta Air Lines               42
SOUTHWEST AIRLINES CO         41
United Airlines               38

...
Tri MG Intra Asia             1
Kelly Sykora                  1
Bellair Inc                   1
Oklahoma Aviation LLC         1
Vidson Chan                   1
Name: Air.carrier, Length: 11183, dtype: int64

```

```

In [29]: # Let us also use a for loop to print out all aircraft Makes that had the Least Log

# Count how many times each aircraft make appears
make_counts = aviation_data['Make'].value_counts()

# Create a List to append our airplanes to. We will use this List later on to see pl
safe_planes = []

# Loop through the makes
for plane, count in make_counts.items():
    #print(f"{plane}: {count}")
    # Example: only print makes that appear less than 2 times
    if count < 2:
        safe_planes.append(plane)
    print(f"Aircraft with less crashes: {plane}")

```

```

Aircraft with less crashes: Dahlman-Dower
Aircraft with less crashes: Holmes Gary Don
Aircraft with less crashes: Denny Aerocraft
Aircraft with less crashes: Co-Z Development Corp
Aircraft with less crashes: Firefly Balloons Inc
Aircraft with less crashes: Md Helicopters, Inc.
Aircraft with less crashes: Wsk-Pzl Warszawa-Okęcie
Aircraft with less crashes: Treidel Mark/R F D
Aircraft with less crashes: Nbb Inc
Aircraft with less crashes: Holmes William E
Aircraft with less crashes: Sackman
Aircraft with less crashes: Sport Flight International
Aircraft with less crashes: Graff Wilbur C
Aircraft with less crashes: Hunziker
Aircraft with less crashes: Fields Mike
Aircraft with less crashes: I.C.A.-Brasov (Romania)
Aircraft with less crashes: Sherman Craig W
Aircraft with less crashes: Smith Edward I
Aircraft with less crashes: Amirkhanian Shahram Charl

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Aircraft with less crashes: Schempp-Hirth K G
Aircraft with less crashes: Crosley
Aircraft with less crashes: Korrisson Tom
Aircraft with less crashes: Boeing Of Canada/Dehav Div
Aircraft with less crashes: Monnett John T Jr
Aircraft with less crashes: Schooley
Aircraft with less crashes: Schmidt Albert D
Aircraft with less crashes: Mileski
Aircraft with less crashes: Radley Vincent
Aircraft with less crashes: Dji
Aircraft with less crashes: Phelps
Aircraft with less crashes: Olson
Aircraft with less crashes: Phillips William L
Aircraft with less crashes: Gulfstream Aerospace Corp
Aircraft with less crashes: Quicksilver Mfg
Aircraft with less crashes: Schneider
Aircraft with less crashes: Fox Jack G
Aircraft with less crashes: Cessna/Air Repair Inc
Aircraft with less crashes: Shoemaker James B
Aircraft with less crashes: Cruz
Aircraft with less crashes: Advertising Mgmt & Consulting
Aircraft with less crashes: S D Martin
Aircraft with less crashes: Kolb Aircraft Co
Aircraft with less crashes: Radford
Aircraft with less crashes: Welch Floyd L
Aircraft with less crashes: Mason Robert
Aircraft with less crashes: Anderas
Aircraft with less crashes: Schweizer, N36289
Aircraft with less crashes: Flynn Van
Aircraft with less crashes: Brecher Rotorway
Aircraft with less crashes: Swedener
Aircraft with less crashes: Elvin Jack R Jr
Aircraft with less crashes: Tiger Aircraft Llc
Aircraft with less crashes: Sam R Peachey
Aircraft with less crashes: Brewer James M
Aircraft with less crashes: Cliff
Aircraft with less crashes: Murphy Aircraft
Aircraft with less crashes: Hazelwood Michael S
Aircraft with less crashes: Luy Wayman
Aircraft with less crashes: Clark
Aircraft with less crashes: Aero At Sp Zoo
Aircraft with less crashes: Savage Air Llc
Aircraft with less crashes: Thomas A Siminski
Aircraft with less crashes: Cessna/Weaver
Aircraft with less crashes: Rittal Alfred Timothy
Aircraft with less crashes: Marlowe Thooft
Aircraft with less crashes: Univair Aircraft Corporation
Aircraft with less crashes: Oas
Aircraft with less crashes: Beller
Aircraft with less crashes: Fuhrmann-Super Emeraude
Aircraft with less crashes: Boeing Company, Long Beach Div
Aircraft with less crashes: Mantell Allan T
Aircraft with less crashes: N126C Llc
Aircraft with less crashes: Santschi Chris A
Aircraft with less crashes: Nord (Sncan)
Aircraft with less crashes: Indonesian Aerospace
Aircraft with less crashes: Engle David
Aircraft with less crashes: Joby Aero Inc
Aircraft with less crashes: Jonker
Aircraft with less crashes: Zenair Ltd
Aircraft with less crashes: Cox
Aircraft with less crashes: Mcculloch Jerry
Aircraft with less crashes: Sungkwon Kim
Aircraft with less crashes: Aircraft Mfg & Dev. Co.
Aircraft with less crashes: Robertson James F
Aircraft with less crashes: Lsa America Inc
Aircraft with less crashes: Heiser Robert C Jr
Aircraft with less crashes: Consolidated Aeronautics Inc.
Aircraft with less crashes: Dg-Flugzeugbau Gmbh

Aircraft with less crashes: Rehn
Aircraft with less crashes: Avia Stroitel
Aircraft with less crashes: Dayon
Aircraft with less crashes: Hutchinson Kenneth A
Aircraft with less crashes: Mccleery
Aircraft with less crashes: American Champion Aircraft Cor
Aircraft with less crashes: Fagan
Aircraft with less crashes: Mauck
Aircraft with less crashes: Skiles Kenneth C
Aircraft with less crashes: Degraw
Aircraft with less crashes: Robert M. Jones
Aircraft with less crashes: Burrill Steven E
Aircraft with less crashes: Hunthrop
Aircraft with less crashes: Mooney Aircraft Corporation
Aircraft with less crashes: Evo13 Llc
Aircraft with less crashes: Zimmerman
Aircraft with less crashes: Leza Lockwood
Aircraft with less crashes: Boeing 777-306Er
Aircraft with less crashes: Tamarack Helicopters Inc
Aircraft with less crashes: Loflin
Aircraft with less crashes: Kermit Weeks
Aircraft with less crashes: Rans Inc
Aircraft with less crashes: University Of Kansas
Aircraft with less crashes: Silfvast
Aircraft with less crashes: Denney
Aircraft with less crashes: Youngs William D
Aircraft with less crashes: Marshall
Aircraft with less crashes: Chris W Kleen
Aircraft with less crashes: Casler Scott
Aircraft with less crashes: Alex Michael Bantum/Tercel Usa
Aircraft with less crashes: Robert Frisbey
Aircraft with less crashes: Dacey
Aircraft with less crashes: Sloan Roger D
Aircraft with less crashes: Kreps
Aircraft with less crashes: Hood John Sidney
Aircraft with less crashes: Groen
Aircraft with less crashes: Blue Side Up Inc
Aircraft with less crashes: Toerner Bob
Aircraft with less crashes: Honda Aircraft Co Llc
Aircraft with less crashes: Henrie Raymond
Aircraft with less crashes: Galloway/Ward
Aircraft with less crashes: Marrin
Aircraft with less crashes: Lester Robert E
Aircraft with less crashes: National Ballooning Ltd
Aircraft with less crashes: Rennie Midget Musta
Aircraft with less crashes: Ayers
Aircraft with less crashes: American Legend Aircraft Co.
Aircraft with less crashes: Grumman Aircraft Cor-Schweizer
Aircraft with less crashes: Bucker Jungmann
Aircraft with less crashes: Jm Kemp
Aircraft with less crashes: Neefjes
Aircraft with less crashes: Colonial
Aircraft with less crashes: Sweet Wayne A
Aircraft with less crashes: Hoyle
Aircraft with less crashes: Fortuna Dave
Aircraft with less crashes: Pilgrim Samuel W Jr
Aircraft with less crashes: Behne
Aircraft with less crashes: Alexander
Aircraft with less crashes: Alliant
Aircraft with less crashes: Watson David E
Aircraft with less crashes: Wingtip To Wingtip, Llc
Aircraft with less crashes: Cgs Aviation
Aircraft with less crashes: Donald G Stokes
Aircraft with less crashes: Laseure
Aircraft with less crashes: Gordon
Aircraft with less crashes: Mosier Robert S
Aircraft with less crashes: Robin
Aircraft with less crashes: Chapman Mark A
Aircraft with less crashes: Karibian Hurant

Aircraft with less crashes: Rivers Lindsey Lee
Aircraft with less crashes: Gulfstream American Corp.
Aircraft with less crashes: Steven R Mcneese
Aircraft with less crashes: Johnson Gary
Aircraft with less crashes: Zenith Acft Co
Aircraft with less crashes: Cessna Aircraft Co.
Aircraft with less crashes: Bach Joseph E
Aircraft with less crashes: Hine T L/Johnson R
Aircraft with less crashes: Wasson Loehle
Aircraft with less crashes: Krusmark David Homer
Aircraft with less crashes: Mini-Max
Aircraft with less crashes: Epig
Aircraft with less crashes: Evolution
Aircraft with less crashes: Piper / Laudeman
Aircraft with less crashes: Found Acft Canada Inc
Aircraft with less crashes: Weinberg
Aircraft with less crashes: Diehl
Aircraft with less crashes: Hendryx Steve/Wiley Ross
Aircraft with less crashes: Powerchute Llc
Aircraft with less crashes: Moore Thomas O
Aircraft with less crashes: Day William L
Aircraft with less crashes: Bailey Robert
Aircraft with less crashes: Sc Iar Sa Brasov
Aircraft with less crashes: Boring Robert Burton
Aircraft with less crashes: Brockman William A
Aircraft with less crashes: Herem
Aircraft with less crashes: Marino
Aircraft with less crashes: Buhl
Aircraft with less crashes: Hamlin John D
Aircraft with less crashes: Hoskins Samuel R
Aircraft with less crashes: Balony Kubicek Spol
Aircraft with less crashes: Boeing-Stearman
Aircraft with less crashes: Olson Perry D
Aircraft with less crashes: Mcholland
Aircraft with less crashes: Ragonese Tim
Aircraft with less crashes: Uvify
Aircraft with less crashes: Magni
Aircraft with less crashes: Quest Aircraft Company
Aircraft with less crashes: Bins Tom
Aircraft with less crashes: Aviat Aircraft Inc.
Aircraft with less crashes: Noorduyn
Aircraft with less crashes: Czech Sportplanes Sro
Aircraft with less crashes: Viguie G/Viguie M
Aircraft with less crashes: Staudacher Aircraft Inc
Aircraft with less crashes: Ayres Thrush
Aircraft with less crashes: Brinkerhuff Gerald G
Aircraft with less crashes: Mckeehan James F
Aircraft with less crashes: Berger Michael A
Aircraft with less crashes: Klaas Development Inc
Aircraft with less crashes: Walter S Johnson Iii
Aircraft with less crashes: United Consultants
Aircraft with less crashes: Dreyer
Aircraft with less crashes: Seace David A
Aircraft with less crashes: Mccurry Charles P
Aircraft with less crashes: Pfouts Alfred L
Aircraft with less crashes: Jans Robert
Aircraft with less crashes: Capital Holdings 226 Llc
Aircraft with less crashes: Ohlgren Brent E
Aircraft with less crashes: Hebert Peter J
Aircraft with less crashes: Costruzioni Aeronautiche
Aircraft with less crashes: Tompkins
Aircraft with less crashes: Bond Neal O
Aircraft with less crashes: Jihlavan
Aircraft with less crashes: Schmidt Randall M
Aircraft with less crashes: Quist
Aircraft with less crashes: Vanderhoof Steve
Aircraft with less crashes: Columbia Helicopters
Aircraft with less crashes: Bice
Aircraft with less crashes: Rogers Homer/Rogers Sheila

Aircraft with less crashes: Wight
Aircraft with less crashes: Lemond
Aircraft with less crashes: Corben Baby Ace
Aircraft with less crashes: Daniels
Aircraft with less crashes: New Glasair
Aircraft with less crashes: Albright Stan
Aircraft with less crashes: Quasar Acft Co Llc
Aircraft with less crashes: Burkholder Jimmy C
Aircraft with less crashes: White
Aircraft with less crashes: Mxr Technologies
Aircraft with less crashes: Powerchute
Aircraft with less crashes: Eagleston John H
Aircraft with less crashes: Ratheon Aircraft Company
Aircraft with less crashes: Richard Rank
Aircraft with less crashes: Luscombe Silvaire Aircraft Co.
Aircraft with less crashes: Nuse George
Aircraft with less crashes: Thomsen
Aircraft with less crashes: Barrow
Aircraft with less crashes: Blumer
Aircraft with less crashes: Flaglor Tom
Aircraft with less crashes: David W Oakes
Aircraft with less crashes: Harms Robert M
Aircraft with less crashes: Brm Aero
Aircraft with less crashes: Max A Boesiger Jr
Aircraft with less crashes: Scott
Aircraft with less crashes: Snelling
Aircraft with less crashes: Harry Crosby (Vans)
Aircraft with less crashes: Hilderson Oswald
Aircraft with less crashes: William Wright
Aircraft with less crashes: Ross H/Herriott M
Aircraft with less crashes: Stafford Wayne H
Aircraft with less crashes: Payne/Foster
Aircraft with less crashes: Evens
Aircraft with less crashes: Kolb Aircraft Inc
Aircraft with less crashes: Flugzeugproduktions-Und Vertri
Aircraft with less crashes: Shaw Douglas Wayne
Aircraft with less crashes: Manweiller
Aircraft with less crashes: Stemme
Aircraft with less crashes: Krips Jack E Jr
Aircraft with less crashes: Campbell
Aircraft with less crashes: Chistov
Aircraft with less crashes: Sproul
Aircraft with less crashes: Halbrook
Aircraft with less crashes: Kennedy
Aircraft with less crashes: Eads Socata
Aircraft with less crashes: Frey
Aircraft with less crashes: Aero Vodochody Aero. Works
Aircraft with less crashes: Ferguson Aircraft
Aircraft with less crashes: Fisher Harold R
Aircraft with less crashes: Piper Aerostar
Aircraft with less crashes: Mills
Aircraft with less crashes: Endler Glasair/Glasair 1-Td
Aircraft with less crashes: Lien
Aircraft with less crashes: Leineke Walter L
Aircraft with less crashes: Jabiru
Aircraft with less crashes: Chicco
Aircraft with less crashes: Hurley Richard A
Aircraft with less crashes: Aventura
Aircraft with less crashes: Wolseley Motors, Inc.
Aircraft with less crashes: Wsk-Pzl Meilec
Aircraft with less crashes: Helton
Aircraft with less crashes: Mcfarland Wm H
Aircraft with less crashes: Sonex Limited
Aircraft with less crashes: Kaldor Gregory N
Aircraft with less crashes: Roberts Alan W
Aircraft with less crashes: Myron Oleson
Aircraft with less crashes: Budd
Aircraft with less crashes: Scott Mills
Aircraft with less crashes: Ferdon

Aircraft with less crashes: Hachem Zachery S
Aircraft with less crashes: Moore
Aircraft with less crashes: Davidson
Aircraft with less crashes: Tarantola Leonard
Aircraft with less crashes: Boson
Aircraft with less crashes: Rans, Inc.
Aircraft with less crashes: Rogers Kenneth J
Aircraft with less crashes: Bibbee
Aircraft with less crashes: Fisher Michael H
Aircraft with less crashes: Pensinger
Aircraft with less crashes: Thornton
Aircraft with less crashes: Agustawestland Philadelphia Co
Aircraft with less crashes: Attaway Robert H
Aircraft with less crashes: Brown Mark
Aircraft with less crashes: Carillon John C
Aircraft with less crashes: Ashcraft
Aircraft with less crashes: Rotorcraft Developement Corp.
Aircraft with less crashes: Aerosport Ltd
Aircraft with less crashes: Leatherman Karl L
Aircraft with less crashes: Evektor-Aerotechnik
Aircraft with less crashes: Clayhold
Aircraft with less crashes: Aircraft Mfg & Dev. Co. (Amd)
Aircraft with less crashes: Ferguson William C
Aircraft with less crashes: Roach Neil
Aircraft with less crashes: Cubcrafter
Aircraft with less crashes: Experimental
Aircraft with less crashes: Bayliss Milton A Iii
Aircraft with less crashes: Garrison Ronald L
Aircraft with less crashes: Rardin William I
Aircraft with less crashes: Rhoads
Aircraft with less crashes: Bordelon Bruce
Aircraft with less crashes: Clem William B Iii
Aircraft with less crashes: Bordelon
Aircraft with less crashes: Adolphson
Aircraft with less crashes: Thomas Scott
Aircraft with less crashes: Welch Thomas
Aircraft with less crashes: Bielawa
Aircraft with less crashes: Express
Aircraft with less crashes: Parks J L/Dreffin D
Aircraft with less crashes: Norton Claude C
Aircraft with less crashes: Lyons Robert
Aircraft with less crashes: Bezinque
Aircraft with less crashes: Sonex
Aircraft with less crashes: Cross-Capps
Aircraft with less crashes: Schneider Richard J
Aircraft with less crashes: Divis S L/Waltrip A J
Aircraft with less crashes: Floyd Joseph B
Aircraft with less crashes: Kramer Clemens E
Aircraft with less crashes: Leider
Aircraft with less crashes: Peter W Stevens
Aircraft with less crashes: Darney
Aircraft with less crashes: Nasa Ames Research Center
Aircraft with less crashes: Lowerre Bruce T
Aircraft with less crashes: Case Richard L
Aircraft with less crashes: Amen
Aircraft with less crashes: Johnson Barron T
Aircraft with less crashes: Andrews
Aircraft with less crashes: Jones Ronald C
Aircraft with less crashes: Trusty
Aircraft with less crashes: Larson
Aircraft with less crashes: Zenith Aircraft Co
Aircraft with less crashes: Erickson Larry D
Aircraft with less crashes: Croman Corporation
Aircraft with less crashes: Jetprop Dlx Piper
Aircraft with less crashes: Grimm
Aircraft with less crashes: Blum Matthew
Aircraft with less crashes: Starduster Ii
Aircraft with less crashes: Raytheon Company
Aircraft with less crashes: Cessna Ector

Aircraft with less crashes: Grumman Aircraft
Aircraft with less crashes: L Goldner
Aircraft with less crashes: Hillam Scott L
Aircraft with less crashes: Hall Jeffrey
Aircraft with less crashes: Miller/Culpepper
Aircraft with less crashes: Johnston Douglas S
Aircraft with less crashes: Cotton Galen M
Aircraft with less crashes: Schafer
Aircraft with less crashes: Marks Ca Iii
Aircraft with less crashes: Pearson Jon M
Aircraft with less crashes: Wooters
Aircraft with less crashes: North American/Victoria Mnt Lt
Aircraft with less crashes: Air Tractor, Inc.
Aircraft with less crashes: Graves
Aircraft with less crashes: Campbell David
Aircraft with less crashes: Paradise Aircraft Usa Llc
Aircraft with less crashes: Mcdonnell-Douglas
Aircraft with less crashes: Rice
Aircraft with less crashes: Quad City Ultralight Acft Corp
Aircraft with less crashes: Jerome D Fischer
Aircraft with less crashes: Mcculley Ronald
Aircraft with less crashes: Herrick David A
Aircraft with less crashes: Brinker / Garner
Aircraft with less crashes: Lydon Patrick F
Aircraft with less crashes: Kostrazewa Andre
Aircraft with less crashes: Avian Balloon
Aircraft with less crashes: Byron J. Moore
Aircraft with less crashes: Aerotrek
Aircraft with less crashes: Yuneec
Aircraft with less crashes: Dennis L Zumbalt
Aircraft with less crashes: Bertram William J
Aircraft with less crashes: Rolladen-Schneider Gmbh
Aircraft with less crashes: Piper/Wally'S Flyers Inc
Aircraft with less crashes: Kitfox Iv
Aircraft with less crashes: Airframes Unlimited
Aircraft with less crashes: Honda Aircraft
Aircraft with less crashes: Brunzlick Larry R
Aircraft with less crashes: Oliver Joseph
Aircraft with less crashes: Facebook Uk Ltd
Aircraft with less crashes: Elkins
Aircraft with less crashes: Bowman
Aircraft with less crashes: Dixon
Aircraft with less crashes: Linstrand
Aircraft with less crashes: Dart
Aircraft with less crashes: Univar
Aircraft with less crashes: Israel Aerospace Industriesltd
Aircraft with less crashes: Desalvatore Al
Aircraft with less crashes: Mudge Ray
Aircraft with less crashes: Lacour
Aircraft with less crashes: Remos
Aircraft with less crashes: Mason
Aircraft with less crashes: Schweizer(Hughes)
Aircraft with less crashes: Glines
Aircraft with less crashes: Carlo Robert
Aircraft with less crashes: Terrell Caragol
Aircraft with less crashes: Brumbaugh B/Kasowski L
Aircraft with less crashes: Piontkowski
Aircraft with less crashes: Moynahan
Aircraft with less crashes: Helie
Aircraft with less crashes: Kawasaki Heavy Industries Ltd.
Aircraft with less crashes: Leonardo Spa
Aircraft with less crashes: Dean Leslie N
Aircraft with less crashes: Belcher William B Ii
Aircraft with less crashes: Iniziative
Aircraft with less crashes: Pilatus Aircraft
Aircraft with less crashes: Michael A Howard
Aircraft with less crashes: Dusenberry Mark J
Aircraft with less crashes: Redd Tom
Aircraft with less crashes: Orlican

Aircraft with less crashes: Earl Allen
Aircraft with less crashes: Mueller Michael Walter
Aircraft with less crashes: Aviocar Casa
Aircraft with less crashes: Jenkins Jack
Aircraft with less crashes: Doppelt Fredric F
Aircraft with less crashes: Mayo
Aircraft with less crashes: Cook
Aircraft with less crashes: Stirling
Aircraft with less crashes: Loehr Thomas H
Aircraft with less crashes: Mcgrath Robert F
Aircraft with less crashes: Andre Kostrzewa
Aircraft with less crashes: Wogenstahl Wallace L
Aircraft with less crashes: Bereznak
Aircraft with less crashes: Sport Plane Dynamics Llc
Aircraft with less crashes: Lefever Paul M
Aircraft with less crashes: La Moutte
Aircraft with less crashes: Grumman American Aviation Corp
Aircraft with less crashes: Aeros Ltd
Aircraft with less crashes: Landrum Kelly T
Aircraft with less crashes: Neland Richard L
Aircraft with less crashes: Texas Helicopter Corporation
Aircraft with less crashes: Ertz Mark G
Aircraft with less crashes: Merrell Stephen
Aircraft with less crashes: Cano Dave
Aircraft with less crashes: Airmax Construcoes Aeronautica
Aircraft with less crashes: Glasair
Aircraft with less crashes: Charles Peet
Aircraft with less crashes: Waters Peter T
Aircraft with less crashes: Shannon James A Jr
Aircraft with less crashes: Gladstone
Aircraft with less crashes: Hph Ltd
Aircraft with less crashes: Wohnoutka Steven M
Aircraft with less crashes: Marsh Aviation
Aircraft with less crashes: Gallagher John C
Aircraft with less crashes: New Kolb Aircraft Co
Aircraft with less crashes: Lantzair Flyers Inc
Aircraft with less crashes: Honda
Aircraft with less crashes: Piper Pawnee
Aircraft with less crashes: Schoepflin
Aircraft with less crashes: Gremminger Greg
Aircraft with less crashes: Herder Michael
Aircraft with less crashes: Tetrault Ronad
Aircraft with less crashes: Morris Thomas Lee
Aircraft with less crashes: Smith Vilas
Aircraft with less crashes: Kerr Matthew
Aircraft with less crashes: Zach Vans
Aircraft with less crashes: Tarantola
Aircraft with less crashes: Buckeye Aviation Inc
Aircraft with less crashes: Wiley
Aircraft with less crashes: Malone Henry O
Aircraft with less crashes: Carothers
Aircraft with less crashes: Woolston Glenn E
Aircraft with less crashes: Schleicher Alexander
Aircraft with less crashes: Schweizer 300Cbi
Aircraft with less crashes: Polit
Aircraft with less crashes: Kevin Wilkinson
Aircraft with less crashes: Xtremeair Gmbh
Aircraft with less crashes: Cornett Steven M
Aircraft with less crashes: Erick Magno & Assoc Pa
Aircraft with less crashes: Jerome A Baak
Aircraft with less crashes: Ridge Lowell H
Aircraft with less crashes: Taylorcraft Corporation
Aircraft with less crashes: Raf
Aircraft with less crashes: S C Aerostar S A
Aircraft with less crashes: Montana
Aircraft with less crashes: Cgs
Aircraft with less crashes: Six Chuter, Inc
Aircraft with less crashes: Davis Daniel T
Aircraft with less crashes: Capra, Salvatore O

Aircraft with less crashes: Evans Robert W Sr
Aircraft with less crashes: Construcciones Aeronauticas
Aircraft with less crashes: Delconte Emidio J
Aircraft with less crashes: Glos Wallis Richard Jr
Aircraft with less crashes: Blanik
Aircraft with less crashes: Monroig Pedro J
Aircraft with less crashes: Griffiths James Sydney
Aircraft with less crashes: Firefly Balloons
Aircraft with less crashes: Karns
Aircraft with less crashes: Wilderoder
Aircraft with less crashes: Payne Steven R
Aircraft with less crashes: Kitfox
Aircraft with less crashes: Eckenrode Carl J
Aircraft with less crashes: Douglas A. Pohl
Aircraft with less crashes: Traxler John N
Aircraft with less crashes: Robert Trembly
Aircraft with less crashes: Garratt Mansfield W
Aircraft with less crashes: Garland
Aircraft with less crashes: Cox John Wiley
Aircraft with less crashes: C A S A
Aircraft with less crashes: Corvus
Aircraft with less crashes: Boykin Stephen Vance
Aircraft with less crashes: O'Dell
Aircraft with less crashes: Embraer Executive Aircraft Inc
Aircraft with less crashes: Tuberville
Aircraft with less crashes: Ison Aircraft
Aircraft with less crashes: Chance Vought
Aircraft with less crashes: Diamond Aircraft Industries Inc
Aircraft with less crashes: Questair, Inc.
Aircraft with less crashes: Calvin Nate H
Aircraft with less crashes: Airbus/Eurocopter
Aircraft with less crashes: Eastabrooks John T
Aircraft with less crashes: Butler Raymond
Aircraft with less crashes: Esselstyn Chuck
Aircraft with less crashes: Hagerty
Aircraft with less crashes: Tomei
Aircraft with less crashes: Bosco Don
Aircraft with less crashes: Robert J Reimbold
Aircraft with less crashes: Joseph Bender
Aircraft with less crashes: Walsh Philip J
Aircraft with less crashes: Titan
Aircraft with less crashes: Phoenix Air
Aircraft with less crashes: Easton
Aircraft with less crashes: Parker
Aircraft with less crashes: Mcdonnell Douglas Corporation
Aircraft with less crashes: Excalibur Aircraft
Aircraft with less crashes: Aero Works
Aircraft with less crashes: Linke
Aircraft with less crashes: Cupaiolo
Aircraft with less crashes: Antonovich Anton B
Aircraft with less crashes: Valldejuli John A
Aircraft with less crashes: Travel Air
Aircraft with less crashes: Winship Kent S
Aircraft with less crashes: Cgs Aviation Llc
Aircraft with less crashes: Pilatus Britten-Norman
Aircraft with less crashes: Rotherwick
Aircraft with less crashes: Marshall James J
Aircraft with less crashes: Chamberlain Gerald
Aircraft with less crashes: Alexander Thomas P
Aircraft with less crashes: Sigmon Harvey E
Aircraft with less crashes: Bae Systems (Operations) Limit
Aircraft with less crashes: Brown Narcisse A
Aircraft with less crashes: Harritty William V
Aircraft with less crashes: Debus J / Mountain S / Bowes E
Aircraft with less crashes: Wohaska John
Aircraft with less crashes: Yates
Aircraft with less crashes: Bushby
Aircraft with less crashes: Ankestar, Bradley D.
Aircraft with less crashes: Velline'S

Aircraft with less crashes: M7Aero
Aircraft with less crashes: Sud Aviation/Eurocopter
Aircraft with less crashes: 781569 Inc
Aircraft with less crashes: Refling
Aircraft with less crashes: Rotherwick Hr
Aircraft with less crashes: Palen
Aircraft with less crashes: Black Donald
Aircraft with less crashes: Jennings John C
Aircraft with less crashes: Pridmore
Aircraft with less crashes: Summit
Aircraft with less crashes: Wampach
Aircraft with less crashes: Colt Balloons
Aircraft with less crashes: Mooney International Corp
Aircraft with less crashes: Bunker
Aircraft with less crashes: Citabria
Aircraft with less crashes: Christensen Steve
Aircraft with less crashes: Scotts-Bell 47 Inc
Aircraft with less crashes: Hooper James A
Aircraft with less crashes: Jackson Fred M
Aircraft with less crashes: Taylorcraft Aviation
Aircraft with less crashes: Texas Air Ventures Inc
Aircraft with less crashes: Moyes
Aircraft with less crashes: Schulke
Aircraft with less crashes: Ronald V White
Aircraft with less crashes: Yeager Inc.
Aircraft with less crashes: Viking Air Limited
Aircraft with less crashes: Supinski Mark R
Aircraft with less crashes: Mischke
Aircraft with less crashes: Jones Rodney V
Aircraft with less crashes: Marley
Aircraft with less crashes: Evektor Aerotechnik As
Aircraft with less crashes: Westcott
Aircraft with less crashes: Mckenzie
Aircraft with less crashes: Rans S-12
Aircraft with less crashes: Ab Sportine Aviacija
Aircraft with less crashes: Mkii Corporation
Aircraft with less crashes: Hermann Bjorn
Aircraft with less crashes: John V Rawson Jr
Aircraft with less crashes: Fall Martin
Aircraft with less crashes: Pekola James W
Aircraft with less crashes: Venus
Aircraft with less crashes: Helpling Helen C
Aircraft with less crashes: Brewster
Aircraft with less crashes: Frazier
Aircraft with less crashes: Oliver
Aircraft with less crashes: Bhi H60 Helicopters Llc
Aircraft with less crashes: Easler Kelly
Aircraft with less crashes: Byler
Aircraft with less crashes: Tubbs S/Performance Air Inc
Aircraft with less crashes: Bartholomew
Aircraft with less crashes: Tacchi Torello F
Aircraft with less crashes: Jeremiah Jackson
Aircraft with less crashes: Wright B Flyer Inc
Aircraft with less crashes: Jdt Mini-Max Llc
Aircraft with less crashes: Gmk Ventures Llc
Aircraft with less crashes: Marlman
Aircraft with less crashes: St Clair David L
Aircraft with less crashes: Shaffstall
Aircraft with less crashes: Nolan
Aircraft with less crashes: McNulty John S
Aircraft with less crashes: Mxr Technologies Inc
Aircraft with less crashes: Kjonaas
Aircraft with less crashes: Jahnke Lionel G
Aircraft with less crashes: Deitz
Aircraft with less crashes: Stol Llc
Aircraft with less crashes: Antares Us
Aircraft with less crashes: Stits Aircraft
Aircraft with less crashes: Davis Michael J
Aircraft with less crashes: Young John E

Aircraft with less crashes: Aerotek
Aircraft with less crashes: Unregistered
Aircraft with less crashes: Westerhout/Gagnier
Aircraft with less crashes: Schneider John W
Aircraft with less crashes: Stephen L Kruer
Aircraft with less crashes: Engineering And Research
Aircraft with less crashes: Williams Yakovlev
Aircraft with less crashes: Rans Employee Flying Club
Aircraft with less crashes: Schupp Edward W
Aircraft with less crashes: Bailey N Moyes
Aircraft with less crashes: Beech Aircraft Corporation
Aircraft with less crashes: Stump
Aircraft with less crashes: Eric A Munzer
Aircraft with less crashes: Partenavia Spa
Aircraft with less crashes: Healy
Aircraft with less crashes: Spackman
Aircraft with less crashes: Helicycle/Morrissey Rr
Aircraft with less crashes: Christopher
Aircraft with less crashes: Troyer
Aircraft with less crashes: Michael Cans
Aircraft with less crashes: Boswell John J
Aircraft with less crashes: Hughes Charles R
Aircraft with less crashes: Adams John R Jr
Aircraft with less crashes: Diamond Aircraft Industries In
Aircraft with less crashes: Perth Amboy
Aircraft with less crashes: Klemme William H
Aircraft with less crashes: Babcock
Aircraft with less crashes: Kennedy Michael M
Aircraft with less crashes: Wilson
Aircraft with less crashes: Interplane
Aircraft with less crashes: Eberle John S
Aircraft with less crashes: Jewett
Aircraft with less crashes: Edson Robert W
Aircraft with less crashes: Riffel Jerris L
Aircraft with less crashes: Ag-Cat Corporation
Aircraft with less crashes: Ulrich Christen
Aircraft with less crashes: Nicholson
Aircraft with less crashes: Mark C Pauls
Aircraft with less crashes: Holden Frank Joseph
Aircraft with less crashes: Bertagna John
Aircraft with less crashes: Shaw
Aircraft with less crashes: Berry Dean
Aircraft with less crashes: Backovich George C
Aircraft with less crashes: Ketonen
Aircraft with less crashes: Stroup Robert
Aircraft with less crashes: Jackson
Aircraft with less crashes: Rice Leo B
Aircraft with less crashes: Marrero Andres
Aircraft with less crashes: Worthington Donald Wayne
Aircraft with less crashes: Skykits Usa Corp
Aircraft with less crashes: Nelson Steven Paul
Aircraft with less crashes: Hitchcock
Aircraft with less crashes: Teunis
Aircraft with less crashes: Worgull
Aircraft with less crashes: Hatle
Aircraft with less crashes: Ostertag Walter G
Aircraft with less crashes: Bell Helicopter Co
Aircraft with less crashes: Barche
Aircraft with less crashes: Moody-Siple
Aircraft with less crashes: William L Bell
Aircraft with less crashes: Thomas C Sikes
Aircraft with less crashes: Downer
Aircraft with less crashes: Rgj Aviation Llc
Aircraft with less crashes: Eccker
Aircraft with less crashes: Leroy Lakey
Aircraft with less crashes: Holt Herbert L
Aircraft with less crashes: Teal Harry H
Aircraft with less crashes: Cotter
Aircraft with less crashes: Chapel Robert B

Aircraft with less crashes: Sorensen
Aircraft with less crashes: Clamar Floats Inc
Aircraft with less crashes: Bal-Air Inc/Wayne John K
Aircraft with less crashes: Brenholt Larry R
Aircraft with less crashes: Bean R E/R B Weld Inc
Aircraft with less crashes: Soneral
Aircraft with less crashes: Tromsness Enterprises Inc
Aircraft with less crashes: Sidler Mike
Aircraft with less crashes: Brewer
Aircraft with less crashes: Ray E Roberts
Aircraft with less crashes: Brennan
Aircraft with less crashes: Mahre
Aircraft with less crashes: Miller Charles W
Aircraft with less crashes: Cessna Skyhawk Ii
Aircraft with less crashes: K Copters
Aircraft with less crashes: Reims
Aircraft with less crashes: Leigh
Aircraft with less crashes: Carr
Aircraft with less crashes: National Ballooning
Aircraft with less crashes: Cessna Reims
Aircraft with less crashes: Leonardo
Aircraft with less crashes: Art Lee Delano
Aircraft with less crashes: Rainbow Aircraft (Pty) Ltd
Aircraft with less crashes: Thrush Aircraft Llc
Aircraft with less crashes: Top Dog
Aircraft with less crashes: Roberto P. Garcia
Aircraft with less crashes: Alvarez Marvin R
Aircraft with less crashes: Shirey David A
Aircraft with less crashes: Fetterman Lanny R
Aircraft with less crashes: Mcleod Alan
Aircraft with less crashes: Weatherly Aviation Company Inc
Aircraft with less crashes: Merit Aviation Llc
Aircraft with less crashes: Kevin P Stolhammer
Aircraft with less crashes: Moynihan Richard D
Aircraft with less crashes: Meuer Mark
Aircraft with less crashes: Stevens R P/Mccright D W
Aircraft with less crashes: Toman Jack Jr
Aircraft with less crashes: Wittman D R/Wittman D M
Aircraft with less crashes: Randall Amanda
Aircraft with less crashes: Pyka Inc
Aircraft with less crashes: Allstar Pzl Glider
Aircraft with less crashes: Richards Heavylift
Aircraft with less crashes: Polaris Motors
Aircraft with less crashes: Quicksilver Aircraft
Aircraft with less crashes: Eurocopter Deutschland
Aircraft with less crashes: Bakeng
Aircraft with less crashes: Walling
Aircraft with less crashes: Allen Raymond H
Aircraft with less crashes: Tuth
Aircraft with less crashes: Itec Inc
Aircraft with less crashes: Topdog Ultralights
Aircraft with less crashes: Frederick Hays-Roth
Aircraft with less crashes: Hemp Timothy
Aircraft with less crashes: Lyons
Aircraft with less crashes: Woodrow Larry W
Aircraft with less crashes: Sikorsky Aircraft Corporation
Aircraft with less crashes: Lorentzen
Aircraft with less crashes: Embraer Aircraft
Aircraft with less crashes: Ralph
Aircraft with less crashes: Sproul Keith A
Aircraft with less crashes: Howes
Aircraft with less crashes: Reamer
Aircraft with less crashes: Aero Smart Solutions Inc
Aircraft with less crashes: Arrow-Falcon Exporters, Inc.
Aircraft with less crashes: Adams
Aircraft with less crashes: Gunnoe
Aircraft with less crashes: Gates Learjet Corp
Aircraft with less crashes: Kakeldey Ronald O
Aircraft with less crashes: C A Tecnam Srl

Aircraft with less crashes: Philip D Anderson
Aircraft with less crashes: Tupolev
Aircraft with less crashes: Vaughn
Aircraft with less crashes: Vulcanair
Aircraft with less crashes: Mallory Christopher L
Aircraft with less crashes: Gn-1 Aircamper
Aircraft with less crashes: Continental Copters
Aircraft with less crashes: Tubbs S/Performance
Aircraft with less crashes: Crabtree
Aircraft with less crashes: Wheeler C / Wheeler K
Aircraft with less crashes: Nelson Miles
Aircraft with less crashes: Homer
Aircraft with less crashes: Smith Albert F
Aircraft with less crashes: Super 18 Llc
Aircraft with less crashes: Thompson
Aircraft with less crashes: Adams Balloons Llc
Aircraft with less crashes: Silverlight Aviation
Aircraft with less crashes: Enbody Frank
Aircraft with less crashes: New Piper
Aircraft with less crashes: Walker J C
Aircraft with less crashes: Fenton
Aircraft with less crashes: Canadian Light Acft Sales &Svc
Aircraft with less crashes: British Aircraft Corp
Aircraft with less crashes: Johnston William Alfred Jr
Aircraft with less crashes: Swiezy
Aircraft with less crashes: Taylorcraft Aviation Corp.
Aircraft with less crashes: Juneau (Zenith Aircraft Co)
Aircraft with less crashes: Smith Miniplane
Aircraft with less crashes: Dressen
Aircraft with less crashes: Ntbk
Aircraft with less crashes: Robert Golding
Aircraft with less crashes: Buhlmann Howard
Aircraft with less crashes: Shepard Jimmy D Jr
Aircraft with less crashes: Mcdaniel
Aircraft with less crashes: Scotts-Bell 47, Inc.
Aircraft with less crashes: Quartz Mountain Aerospace
Aircraft with less crashes: Johnson Garret W
Aircraft with less crashes: Golden Circle
Aircraft with less crashes: Questair Inc
Aircraft with less crashes: Thunderbird Aviation
Aircraft with less crashes: Gippsaero Pty Ltd
Aircraft with less crashes: Simpson
Aircraft with less crashes: Partenavia S.P.A.
Aircraft with less crashes: Bird
Aircraft with less crashes: Barnard/Stancil
Aircraft with less crashes: Just Aircraft Llc
Aircraft with less crashes: Owen
Aircraft with less crashes: Moore Edward R
Aircraft with less crashes: Skyrunner
Aircraft with less crashes: Worley Dennis
Aircraft with less crashes: Heinz
Aircraft with less crashes: Dayton
Aircraft with less crashes: Donegan Benton
Aircraft with less crashes: Thorp
Aircraft with less crashes: Wing Harold
Aircraft with less crashes: Agustawestland Philadelphia
Aircraft with less crashes: Jess Llc
Aircraft with less crashes: Meyers Industries Inc
Aircraft with less crashes: Luciano Edison
Aircraft with less crashes: Aurora
Aircraft with less crashes: Bede
Aircraft with less crashes: Marlin
Aircraft with less crashes: Murray Richard F
Aircraft with less crashes: Burr Andrew E Xiv
Aircraft with less crashes: Dickey
Aircraft with less crashes: Dornier Gmbh
Aircraft with less crashes: Still Michael J
Aircraft with less crashes: Fairchild Funk
Aircraft with less crashes: Turck G L/Duflo J T

Aircraft with less crashes: Kidd Chris
Aircraft with less crashes: Argence
Aircraft with less crashes: Capella Aircraft Corporation (
Aircraft with less crashes: Huston Charles D
Aircraft with less crashes: Wolfe
Aircraft with less crashes: Sutton
Aircraft with less crashes: Goetz
Aircraft with less crashes: Aircraft Industries A.S.
Aircraft with less crashes: Delf Tim
Aircraft with less crashes: Pereyra
Aircraft with less crashes: Clark James T
Aircraft with less crashes: Green Gary E
Aircraft with less crashes: Lange Flugzeugbau Gmbh
Aircraft with less crashes: Davis Dan B
Aircraft with less crashes: Hummelbird
Aircraft with less crashes: Airborne (Australia)
Aircraft with less crashes: Seguine
Aircraft with less crashes: Skykits
Aircraft with less crashes: Honda Jet
Aircraft with less crashes: Thompson David
Aircraft with less crashes: Robert A Miller
Aircraft with less crashes: Giboney
Aircraft with less crashes: Henry Slosing
Aircraft with less crashes: Ludwig Larry E
Aircraft with less crashes: Anatra Bart T
Aircraft with less crashes: Rearwin
Aircraft with less crashes: Glasair Aviation Llc
Aircraft with less crashes: Shaffer William C
Aircraft with less crashes: Waller Charles R
Aircraft with less crashes: Gulfstream Schweizer A/C Corp
Aircraft with less crashes: Progressive Aerodyne Inc
Aircraft with less crashes: Wielt
Aircraft with less crashes: Hahn
Aircraft with less crashes: Folland Aircraft Co Ltd
Aircraft with less crashes: Aero Sp Z O O (Gobosh)
Aircraft with less crashes: Shorey Timothy A
Aircraft with less crashes: Mooney Airplane Company, Inc.
Aircraft with less crashes: Ballonbau Worner Gmbh
Aircraft with less crashes: Scaled Composites
Aircraft with less crashes: Southern Airmotive Corp.
Aircraft with less crashes: Nagel
Aircraft with less crashes: M-Squared
Aircraft with less crashes: Bombardier Learjet Corp.
Aircraft with less crashes: Sadler
Aircraft with less crashes: Lee Oscar D Iii
Aircraft with less crashes: Johnson Leonard G
Aircraft with less crashes: Explorer Aeronautique Inc.
Aircraft with less crashes: Sater
Aircraft with less crashes: Ferkin
Aircraft with less crashes: Ultramagic S A
Aircraft with less crashes: Hall Steven C
Aircraft with less crashes: Thompson Bruce D
Aircraft with less crashes: Dratbe Shmiel Amir
Aircraft with less crashes: Layson Stanley B
Aircraft with less crashes: Preiss Vans
Aircraft with less crashes: Shannon William
Aircraft with less crashes: Haeussler Ray
Aircraft with less crashes: Grumman American Aviation
Aircraft with less crashes: Lopez Phillip
Aircraft with less crashes: Tl Ultralight
Aircraft with less crashes: Heinlein George
Aircraft with less crashes: Dean Patrick G
Aircraft with less crashes: Hyde William R
Aircraft with less crashes: Raytheon Corporate Jets Inc
Aircraft with less crashes: Randall W Grandpre
Aircraft with less crashes: Johnson
Aircraft with less crashes: Reims-Cessna
Aircraft with less crashes: Eskildsen
Aircraft with less crashes: Atkins John

Aircraft with less crashes: Moffitt Oscar/ Kit Prostar A/C
Aircraft with less crashes: Ams-Flight D.O.O.
Aircraft with less crashes: Reeves
Aircraft with less crashes: Valentin
Aircraft with less crashes: Warth Dennis J
Aircraft with less crashes: Vink Robert D
Aircraft with less crashes: Williams Glenn
Aircraft with less crashes: Wilde Daniel L
Aircraft with less crashes: Berrie
Aircraft with less crashes: Benton Fred D
Aircraft with less crashes: Koen Lancair
Aircraft with less crashes: Slaughter Mike
Aircraft with less crashes: Hook
Aircraft with less crashes: Tucker Mitchel C
Aircraft with less crashes: Baker Wayne
Aircraft with less crashes: Gingras Michel
Aircraft with less crashes: Flournoy Martin R
Aircraft with less crashes: Terry F King
Aircraft with less crashes: Picard Roy J
Aircraft with less crashes: Socata-Groupe Aerospatiale
Aircraft with less crashes: Nelson
Aircraft with less crashes: Douglas Brian G
Aircraft with less crashes: Czech Sport Aircraft A S
Aircraft with less crashes: Ultralight America
Aircraft with less crashes: Daniel L Patrick
Aircraft with less crashes: Bunch
Aircraft with less crashes: Kilishek George T
Aircraft with less crashes: Noles Vance L
Aircraft with less crashes: Halladay Roy
Aircraft with less crashes: Airbus Helicopters Deutschland
Aircraft with less crashes: Kenneth A Berger
Aircraft with less crashes: Arion Aircraft Llc
Aircraft with less crashes: Moe-Pietenpol
Aircraft with less crashes: Grumman Acft Eng Cor
Aircraft with less crashes: Seher
Aircraft with less crashes: Griffith E/Boyd W E
Aircraft with less crashes: Bombardier Canadair
Aircraft with less crashes: Dearmond Clint
Aircraft with less crashes: Columbia Aircraft Mfg.
Aircraft with less crashes: Eclipse Aerospace Inc
Aircraft with less crashes: Dova Aircraft Sro
Aircraft with less crashes: Warner Lewis
Aircraft with less crashes: Cantlon
Aircraft with less crashes: Wermling
Aircraft with less crashes: Beers
Aircraft with less crashes: Steppling
Aircraft with less crashes: Didier Siffer (E-Ab)
Aircraft with less crashes: Dankelman Peter G
Aircraft with less crashes: Finney Thorp
Aircraft with less crashes: Hubbell
Aircraft with less crashes: Apollo
Aircraft with less crashes: Iar Brasov
Aircraft with less crashes: Ayres Corp
Aircraft with less crashes: Burton
Aircraft with less crashes: Ruiz E
Aircraft with less crashes: Arado-Flugzeugwerke Gmbh
Aircraft with less crashes: Williams Christopher T
Aircraft with less crashes: Wheat
Aircraft with less crashes: Huebbe
Aircraft with less crashes: Foster John
Aircraft with less crashes: Glimn
Aircraft with less crashes: Wragg George
Aircraft with less crashes: Quicksilver Enterprises Inc
Aircraft with less crashes: Waltermire
Aircraft with less crashes: Monte Clark
Aircraft with less crashes: Ica Brasov
Aircraft with less crashes: Fleming Eldridge E
Aircraft with less crashes: T51 Inc.
Aircraft with less crashes: Aermacchi

Aircraft with less crashes: Mckay Gene
Aircraft with less crashes: Glaeser
Aircraft with less crashes: Holst Lawrence E
Aircraft with less crashes: T&T Aviation Inc
Aircraft with less crashes: Carpenter
Aircraft with less crashes: Mchenry George B Jr
Aircraft with less crashes: Glenn H Curtiss Museum
Aircraft with less crashes: Goudie
Aircraft with less crashes: Miller Gregory Scott
Aircraft with less crashes: Airborne Australia
Aircraft with less crashes: Spaulding Errol
Aircraft with less crashes: Sorrell
Aircraft with less crashes: Cantrell Lw
Aircraft with less crashes: Aviate
Aircraft with less crashes: Brumwell
Aircraft with less crashes: Johnston Coyt E
Aircraft with less crashes: Gulfstream Aerospace Corp.
Aircraft with less crashes: Skistmas George
Aircraft with less crashes: Rhinehart
Aircraft with less crashes: Franklin
Aircraft with less crashes: Emory B. Wood
Aircraft with less crashes: Maarten H Versteeg
Aircraft with less crashes: Aerofab Inc
Aircraft with less crashes: Dayton A Babcock
Aircraft with less crashes: Maxfly Inc/Mckay Wm
Aircraft with less crashes: Coyote
Aircraft with less crashes: Cameron Balloons U S
Aircraft with less crashes: John M Corneal
Aircraft with less crashes: Dekkinga
Aircraft with less crashes: I.C.A.-Brasov
Aircraft with less crashes: Sadler Terry A
Aircraft with less crashes: Joseph C. Andrews, Jr.
Aircraft with less crashes: Poulin L/Cullen D
Aircraft with less crashes: Bollinger Robert L
Aircraft with less crashes: Badeaux
Aircraft with less crashes: Sierra
Aircraft with less crashes: Joy Aviation Ltd
Aircraft with less crashes: Trom Wayne
Aircraft with less crashes: Holloman L B/Holloman E M
Aircraft with less crashes: Bowley
Aircraft with less crashes: Hiller-Tri-Plex Ind.Inc.
Aircraft with less crashes: North Wing Uum Inc
Aircraft with less crashes: Brian P North
Aircraft with less crashes: Brandt Leroy E
Aircraft with less crashes: Higher Class Aviation
Aircraft with less crashes: Prendergast
Aircraft with less crashes: McDonnell Douglas Helicopters
Aircraft with less crashes: Aviat Aircraft
Aircraft with less crashes: Hoskins
Aircraft with less crashes: Gray
Aircraft with less crashes: Mds Fying Llc
Aircraft with less crashes: Dykas
Aircraft with less crashes: Kretsinger
Aircraft with less crashes: Robertson
Aircraft with less crashes: American Aviation Corp. (Aac)
Aircraft with less crashes: Consolidated Aeronautics Inc
Aircraft with less crashes: Drochak
Aircraft with less crashes: Sportine Aviacija
Aircraft with less crashes: Stucky Steven D
Aircraft with less crashes: Moser Georg
Aircraft with less crashes: Short Brothers & Harland Ltd.
Aircraft with less crashes: Morgan James E
Aircraft with less crashes: Skystar
Aircraft with less crashes: Moore Byron J
Aircraft with less crashes: Bristell
Aircraft with less crashes: Extra Flugzeugproduktions-Gmbh
Aircraft with less crashes: Fuller Van L
Aircraft with less crashes: Curtiss-Wright
Aircraft with less crashes: Angus Watt

Aircraft with less crashes: Hummel / Finberg
Aircraft with less crashes: Better Burn Llc/Startube Div
Aircraft with less crashes: Bobo Christopher J
Aircraft with less crashes: Glines Kenneth
Aircraft with less crashes: Gardner Douglas P
Aircraft with less crashes: Lepow David A
Aircraft with less crashes: Binkley Richard
Aircraft with less crashes: Webb
Aircraft with less crashes: Denisar Richard A
Aircraft with less crashes: Gottschalk John R
Aircraft with less crashes: Leder John A
Aircraft with less crashes: W.H. Hunnicutt
Aircraft with less crashes: Wsk-Mielec
Aircraft with less crashes: League
Aircraft with less crashes: David Shell
Aircraft with less crashes: Stump Bradley
Aircraft with less crashes: Aerofab
Aircraft with less crashes: Moyes Bailey
Aircraft with less crashes: Head
Aircraft with less crashes: Nelson Larry L
Aircraft with less crashes: Merritt Leslie R
Aircraft with less crashes: Leroux John F
Aircraft with less crashes: Airbus Helicopters (Eurocopte
Aircraft with less crashes: Doubleday Donald
Aircraft with less crashes: David Jarrett
Aircraft with less crashes: Combs Earl W
Aircraft with less crashes: Aerostar S A
Aircraft with less crashes: Burleigh
Aircraft with less crashes: Colyaer Sl
Aircraft with less crashes: Sanderson
Aircraft with less crashes: Whitehead
Aircraft with less crashes: Thomas David W
Aircraft with less crashes: Ttx Air Llc
Aircraft with less crashes: Mcglashan
Aircraft with less crashes: Fdr601 Llc
Aircraft with less crashes: World Aircraft Co
Aircraft with less crashes: Willoughby Pete A
Aircraft with less crashes: Lawson Ronald S
Aircraft with less crashes: Aero Adventure
Aircraft with less crashes: Extra Flugzeugbau
Aircraft with less crashes: Myers
Aircraft with less crashes: Sauer
Aircraft with less crashes: Holmgreen John B
Aircraft with less crashes: Dantonio
Aircraft with less crashes: Gates Learjet Corporation
Aircraft with less crashes: S M & T Aircraft
Aircraft with less crashes: Airborne Windsport
Aircraft with less crashes: Glaser-Dirks
Aircraft with less crashes: Paul B. Johnson
Aircraft with less crashes: Lanshe Aerospace
Aircraft with less crashes: Richards Heavylift Helo Inc
Aircraft with less crashes: Kaufmann
Aircraft with less crashes: Univair
Aircraft with less crashes: Douglas D. Turner
Aircraft with less crashes: Morehead
Aircraft with less crashes: Bonde
Aircraft with less crashes: Kumhyr David B
Aircraft with less crashes: Avro
Aircraft with less crashes: Snobird
Aircraft with less crashes: Elkind Bruce
Aircraft with less crashes: Boeing-Vertol
Aircraft with less crashes: Reims Aviation S.A.
Aircraft with less crashes: Cismowski
Aircraft with less crashes: Bell/Garlick
Aircraft with less crashes: Morrison Joseph
Aircraft with less crashes: Fechtner
Aircraft with less crashes: Kerr John A
Aircraft with less crashes: Atkinson
Aircraft with less crashes: Lammers Sjef J

Aircraft with less crashes: Sibley
Aircraft with less crashes: Issoire Siren
Aircraft with less crashes: North American-Medore
Aircraft with less crashes: Focke-Wulf
Aircraft with less crashes: Ouzts Rodney
Aircraft with less crashes: Stolp Starduster
Aircraft with less crashes: Chris Mitchell
Aircraft with less crashes: Owens
Aircraft with less crashes: Vashon Aircraft
Aircraft with less crashes: Barney
Aircraft with less crashes: Erickson Air Crane
Aircraft with less crashes: Mckenna James E
Aircraft with less crashes: Sonex / John D. Mccarter
Aircraft with less crashes: Wight Albert A
Aircraft with less crashes: Drone Paul E
Aircraft with less crashes: Carrithers Carl L
Aircraft with less crashes: M-Squared Aircraft
Aircraft with less crashes: Smithwick/Treidel
Aircraft with less crashes: Pipistrel D O O
Aircraft with less crashes: Sky International, Inc.
Aircraft with less crashes: Just Aircraft
Aircraft with less crashes: Culver Glenn
Aircraft with less crashes: Crisman
Aircraft with less crashes: Porbeck John M
Aircraft with less crashes: Pittman Eddie G
Aircraft with less crashes: Prendergast John/Vans
Aircraft with less crashes: Claus Rodney L
Aircraft with less crashes: Consolidated Vultee
Aircraft with less crashes: Brown Michael
Aircraft with less crashes: Kelley Derrick/Leza
Aircraft with less crashes: Forster
Aircraft with less crashes: Lewis Brandon Scott
Aircraft with less crashes: Luttenbacher Kurt
Aircraft with less crashes: Elemdorf
Aircraft with less crashes: Sport Flight
Aircraft with less crashes: Timothy J Cowper
Aircraft with less crashes: Omlin Robert G
Aircraft with less crashes: Cote James
Aircraft with less crashes: Walters
Aircraft with less crashes: Aveko Sro
Aircraft with less crashes: Southern Powered Parachute
Aircraft with less crashes: James B. Taplin
Aircraft with less crashes: Softex Invest Llc
Aircraft with less crashes: Southern Powered Parachutes
Aircraft with less crashes: Kolb
Aircraft with less crashes: Rose-Rhinehart
Aircraft with less crashes: Yost Edwin S
Aircraft with less crashes: Willerton
Aircraft with less crashes: Stribling James L
Aircraft with less crashes: Yamokoski William
Aircraft with less crashes: Cosmos
Aircraft with less crashes: North American Rockwell
Aircraft with less crashes: Auman J1
Aircraft with less crashes: Airborne Windsports
Aircraft with less crashes: Lavigna
Aircraft with less crashes: S.N.I.A.S.
Aircraft with less crashes: Indus Aviation Inc.
Aircraft with less crashes: Titan Aerospace Holdings Inc
Aircraft with less crashes: Billy Amerson
Aircraft with less crashes: Stephenson
Aircraft with less crashes: Quad City Ultralights
Aircraft with less crashes: British Aircraft Corp.
Aircraft with less crashes: Maxair Drifter
Aircraft with less crashes: Air Creation Usa Llc
Aircraft with less crashes: Eipper Formance Inc
Aircraft with less crashes: Bowen Christopher W
Aircraft with less crashes: Sportflight International Llc
Aircraft with less crashes: Dragon Fly Aviation
Aircraft with less crashes: Robinson Helicopter Co Inc

Aircraft with less crashes: Piper Cub Crafters
Aircraft with less crashes: Kitty Hawk
Aircraft with less crashes: Johnson Glenn L
Aircraft with less crashes: Wilson William M
Aircraft with less crashes: Needham
Aircraft with less crashes: Ristine
Aircraft with less crashes: Freeman Heritage Collection
Aircraft with less crashes: Carlton M. Cadwell
Aircraft with less crashes: Aviamilano
Aircraft with less crashes: Sorenson
Aircraft with less crashes: Malkin Roy K
Aircraft with less crashes: Mdhi
Aircraft with less crashes: North Wing Uum Inc.
Aircraft with less crashes: Chad Lewis
Aircraft with less crashes: Agusta/Westland
Aircraft with less crashes: Davis Mark
Aircraft with less crashes: Paul R Seipt
Aircraft with less crashes: Curnutt Elton E
Aircraft with less crashes: Fly Hard Trike Inc
Aircraft with less crashes: Pdps Pzl-Bielsko
Aircraft with less crashes: Flightstar Inc
Aircraft with less crashes: Northrop
Aircraft with less crashes: Stucker Virgil A
Aircraft with less crashes: Smith Richard D Jr
Aircraft with less crashes: Purtee Kevin M
Aircraft with less crashes: Brupbacher Chris
Aircraft with less crashes: American Eurocopter
Aircraft with less crashes: Boughner
Aircraft with less crashes: Diehl William A
Aircraft with less crashes: Goodacre
Aircraft with less crashes: Stewart Mw/Stewart Jd
Aircraft with less crashes: Render
Aircraft with less crashes: Brice Ron
Aircraft with less crashes: Knox Marion L
Aircraft with less crashes: Eichhorn Gary L
Aircraft with less crashes: Kuykendall Charles
Aircraft with less crashes: Gefa-Flug Gmbh
Aircraft with less crashes: Bauer Thomas G
Aircraft with less crashes: Agustawestland Spa
Aircraft with less crashes: Vans Aircraft
Aircraft with less crashes: British Aerospace Civil Aircr
Aircraft with less crashes: Prizio
Aircraft with less crashes: Otterback Nicholas J
Aircraft with less crashes: Kelm David
Aircraft with less crashes: Koth Larry
Aircraft with less crashes: Laurienzo Gabriel A
Aircraft with less crashes: Avions Fairey
Aircraft with less crashes: Fairchild Heli-Porter
Aircraft with less crashes: Dressen Donald L
Aircraft with less crashes: Chech Aircraft Works Spol Sro
Aircraft with less crashes: Celier Aviation
Aircraft with less crashes: Brm Aero Sro
Aircraft with less crashes: Brown Mitch
Aircraft with less crashes: Hansen Ib C
Aircraft with less crashes: Morrison
Aircraft with less crashes: Harden
Aircraft with less crashes: Piaggio Aero Industries Spa
Aircraft with less crashes: Eslinger C W/Eslinger S M
Aircraft with less crashes: Aerostar Acft Corp Of Texas
Aircraft with less crashes: Aerospatale Alenia
Aircraft with less crashes: From Here To There Pdq Inc
Aircraft with less crashes: Nalis
Aircraft with less crashes: Laird
Aircraft with less crashes: Grimes Barry R
Aircraft with less crashes: T Bird
Aircraft with less crashes: As+ Ltd
Aircraft with less crashes: Clutton Eric
Aircraft with less crashes: Simmons
Aircraft with less crashes: Walker Louie H

Aircraft with less crashes: Gulfstream Aerospace Lp
Aircraft with less crashes: Klemp Gregory J
Aircraft with less crashes: Gaynor Donald J
Aircraft with less crashes: Hallendorf Tom
Aircraft with less crashes: Iversen
Aircraft with less crashes: Hall Thomas K
Aircraft with less crashes: Fritz Neumeyer
Aircraft with less crashes: Rogers
Aircraft with less crashes: S.O.C.A.T.A.
Aircraft with less crashes: Bowers Fly Baby
Aircraft with less crashes: Richmond Jim R
Aircraft with less crashes: Murray
Aircraft with less crashes: Andrew Mckimmon
Aircraft with less crashes: Black Christopher
Aircraft with less crashes: Air Gulfstream Airlines Inc
Aircraft with less crashes: Culver
Aircraft with less crashes: Evans James Jay
Aircraft with less crashes: Fisher Flying Products
Aircraft with less crashes: Stoddard Hamilton
Aircraft with less crashes: Bartle
Aircraft with less crashes: Monocoupe
Aircraft with less crashes: Dalin Ronald K
Aircraft with less crashes: Swalley Mark H
Aircraft with less crashes: Frederickson Charles A
Aircraft with less crashes: Weiss
Aircraft with less crashes: Couvillion
Aircraft with less crashes: D & D Aircraft
Aircraft with less crashes: Skykits Corporation
Aircraft with less crashes: Sanderson Herbert H
Aircraft with less crashes: Ferree
Aircraft with less crashes: Bryan Jerry R
Aircraft with less crashes: Inman J D
Aircraft with less crashes: Dunn David
Aircraft with less crashes: Bell-Tellijohn
Aircraft with less crashes: Whittman
Aircraft with less crashes: Lennox Kenneth J
Aircraft with less crashes: Kaylor J E/Strahlmann R L
Aircraft with less crashes: Dayton-Wright
Aircraft with less crashes: Vertical Unlimited Llc
Aircraft with less crashes: Johnny F Anderson
Aircraft with less crashes: Kundel
Aircraft with less crashes: Boeing Commercial Airplane Gro
Aircraft with less crashes: Sabrena
Aircraft with less crashes: Christopher John P
Aircraft with less crashes: Zivko Aeronautics Inc
Aircraft with less crashes: Eagle Aircraft Co.
Aircraft with less crashes: Mays
Aircraft with less crashes: Cobalt Aircraft Industries Inc
Aircraft with less crashes: Alliant Aviation
Aircraft with less crashes: Dassault Falcon
Aircraft with less crashes: Aircraft Mfg & Design Llc
Aircraft with less crashes: Hudson
Aircraft with less crashes: Concannon Milton
Aircraft with less crashes: Jantzen
Aircraft with less crashes: Shiver
Aircraft with less crashes: Grob Aircraft Ag
Aircraft with less crashes: Head Balloons Inc.
Aircraft with less crashes: Rolladen-Schneider Ohg
Aircraft with less crashes: Indus Aviation Inc
Aircraft with less crashes: Rainbow Aircraft Pty Ltd
Aircraft with less crashes: Bolstridge Wallace R
Aircraft with less crashes: Keuthan
Aircraft with less crashes: Diamond Aircraft Industry Inc
Aircraft with less crashes: Phantom Aircraft Co
Aircraft with less crashes: Bedecorp Llc
Aircraft with less crashes: Buschmann Robert E
Aircraft with less crashes: Worthington
Aircraft with less crashes: Jimenez
Aircraft with less crashes: Muffett

Aircraft with less crashes: Rouse
 Aircraft with less crashes: Mchargue
 Aircraft with less crashes: Central Ohio Dragonfly Club
 Aircraft with less crashes: Abbett Gerry
 Aircraft with less crashes: Kevin Lippert
 Aircraft with less crashes: Aliev Bulent
 Aircraft with less crashes: Saab-Scania
 Aircraft with less crashes: Miller J Kirtley
 Aircraft with less crashes: Daniels Alan L
 Aircraft with less crashes: Wejebe Jose
 Aircraft with less crashes: Hiller-Rogerson Helicopter
 Aircraft with less crashes: Hemmer
 Aircraft with less crashes: Croman
 Aircraft with less crashes: Peterson-Feder-Splinter
 Aircraft with less crashes: Sud Aviation
 Aircraft with less crashes: Steven Hardie
 Aircraft with less crashes: Clifton
 Aircraft with less crashes: Lake John K
 Aircraft with less crashes: Nicholson David F

In [30]: *# Confirming that we have made a list of safe planes - with the least crashes*
 print(safe_planes)

['Dahlman-Dower', 'Holmes Gary Don', 'Denny Aerocraft', 'Co-Z Development Corp', 'Fir
 efly Balloons Inc', 'Md Helicopters, Inc.', 'Wsk-Pzl Warszawa-Okecie', 'Treidel Mark/R
 F D', 'Nbb Inc', 'Holmes William E', 'Sackman', 'Sport Flight International', 'Graff
 Wilbur C', 'Hunziker', 'Fields Mike', 'I.C.A.-Brasov (Romania)', 'Sherman Craig W',
 'Smith Edward I', 'Amirkhanian Shahram Charl', 'Schempp-Hirth K G', 'Crosley', 'Korri
 son Tom', 'Boeing Of Canada/Dehav Div', 'Monnett John T Jr', 'Schooley', 'Schmidt Alb
 ert D', 'Mileski', 'Radley Vincent', 'Dji', 'Phelps', 'Olson', 'Phillips William L',
 'Gulfstream Aerospace Corp', 'Quicksilver Mfg', 'Schneider', 'Fox Jack G', 'Cessna/Ai
 r Repair Inc', 'Shoemaker James B', 'Cruz', 'Advertising Mgmt & Consulting', 'S D Mar
 tin', 'Kolb Aircraft Co', 'Radford', 'Welch Floyd L', 'Mason Robert', 'Anderas', 'Sch
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Taplin', 'Softex Invest Ll c', 'Southern Powered Parachutes', 'Kolb', 'Rose-Rhinehart', 'Yost Edwin S', 'Willert on', 'Stribling James L', 'Yamokoski William', 'Cosmos', 'North American Rockwell', 'Auman JI', 'Airborne Windsports', 'Lavigna', 'S.N.I.A.S.', 'Indus Aviation Inc.', 'T itan Aerospace Holdings Inc', 'Billy Amerson', 'Stephenson', 'Quad City Ultralights', 'British Aircraft Corp.', 'Maxair Drifter', 'Air Creation Usa Llc', 'Eipper Formance Inc', 'Bowen Christopher W', 'Sportflight International Llc', 'Dragon Fly Aviation', 'Robinson Helicopter Co Inc', 'Piper Cub Crafters', 'Kitty Hawk', 'Johnson Glenn L', 'Wilson William M', 'Needham', 'Ristine', 'Freeman Heritage Collection', 'Carlton M. Cadwell', 'Aviamilano', 'Sorenson', 'Malkin Roy K', 'Mdhi', 'North Wing Uum Inc.', 'C had Lewis', 'Agusta/Westland', 'Davis Mark', 'Paul R Seipt', 'Curnutt Elton E', 'Fly Hard Trike Inc', 'Pdps Pzl-Bielsko', 'Flightstar Inc', 'Northrop', 'Stucker Virgil A', 'Smith Richard D Jr', 'Purtee Kevin M', 'Brupbacher Chris', 'American Eurocopte

r', 'Boughner', 'Diehl William A', 'Goodacre', 'Stewart Mw/Stewart Jd', 'Render', 'Brice Ron', 'Knox Marion L', 'Eichhorn Gary L', 'Kuykendall Charles', 'Gefa-Flug Gmbh', 'Bauer Thomas G', 'Agustawestland Spa', 'Vans Aircraft', 'British Aerospace Civil Aircraft', 'Prizio', 'Otterback Nicholas J', 'Kelm David', 'Koth Larry', 'Laurienzo Gabriel A', 'Avions Fairey', 'Fairchild Heli-Porter', 'Dressen Donald L', 'Chech Aircraft Works Spol Sro', 'Celier Aviation', 'Brm Aero Sro', 'Brown Mitch', 'Hansen Ib C', 'Morrison', 'Harden', 'Piaggio Aero Industries Spa', 'Eslinger C W/Eslinger S M', 'Aerostar Acft Corp Of Texas', 'Aerospatiale Alenia', 'From Here To There Pdq Inc', 'Nalis', 'Laird', 'Grimes Barry R', 'T Bird', 'As+ Ltd', 'Clutton Eric', 'Simmons', 'Walker Louise H', 'Gulfstream Aerospace Lp', 'Klemp Gregory J', 'Gaynor Donald J', 'Hallendorf Tom', 'Iversen', 'Hall Thomas K', 'Fritz Neumeyer', 'Rogers', 'S.O.C.A.T.A.', 'Bowers Fly Baby', 'Richmond Jim R', 'Murray', 'Andrew Mckimmon', 'Black Christopher', 'Air Gulfstream Airlines Inc', 'Culver', 'Evans James Jay', 'Fisher Flying Products', 'Stoddard Hamilton', 'Bartle', 'Monocoupe', 'Dalin Ronald K', 'Swalley Mark H', 'Fredericks on Charles A', 'Weiss', 'Couvillion', 'D & D Aircraft', 'Skykits Corporation', 'Sanderson Herbert H', 'Ferree', 'Bryan Jerry R', 'Inman J D', 'Dunn David', 'Bell-Tellijohn', 'Whittman', 'Lennox Kenneth J', 'Kaylor J E/Strahlmann R L', 'Dayton-Wright', 'Vertical Unlimited Llc', 'Johnny F Anderson', 'Kundel', 'Boeing Commercial Airplane Group', 'Sabrena', 'Christopher John P', 'Zivko Aeronautics Inc', 'Eagle Aircraft Co.', 'Mays', 'Cobalt Aircraft Industries Inc', 'Alliant Aviation', 'Dassault Falcon', 'Aircraft Mfg & Design Llc', 'Hudson', 'Concannon Milton', 'Jantzen', 'Shiver', 'Grob Aircraft Ag', 'Head Balloons Inc.', 'Rolladen-Schneider Ohg', 'Indus Aviation Inc', 'Rainbow Aircraft Pty Ltd', 'Bolstridge Wallace R', 'Keuthan', 'Diamond Aircraft Industry Inc', 'Phantom Aircraft Co', 'Bedecorp Llc', 'Buschmann Robert E', 'Worthington', 'Jimenez', 'Muffett', 'Rouse', 'Mchargue', 'Central Ohio Dragonfly Club', 'Abbett Gerry', 'Kevin Lippert', 'Aliev Bulent', 'Saab-Scania', 'Miller J Kirtley', 'Daniels Alan L', 'Wejebe Jose', 'Hiller-Rogerson Helicopter', 'Hemmer', 'Croman', 'Peterson-Feder-Splinter', 'Sud Aviation', 'Steven Hardie', 'Clifton', 'Lake John K', 'Nicholson David F']

From the summary data on the categorical variables:

1. Most crashes were non-fatal (2700) while the 2nd most crashes were fatal (500).
2. Most injury severity to the aircraft was substantial (2449), destroyed (517) or minor (514).
3. Most aircrafts were airplanes (2987), followed by helicopter (475) and balloon (11).
4. Most aircraft make involved in accidents were: Boeing (834), Cessna (538), Piper (249) then Airbus (207). Many other aircrafts as shown in the output above had less than 2 crashes. This means that they had the least number of crashes that could be interpreted as a safe aircraft.
5. The most common aircraft model was the 737 (218), A£320 (61), 208B (58), 747 (51), 777 (46)
6. The most common engine type was reciprocating (1961), tubro fan (686), turbo prop (318), turbo shaft (298).
7. The purpose for majority of the flights was unknown (2864) but of the known, they were for personal (211), aerial application (193) and business (61)
8. American airlines operated the largest fleet (1008), followed by South West Airlines (41), Delta Airlines (37) and United Airlines (37)

Objective 2.1: Relation between different aircraft make and purpose of flight

```
In [31]: # we will first save the common purposes as variable name 'common purposes' to include
# Define the selected purposes
# Define the selected purposes
selected_purposes = [
    'Personal',
    'Business',
```

```

    'Other Work Use',
    'Executive/corporate',
    'Public Aircraft - Local',
    'Public Aircraft - State'
]

# Filter dataset for only these purposes
filtered_data = aviation_data[aviation_data['Purpose.of.flight'].isin(selected_purpo

# Group by purpose and show all unique aircraft makes per purpose
aircraft_examples_by_purpose = (
    filtered_data.groupby('Purpose.of.flight')['Make']
    .unique()
    .apply(list) # convert array to list for display
)

# Ensure full column content is visible
pd.set_option('display.max_colwidth', None)

# Display the results
aircraft_examples_by_purpose

```

```

Out[31]: Purpose.of.flight
Business      [Cessna, Beech, Robinson, Beechcraft, Piper, Robinson Heli
copter Company, Eclipse Aviation Corporation, Mkii Corporation, Piper Cub Crafters, T
aylorcraft Aviation, Raytheon Company, Dehavilland, Bell, Hughes, Socata, Agusta, Hub
bell, Robinson Helicopter, Dassault Falcon, Smith, Cirrus Design Corp, Mitsubishi, Pr
idmore, Hawker Beechcraft, Hawker, Siai-Marchetti, Grumman, Lancair, Bombardier Inc,
Hiller, Dassault-Breguet, Stinson, Siai Marchetti, Ludwig Larry E, Cirrus Design Cor
p., Sikorsky, Rice Leo B, Aero Vodochody, Bellanca, Embraer, Schoepflin, Aerospatial
e, Grumman Aircraft Eng Corp, Raytheon Aircraft Company, Cirrus Design Corporation, N
ew Piper Aircraft Inc, Hawker Beechcraft Corporation, Eurocopter, Piaggio, Air Tracto
r Inc, Ultramagic Sa, Ultramagic, Aero Commander, Yuneec, Mcdonnell Douglas Helicopte
r, Raytheon, Cameron Balloons Us, Klaas Development Inc, Burton, Flight Design Gmbh,
G-Dawg Llc, Raytheon Corporate Jets Inc, Balony Kubicek Spol, Israel Aircraft Industr
ies, Mooney Airplane Co Inc, Pilatus, Aerostar International, Bell Helicopter Textron
Canada, Bristell, Kubicek, Air Tractor, Learjet, Curtiss Wright, Icon Aircraft Inc, C
olumbia Aircraft Mfg, Thrush, Bereznak, Learjet Inc, Gulfstream Aerospace, Agusta Bel
l, Bell Helicopter, North American, Let, Douglas, Cameron, Lindstrand, Canadair, Ico
n, Textron Aviation Inc, De Havilland, Rockwell, Boeing, Airbus, Enstrom, Britten-Nor
man, Leonardo Spa, Cameron Balloons U S, Embraer Executive Aircraft Inc, Mooney, Airb
us Helicopters, ...]
Executive/corporate
[Raytheon Aircraft Company, Bombardier, Inc., Cessna, Carlton M. Cadwell, Beech, Robi
nson, Sikorsky, Beechcraft, Gates Learjet Corporation, Pilatus Aircraft Ltd, Piper, G
ulfstream, Fairchild, Gulfstream Aerospace, Cirrus Design Corp, Bell, Mitsubishi, Lea
rjet Inc, Eurocopter, Pilatus, Robinson Helicopter Company, Bell Helicopter Textron,
Bombardier Canadair, Dassault-Breguet, Gates Learjet Corp., Bae, Swearingen, Israel A
ircraft Industries, Agusta, Honda Aircraft, Embraer, Raytheon, Textron Aviation Inc,
Israel Aerospace Industriesltd, Bombardier Inc]
Other Work Use
[Beech, Piper, Bell, Curtiss-Wright, Ultramagic, Sikorsky, Socata, Cessna, Robinson,
Dehavilland, Firefly Balloons, Hughes, Schweizer, North American, Robinson Helicopte
r, Eurocopter, National Ballooning, Cirrus Design Corp, Aerostar International Inc, W
aco, Ayres Corporation, White, Curtiss Wright, Helio, Messerschmitt-Boelkow-Blohm, Sh
ort Bros. & Harland, Cameron Balloons Us, Let, Head Balloons Inc, Mcdonnell Douglas H
elicopters, Enstrom, Lindstrand, Aerospatiale, Stinson, Dg Flugzeugbau Gmbh, Mcdonnel
l Douglas, Williams Helicopter Corp, Rockwell International, Avian Balloon, Agusta, H
iller, Cameron Balloons, Robinson Helicopter Company, Arbc Inc Dbalindstrand, Lindst
rand Balloons, Air Tractor Inc, Kubicek, Bell Helicopter Textron Canada, American Avi
ation, Agustawestland Spa, Aero Commander, Israel Aircraft Industries, Colt Balloons,
Itec Inc, Head Balloons Inc., Aerostar International, Short Bros, Md Helicopter Inc,
Smith, Airbus, Agustawestland Philadelphia, Champion, De Havilland, Douglas, Siai-Mar
chetti, Air Tractor, Robinson Helicopter Co, Gefa-Flug Gmbh, Eurocopter France, Ameri
can Eurocopter Corp, Md Helicopter, L-Bird Llc, Classic Aircraft Corp, Cub Crafters I
nc, Aviat, S M & T Aircraft, Boeing, Garlick, American Champion Aircraft, Pipistrel,
Raytheon, Airbus Helicopters, Ultramagic S A, Eurocopter Deutschland Gmbh, Hughes Hel
icopters Inc, Gates Lear Jet Corp.]

```


Personal

[McDonnell Douglas, Boeing, Hughes, Piper, Cessna, British Aerospace, Eurocopter, De Havilland, Fairchild, Beech, Raytheon Corporate Jets, Bombardier, Aerospaciale, Bell, Airbus Industrie, Embraer, Hawker Siddeley, Saab-Scania Ab (Saab), Aero Commander, Learjet, Airbus, Bombardier, Inc., Mitsubishi, Canadair, Britten-Norman, Mbb, Learjet Inc, Bell Helicopter Textron, Eurocopter France, Barnard/Stancil, Dean Patrick G, Grumman American, Beechcraft, Waltermire, Luscombe, Robinson, Robinson Helicopter, Raytheon Aircraft Company, Kidd Chris, Kaylor J E/Strahlmann R L, Wooters, Burkhart Grob, Maule, Lancair, Steven Hardie, Clutton Eric, Wilson, Aviat, Raytheon, Waco, Bartle, Ulrich Christen, Great Lakes, North American, Morrison, Stinson, Cirrus Design Corp, Mooney, Ercoupe (Eng & Research Corp.), Rans, Inc., Douglas D. Turner, Hatle, Neiva, Sai-Marchetti, American Aviation Corp. (Aac), Czech Aircraft Works Spol Sro, Cirrus Design Corp., Grumman, Snobird, Questair, Inc., Dayon, Emory B. Wood, Champion, Bombardier Inc, Aeronca, Tromsness Enterprises Inc, Agusta/Westland, Rockwell, Cameron Balloons, Vans Aircraft, Extra Flugzeugbau, Higher Class Aviation, Shaffstall, Desalvatore Al, American Champion (Acac), Thorp, Schleicher, Diamond Aircraft Industries, Fairchild Hiller, Babcock, Scottish Aviation, Columbia Aircraft Mfg., Pilatus, Downer, Aviat e, Kitfox Iv, Rotorway, Nolan, Poulin L/Cullen D, Harms Robert M, ...]

Public Aircraft - Local

[Robinson, Md Helicopter Inc, Eurocopter, Beech, McDonnell Douglas Helicopter, Cessna, Bell, Piper, McDonnell Douglas Heli Co, Md Helicopter, Hughes, Bell Helicopter Textron Canada, Autogyro, Airbus Helicopters, Eurocopter Deutschland Gmbh, Flight Design Gmbh, Aviat Aircraft Inc, Leonardo]

Public Aircraft - State

[Aerospaciale, Cessna, Bell, Robinson Helicopter, Agusta Spa, Hughes, Eurocopter, Piper, Beech, Partenavia, Cub Crafters Inc, Bellanca, Md Helicopter, Rockwell]

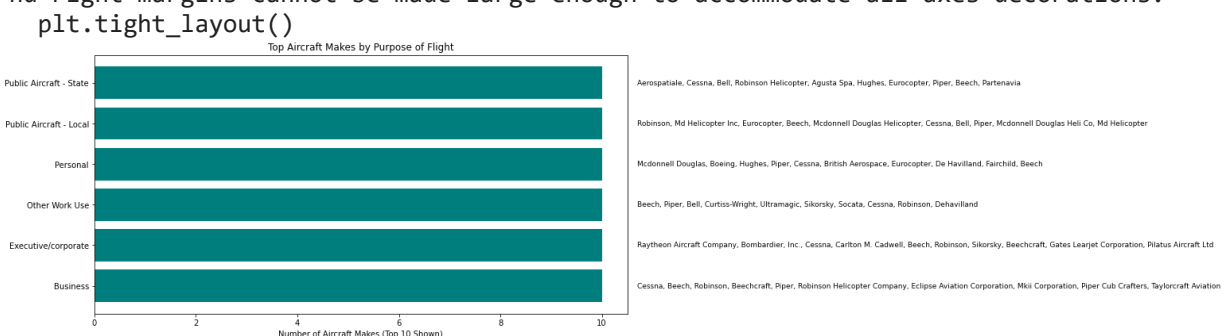
Name: Make, dtype: object

```
In [48]: # Illustrate our findings in a horizontal bar graph (but since the figure is huge, w

plt.figure(figsize=(12,6))
for i, purpose in enumerate(aircraft_examples_by_purpose.index):
    top_aircrafts = aircraft_examples_by_purpose[purpose][:10] # only first 10
    plt.barh(i, len(top_aircrafts), color='teal')
    plt.text(len(top_aircrafts)+0.7, i, ', '.join(top_aircrafts), va='center', fonts

plt.yticks(range(len(aircraft_examples_by_purpose)), aircraft_examples_by_purpose.in
plt.xlabel("Number of Aircraft Makes (Top 10 Shown)")
plt.title("Top Aircraft Makes by Purpose of Flight")
plt.tight_layout()
plt.show()
```

<ipython-input-48-7cb7a2c05d98>:12: UserWarning: Tight layout not applied. The left and right margins cannot be made large enough to accommodate all axes decorations.



Objective 2.2: Relation between aircraft make and Operational cost effectiveness: Engine type

```
In [33]: # Create variable name for all aircraft makes
type_aircrafts = aviation_data['Make'].value_counts().index

# Select top 8 engine types
common_engines = aviation_data['Engine.Type'].value_counts().head(8).index

# Filter data for all aircrafts and common engine types
```



```

filtered_data = aviation_data[
    (aviation_data['Make'].isin(type_aircrafts)) &
    (aviation_data['Engine.Type'].isin(common_engines))
]

# Group by engine type and show all unique aircraft makes per engine type
engine_examples_all = (
    filtered_data.groupby('Engine.Type')['Make']
    .unique()
    .apply(list) # convert array to list for display
)

# Ensure full column content is visible
pd.set_option('display.max_colwidth', None)

# Display the results
engine_examples_all

```

Out[33]: Engine.Type
 Geared Turbofan
 [Airbus]
 None
 [Dg Flugzeugbau Gmbh, Centrair, Colt Balloons, Head Balloons Inc., Balloon Works, Kubicek, Schempp-Hirth, Ultramagic Sa, Schweizer, Ultramagic, I.C.A.-Brasov (Romania)]
 Reciprocating
 [Piper, Boeing, Cessna, De Havilland, Beech, Aero Commander, Britten-Norman, Embraer, Barnard/Stancil, Dean Patrick G, Bell, Robinson, Airbus Industrie, Eurocopter France, Hawker Beechcraft Corp., Grumman American, Beechcraft, Waltermire, Luscombe, Schweizer, Robinson Helicopter, Cirrus Design Corp, Kidd Chris, Kaylor J E/Strahlmann R L, Wothers, Burkhart Grob, Maule, Lancair, Steven Hardie, Clutton Eric, Wilson, Aviat, Raytheon, Piper Aircraft Inc, Waco, Bartle, Ulrich Christen, Great Lakes, North American, Raytheon Aircraft Company, Morrison, American Champion (Acac), Aircraft Mfg & Dev. Co., Stinson, Air Tractor, Mooney, Ercoupe (Eng & Research Corp.), Diamond Aircraft Industries, Hughes, Rans, Inc., Grumman, Douglas D. Turner, Hatle, Neiva, Hiller, Siai-Marchetti, American Aviation Corp. (Aac), Czech Aircraft Works Spol Sro, Cirrus Design Corp., Hawker Beechcraft Corp, Curtiss-Wright, Fantasy Air, Snobird, Questair, Inc., Dayon, Ultramagic, McDonnell Douglas, Emory B. Wood, Aerofab, Let, Dragon Fly Aviation, Carlton M. Cadwell, Champion, Aeronca, Bellanca, Evекtor Aerotechnik, Agusta/Westland, Cameron Balloons, Vans Aircraft, Extra Flugzeugbau, Higher Class Aviation, Grumman-Schweizer, Shaffstall, Desalvatore Al, Extra Flugzeugproduktions-Gmbh, Thorp, Robinson Helicopter Company, Schleicher, Thrush Aircraft, Inc., Hawker Beechcraft Corporation, Babcock, Scottish Aviation, Columbia Aircraft Mfg., Downer, Aviate, Kitfox Iv, Rotorway, Nolan, Ayres, Poulin L/Cullen D, ...]
 Turbo Fan
 [McDonnell Douglas, Boeing, British Aerospace, Fairchild, Raytheon Corporate Jets, Bombardier, Airbus Industrie, Hawker Siddeley, Learjet, Airbus, Bombardier, Inc., Canadair, Cessna, Learjet Inc, Beechcraft, Embraer, Bombardier Inc, Eclipse Aviation Corporation, Douglas, Dassault/Sud, Gates Learjet Corp., Gates Learjet Corporation, McDonnell-Douglas, Embraer-Empresa Brasileira De, Raytheon Aircraft Company, Grumman American Avn. Corp., McDonnell Douglas Aircraft Co, Gulfstream, Hawker Beechcraft, Gulfstream Aerospace, Israel Aircraft Industries, Gulfstream Aerospace Corp., Eclipse Aviation Corp, Dassault-Breguet, Aero Vodochody, Gates Lear Jet, Antonov, Bombardier Learjet Corp., Sukhoi, Canadair Ltd, Embraer S.A., Beech, Boeing Company, Hawker Beechcraft Corporation, Bae, Iai, Rockwell, Cessna Aircraft Company, Embraer S A, Boeing Company, Long Beach Div, Bae Systems (Operations) Limit, Bae Systems, Siai Marchetti, Bombardier Canadair, The Boeing Company, Raytheon Corporate Jets Inc, British Aerospace Civil Aircr, Hawker, Mitsubishi, McDonnell Douglas Corporation, Boeing Commercial Airplane Gro, Avro, Dornier Gmbh, Dassault, Rockwell International, Textron Aviation Inc, Raytheon]
 Turbo Jet
 [Boeing, McDonnell Douglas, Embraer, Airbus Industrie, Learjet, Cessna, Aero Vodochody Aero. Works, Lockheed, Dassault-Breguet, De Havilland, Aero Vodochody, Fouga, Gulfstream American Corp., Douglas, Bombardier, Gates Lear Jet, British Aircraft Corp, Aerovodochody, Israel Aircraft Industries, Hawker Aircraft Ltd, Beech, Mikoyan Gurevich, Folland Aircraft Co Ltd, Mosier Robert S, Bae Systems, Eclipse Aviation Corp, Swearingen, British Aircraft Corp., Hawker Siddeley, McDonnell Douglas Aircraft Co, Bombardier Inc, Learjet Inc, Halladay Roy, Cirrus, Honda Aircraft, Embraer Executive Aircraft Inc]

Turbo Prop [Piper, Cessna, De Havilland, Beech, British Aerospace, Saab-Scania Ab (Saab), Mitsubishi, Raytheon Aircraft Company, Embraer, Air Tractor, Tromsness Enterprises Inc, Rockwell, Fairchild, Pilatus, Ayres, Aero Commander, Socata, Dehavilland, Snow, Ayres Corporation, Schweizer Aircraft Corp, Rockwell International, Lancair, Gulfstream-Schweizer A/C Corp, Construcciones Aeronauticas Sa, General Atomics, Air Tractor Inc, Gulfstream Aerospace Corp, Aerospatiale Alenia, Douglas, New Piper Aircraft Inc, Bombardier Inc, Siai-Marchetti, Wsk Pzl Mielec, Air Tractor Inc., Pilatus Aircraft Ltd, Saab, Boeing Of Canada/Dehav Div, Thrush Aircraft Inc, Grumman Acft Eng Cor-Schweizer, Casa, Short Bros. & Harland, Hawker Beechcraft Corporation, Eads Socata, Atr, Hawker Beechcraft Corp., Piaggio, Saab-Scania, Grumman, Jetprop Dlx Piper, Swearingen, Texas Air Ventures Inc, Schweizer, Pzl Mielec, Quest, Dornier, Grumman Schweizer, Air Tractor, Inc., M7Aero, Aviocar Casa, Piaggio Aero Industries Spa, Piper Aircraft Inc, Boeing, Hawker Beechcraft, Wejebe Jose, League, Convair, Maule, Short Bros, North American Rockwell, Sciar Sa Brasov, Savage Air Llc, Schweizer, N36289, Quest Aircraft Company Llc, Thrush Aircraft, Inc., Fairchild Heli-Porter, Mckenzie, Ttx Air Llc, Bombardier, Embraer Aircraft, Pacific Aerospace Corp Ltd, Hermann Bjorn, Gulfstream Schweizer A/C Corp, Marsh Aviation, Evo13 Llc, Short Brothers & Harland Ltd., Thrush, Garratt Mansfield W, Lockheed, Bae, Aero Smart Solutions Inc, Grob Aircraft Ag, Cessna Aircraft Company, Ag-Cat Corporation, Gippsaero Pty Ltd, Textron Aviation, Beechcraft, Pilatus Aircraft, Thrush Aircraft Llc, Textron Aviation Inc]

Turbo Shaft

[Hughes, Eurocopter, Aerospatiale, Bell, Mbb, Bell Helicopter Textron, Eurocopter France, McDonnell Douglas, Sikorsky, Eurocopter Deutschland Gmbh, Fairchild Hiller, Eurocopter Deutschland, Arrow Falcon Exporters, Inc., Enstrom Helicopter Corp, Agusta, Bushmann Robert E, Md Helicopters Inc, Boeing, Hiller, McDonnell Douglas Helicopter, Md Helicopter Inc, Kaman, Md Helicopter, Cotton Galen M, Rotorcraft Development Corp, Agusta Spa, Kawasaki, Croman, Messerschmitt-Boelkow-Blohm, Arrow Falcon Exporters Inc, McDonnell Douglas Heli Co, Boykin Stephen Vance, Bell Helicopter Textron Canada, Kaman Aerospace Corp, Johnson, Garlick Helicopters Inc, Garlick, Hiller-Rogerson Helicopter, McDonnell Douglas Helicopters, Hyde William R, Robinson Helicopter Co, Messerschmitt-Bolkow-Blohm, Williams Helicopter Corp, Pzl-Swidnik, Rotorcraft Developement Corp., Sud Aviation/Eurocopter, Hughes Helicopters Inc, American Eurocopter Llc, Croman Corporation, Agusta Bell, Bell Helicopter, Boeing-Vertol, Goetz, Sud Aviation, Robinson, American Eurocopter Corp, Agustawestland Spa, Airbus, Agusta Aerospace Corp, Airbus/Eurocopter, Airbus Helicopters, Mdh, S.N.I.A.S., Bell/Garlick, Airbus Helicopters (Eurocopter, Airbus Helicopters Inc, Agustawestland Philadelphia, Helicycle/Morrissey Rr, Tamarack Helicopters Inc, Airbus Helicopters Deutschland, Leonardo, Bell Helicopter Co, Schweizer, Air Tractor, Kawasaki Heavy Industries Ltd., S M & T Aircraft, Arrow-Falcon Exporters, Inc., Piper, American Eurocopter, Agustawestland Philadelphia Co, Richards Heavylift Helo Inc, Bombardier, Ayres Corporation]

Unknown

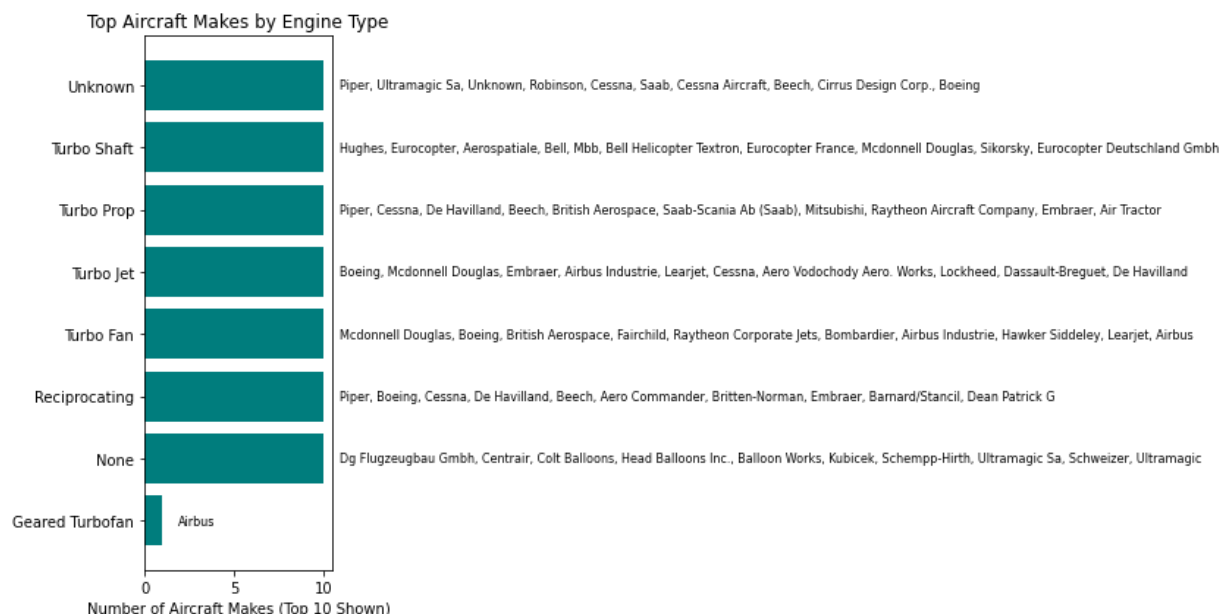
[Piper, Ultramagic Sa, Unknown, Robinson, Cessna, Saab, Cessna Aircraft, Beech, Cirrus Design Corp., Boeing, Buckeye Industries, Cameron]

Name: Make, dtype: object

```
In [49]: # Illustrate our findings in a horizontal bar graph (but since the figure is huge, w

plt.figure(figsize=(12, 6))
for i, engine_type in enumerate(engine_examples_all.index):
    top_aircrafts = engine_examples_all[engine_type][:10] # only first 10
    plt.barh(i, len(top_aircrafts), color='teal')
    plt.text(len(top_aircrafts)+0.9, i, ', '.join(top_aircrafts), va='center', fonts

plt.yticks(range(len(engine_examples_all)), engine_examples_all.index)
plt.xlabel("Number of Aircraft Makes (Top 10 Shown)")
plt.title("Top Aircraft Makes by Engine Type")
plt.tight_layout()
plt.show()
```



Concerning the engines:

Reciprocating engines are simple and very easy to maintain. They are efficient at low speeds and altitudes. They are mostly used for light aircraft and short-range flights. #

Turboprop engines are efficient at medium speeds and are beneficial in regional flights, short to medium haul flights

Turboprop engines are also good for high speeds but have lesser fuel efficiency than turboprop. They however have less mechanical complexity. They are used for long range flights

Objective 2.3: Relation between aircraft make and Safety risk of the aircraft (injury severity, total fatal injuries, total serious injuries).

In this section, we make several assumptions:

1. The aircraft with the least injury severity is the safest.
2. The aircraft with the least total fatal injuries is safest.
3. The aircraft with the least total serious injuries is safest.

2.3.1 Injury_severity

```
In [35]: # For the injury severity, let us look at the frequency of injury severity based on
# Group by Injury.Severity and show all aircraft makes for each severity
injury_examples = (
    aviation_data.groupby('Injury.Severity')['Make']
    .unique() # List all unique aircraft makes per severity
)

# Set max column width to display full content
pd.set_option('display.max_colwidth', None)

# Display
injury_examples
```

```
Out[35]: Injury.Severity
Fatal      [Piper, Cessna, Eurocopter, Boeing, Beech, British Aerospace, Bell, Aero
spatiale, Hawker Beechcraft Corp., Aero Commander, Beechcraft, Robinson, Robinson Hel
```

icopter, Raytheon Aircraft Company, Cirrus Design Corp, Kidd Chris, Kaylor J E/Strahlmann R L, Eurocopter France, Wooters, Lancair, Wilson, Piper Aircraft Inc, Ulrich Christen, Mooney, Neiva, Siai-Marchetti, Czech Aircraft Works Spol Sro, Cirrus Design Corp., Dayon, McDonnell Douglas, Air Tractor, Emory B. Wood, Aerofab, Dragon Fly Aviation, Carlton M. Cadwell, Tromsness Enterprises Inc, Agusta/Westland, Desalvatore Al, Extra Flugzeugproduktions-GmbH, Thorp, Eurocopter Deutschland GmbH, Fairchild Hiller, De Havilland, Grumman American, Aviate, Nolan, Airbus Industrie, Poulin L/Cullen D, Harms Robert M, Socata, Airborne, Mckeehan James F, Helton, Yates, Dehavilland, Aero Vodochody Aero. Works, Snow, Mauck, Schweizer, Douglas A. Pohl, Colyaer Sl, Iversen, Grumman, Hughes, Drochak, Czech Aircraft Works, Schempp-Hirth, Marshall James J, Raytheon Corporate Jets, Moser Georg, Long, Sikorsky, Dickey, Bowman, Ayres, Roberto P. Garcia, Lien, Schleicher, Lockheed, Debus J / Mountain S / Bowes E, Lindstrand Balloons, Gulfstream American Corp, Piper Aerostar, Learjet, Nagel, Antonovich Anton B, Bond e, Iniziative Industriali Italian, Sproul, Maule, Sabre, Hawker-Beechcraft, Silfvast, Universal, Miller J Kirtley, Partenavia Spa, Cirrus, Airbus, Rockwell International, Kaman, ...]

Incident

[Boeing, British Aerospace, Raytheon Corporate Jets, Airbus Industrie, Saab-Scania Ab (Saab), McDonnell Douglas, Mitsubishi, Learjet, Bombardier, Inc., Bell Helicopter Textron, Embraer]

Minor

[Cessna, Eurocopter Deutschland GmbH, Piper, Beech, Textron Aviation, Mooney, Dassault Aviation, Robinson Helicopter Company, Eurocopter, Hughes, Diamond Aircraft Ind Inc, Bell, Learjet Inc, Cirrus Design Corp, Schweizer, Garlick Helicopters Inc, Boeing, Thrush Aircraft Inc, Eastabrooks John T, Air Tractor Inc, Rans, Burrill Steven E, Cub Crafters Inc, Aerospatiale, Schweizer Aircraft Corp, Garlick, Bell Helicopter Textron, Ray E Roberts, Sikorsky, Gates Lear Jet Corp., Dehavilland, Robinson Helicopter, Maule, St Clair David L, Fairchild, Seace David A, Stinson, Airbus Helicopters]

Non-Fatal

[McDonnell Douglas, Hughes, Piper, Boeing, De Havilland, Cessna, Fairchild, Beech, Bombardier, Aerospatiale, Airbus Industrie, Embraer, Hawker Siddeley, Eurocopter, Aero Commander, Bell, Learjet, Airbus, Bombardier, Inc., Canadair, Britten-Norman, Mbb, Learjet Inc, Eurocopter France, Barnard/Stancil, Dean Patrick G, Robinson, Grumman American, Waltermire, Luscombe, Schweizer, Burkhart Grob, Maule, Beechcraft, Steven Hardie, Clutton Eric, Aviat, Raytheon, Raytheon Aircraft Company, Waco, Bartle, Great Lakes, North American, Morrison, American Champion (Acac), Sikorsky, Aircraft Mfg & Dev. Co., Stinson, Air Tractor, Ercoupe (Eng & Research Corp.), Diamond Aircraft Industries, Rans, Inc., Grumman, Douglas D. Turner, Hatle, Hiller, American Aviation Corp. (Aac), Hawker Beechcraft Corp, Curtiss-Wright, Fantasy Air, Snobird, Questair, Inc., Ultramagic, Let, Champion, Bombardier Inc, Aeronca, Bellanca, Mooney, Evektor Aerotechnik, Rockwell, Cameron Balloons, Vans Aircraft, Extra Flugzeugbau, Higher Class Aviation, Grumman-Schweizer, Shaffstall, Robinson Helicopter Company, Schleicher, Thrush Aircraft, Inc., Hawker Beechcraft Corporation, Babcock, Scottish Aviation, Columbia Aircraft Mfg., Pilatus, Downer, Kitfox Iv, Rotorway, Ayres, Eurocopter Deutschland, Eclipse Aviation Corporation, Cirrus, Just Aircraft, Mkii Corporation, Lake, Piper Cub Crafters, Marrin, Douglas, Cirrus Design Corp, Southern Powered Parachutes, ...]

Serious

[Cessna, Piper, Beech, Mooney, Bell, Robinson Helicopter, Eurocopter Deutschland GmbH, Eurocopter, Bellanca, Diamond Aircraft Ind Inc, Air Tractor Inc, Cessna Aircraft Co, Bell Helicopter Textron Canada, Airbus Helicopters, Dehavilland, Airbus Industrie, Boeing, Hawker Aircraft Ltd, Mantell Allan T, Let, Grumman, Hiller, Flightstar Inc, Vans, Evolution Aircraft Inc, De Havilland, Bombardier Inc, Luscombe, Textron Aviation Inc, Burkhart Grob Flugzeugbau, Kumhyr David B, Taylorcraft Aviation Corp, Aerostar International, Evans James Jay, Rhinehart, Schmidt Randall M]

Name: Make, dtype: object

```
In [51]: # Illustrate our findings in a horizontal bar graph (but since the figure is huge, w

plt.figure(figsize=(12, 6))
for i, severity in enumerate(injury_examples.index):
    top_aircrafts = injury_examples[severity][:10] # show only top 10
    plt.barh(i, len(top_aircrafts), color='orange')
    plt.text(len(top_aircrafts) + 0.9, i, ', '.join(top_aircrafts), va='center', fon

plt.yticks(range(len(injury_examples)), injury_examples.index)
plt.xlabel("Number of Aircraft Makes (Top 10 shown)")
plt.title("Aircraft Makes by Injury Severity")
```

```
plt.tight_layout()
plt.show()
```



2.3.2 Total Fatal Injuries

```
In [37]: # Group by Make and sum total fatal injuries
fatal_injuries = aviation_data.groupby('Make')['Total.Fatal.Injuries'].sum()

# Group by total fatal injuries and list all aircraft makes for each total
fatal_injury_examples = fatal_injuries.groupby(fatal_injuries).apply(lambda x: list(

# Set max column width to display full content
pd.set_option('display.max_colwidth', None)

# Display
fatal_injury_examples
```

```
Out[37]: Total.Fatal.Injuries
0.0      [2021Fx3 Llc, 737, 781569 Inc, Ab Sportine Aviacija, Abbett Gerry, Adams, A
dams Balloons Llc, Adams John R Jr, Adolphson, Aermacchi, Aero At Sp Zoo, Aero Smart
Solutions Inc, Aero Sp Z O O, Aero Sp Z O O (Gobosh), Aero Works, Aeromot, Aeropro C
z, Aeros Ltd, Aerospatiale Alenia, Aerosport Ltd, Aerostar Acft Corp Of Texas, Aerost
ar International, Aerostar International Inc, Aerotek, Aerotrek, Ag-Cat Corporation,
Agusta Aerospace Corp, Agustawestland, Agustawestland Philadelphia, Agustawestland Ph
iladelphia Co, Agustawestland Spa, Air Creation Usa Llc, Air Gulfstream Airlines Inc,
Air Tractor, Inc., Airborne (Australia), Airborne Australia, Airbus Helicopters Deuts
chland, Airbus/Eurocopter, Aircraft Industries A.S., Aircraft Mfg & Design Llc, Aircr
aft Mfg & Dev. Co., Aircraft Mfg & Dev. Co. (Amd), Airframes Unlimited, Airmax Constr
ucoes Aeronautica, Airplane Factory (Pty) Ltd, Albright Stan, Alex Michael Bantum/Ter
cel Usa, Aliev Bulent, Allen Raymond H, Alliant, Alvarez Marvin R, Amen, American Avi
ation Corp. (Aac), American Champion, American Champion (Acac), American Eurocopter,
American Legend, American Legend Aircraft Co, American Legend Aircraft Co., Amirkhani
an Shahram Charl, Ams-Flight D.O.O., Anatra Bart T, Anderas, Andre Kostrzewa, Andrew
Mckimmon, Angus Watt, Ankestar, Bradley D., Antares Us, Antonov, Apollo, Apollo Aircr
aft Inc, Arado-Flugzeugwerke Gmbh, Arbc Inc DbA Lindstrand, Argence, Arion Aircraft L
lc, Arrow Falcon Exporters Inc, Arrow Falcon Exporters, Inc., Art Lee Delano, Ashcraf
t, Atkins John, Atkinson, Attaway Robert H, Auman JI, Aurora, Aveko Sro, Aventura, Av
ian Balloon, Aviat Aircraft, Avro, Ayres Thrush, Babcock, Bach Joseph E, Badeaux, Ba
e, Bae Systems, Bae Systems (Operations) Limit, Bagley Curtis Lynn, Bailey Robert, Ba
keng, Baker Wayne, ...]
1.0      [Aero Adventure, Aerofab, Aerostar Aircraft Corporation, Aerostar S A, Air Creation,
Airbus Helicopters (Eurocopte, Airbus Helicopters Inc, Alexander, Alexander Schleiche
r Gmbh & Co, Alexander Thomas P, Alliant Aviation, Alon, American, Andrews, Antonovic
h Anton B, Arrow-Falcon Exporters, Inc., As+ Ltd, Avia Stroitel, Aviat, Aviat Aircraf
t Inc., Aviat Inc, Aviate, Avid, Avions Fairey, Ayres Corp, Backovich George C, Baile
y N Moyes, Bede, Bedecorp Llc, Beech Aircraft Corporation, Berger Michael A, Binkley
```

Richard, Blum Matthew, Bollinger Robert L, Bond Neal O, Bonde, Bowen Christopher W, Bowman, Brenholt Larry R, Brewster, Brian P North, Brice Ron, Brinkerhuff Gerald G, British Aircraft Corp, Brm Aero, Budd, Bunch, Burkhart Grob Flugzeugbau, C A S A, Cameron Balloons Us, Cantrell Lw, Capra, Salvatore O, Carlo Robert, Casa, Case Richard L, Cassutt, Cessna Aircraft Co., Cessna Reims, Cgs, Cgs Aviation Llc, Chamberlain Gerald, Chech Aircraft Works Spol Sro, Chris Mitchell, Christen Industries Inc, Cirrus Design Corporation, Clark, Combs Earl W, Construcciones Aeronauticas, Crosley, Cruz, Culver, Cupaiole, Curtiss Wright, Czech Aircraft Works, Dahlman-Dower, Daniels, Dankelman Peter G, Davis Michael J, Dayon, Dean Leslie N, Debus J / Mountain S / Bowes E, Dg Flugzeugbau Gmbh, Diamond Aircraft, Diamond Aircraft Industries, Dickey, Donegan Benton, Douglas A. Pohl, Dragon Fly Aviation, Drochak, Drone Paul E, Eagleston John H, Eckenrode Carl J, Elkind Bruce, Emory B. Wood, Enbody Frank, Ercoupe, Erickson Larry D, Eskildsen, Evolution Aircraft Inc, Experimental, ...]

2.0

[Advertising Mgmt & Consulting, Aero Vodochody Aero. Works, Aerovodochody, Agusta/Westland, Air Tractor Inc., Airborne Windsport, Airborne Windsports, Aircraft Mfg & Development Co, Allstar Pzl Glider, American Champion Aircraft Cor, Antares, Autogyro, Aviamilano, Ayers, Ballonbau Worner Gmbh, Bean R E/R B Weld Inc, Behne, Benton Fred D, Blue Side Up Inc, Boeing-Stearman, Brantly, Brumwell, Brupbacher Chris, Buckeye, Burkhart Grob, Burkholder Jimmy C, Cameron, Cessna Aircraft Co, Cessna Skyhawk Ii, Cismowski, Claus Rodney L, Columbia Helicopters, Colyaer Sl, Commander Aircraft Company, Conncannon Milton, Cox, Cubcrafters, Czech Aircraft Works Spol Sro, Davidson, Desalvatore Al, Destiny, Diamond Aircraft Industries In, Engineering & Research, Engineering And Research, Enstrom, Erickson Air Crane, Express, Extra Flugzeugproduktions-Gmbh, Finney Thorp, Flugzeugproduktions-Und Vertri, Fritz Neumeyer, From Here To There Pdq Inc, Gates Learjet Corp., Graves, Grumman American, Guimbal, Harden, Harms Robert M, Hawker Aircraft Ltd, Hawker Beechcraft Corp, Hawker-Beechcraft, Hebert Peter J, Hemp Timothy, Icon Aircraft Inc, James B. Taplin, Jetprop Dlx Piper, Jm Kemp, Koen Lancair, Kostrazewa Andre, Lake, Lantzair Flyers Inc, Larson, League, Liberty Aerospace Incorporated, Long, M-Squared, Manweiller, Mayo, Mcdaniel, Monnett John T Jr, Mooney Aircraft Corporation, Moore, Moser Georg, Mxr Technologies, New Piper Aircraft Inc, Piper AeroStar, Poulin L/Cullen D, Pzl Mielec, Quad City Ultralights, Quest, Quest Aircraft Company, Reims-Cessna, Remos Acft Gmbh Flugzeugbau, Remos Aircraft Gmbh, Remos Aircraft Gmbh Flugzeugba, Rose, Rotorway, S.C. AeroStar S.A., Saab, Schmidt Albert D, ...]

3.0

[Aerofab Inc, American Eurocopter Llc, Avions Robin, Ayres, Carlton M. Cadwell, Christensen Steve, Columbia Aircraft Mfg, Convair, Cub Crafters, Czech Sport Aircraft As, Eagle, Epig, Evolution Trikes, Extra Flugzeugproduktions-Und, Gulfstream Aerospace Corp, Hawker Beechcraft Corporation, Iar Brasov, Iversen, Lancair Company, Let, Mbb, McKenzie, Md Helicopters Inc, Messerschmitt-Bolkow-Blohm, North American/Aero Classics, Partenavia Spa, Piper Aircraft, Pitts, Quad City, Quest Aircraft Company Llc, Quicksilver, Reims Aviation, Schempp-Hirth, Socata-Groupe Aerospatiale, Tl Ultralight Sro, Ulrich Christen, Wooters]

4.0

[Agusta Bell, Airborne Windsports Pty Ltd, American Aviation, Ayres Corporation, Beechcraft, Bell Helicopter, Bhi H60 Helicopters Llc, Cirrus Design Corp., Costruzioni Aeronautiche Tecna, Dassault, Flight Design Gmbh, Gulfstream American Corp, Hawker Beech, McDonnell Douglas Heli Co, McDonnell Douglas Helicopter, Md Helicopter Inc, North Wing, P&M Aviation Ltd, Zenith]

5.0

[Aero Vodochody, Agusta Spa, Airborne, Beech Aircraft, Britten-Norman, Hiller, Indonesian Aerospace, Kawasaki, Partenavia, Schleicher]

6.0

[American Champion Aircraft, American Eurocopter Corp, Aviat Aircraft Inc, Israel Aircraft Industries, Lancair, Luscombe, Nanchang China, Neiva, Robinson Helicopter Co, Textron Aviation Inc]

7.0

[Airbus Helicopters, Bell Helicopter Textron Canada, Boeing-Vertol, Cirrus Design, Diamond, Gulfstream Aerospace, Piper Aircraft Inc]

8.0

[Eurocopter France, Extra, Hawker Beechcraft Corp., M7Aero, Maule, Mitsubishi, Raytheon Corporate Jets, Smith, Swearingen]

9.0

[Aeronca, Eurocopter Deutschland Gmbh, Grumman American Avn. Corp., Raytheon]

10.0

[Cessna Aircraft Company, Embraer Aircraft, Fairchild, McDonnell Douglas, Taylorcraft, Textron Aviation, Vans]

11.0

[Bell Helicopter Textron, Rans, Rockwell]

12.0
[Md Helicopter]
13.0
[Piper Aircraft Corporation]
14.0
[Bellanca]
15.0
[Aero Commander, Diamond Aircraft Ind Inc, Hawker Beechcraft, Schweizer]
16.0
[Douglas, Kubicek, Rockwell International]
17.0
[Champion, Gulfstream, Learjet, North American, Pilatus Aircraft Ltd]
18.0
[Aviocar Casa, Cessna Aircraft, Pilatus]
19.0
[Lockheed]
22.0
[British Aerospace, Socata]
23.0
[Bombardier, Viking Air Limited]
25.0
[Cirrus]
26.0
[Robinson Helicopter Company]
27.0
[Britten Norman]
28.0
[Grumman]
29.0
[Raytheon Aircraft Company]
30.0
[Air Tractor]
31.0
[Robinson Helicopter]
33.0
[Dornier]
34.0
[Air Tractor Inc]
38.0
[Hughes]
42.0
[De Havilland]
43.0
[Aerospatiale]
44.0
[Sukhoi]
45.0
[Agusta]
47.0
[Mooney]
54.0
[Dehavilland]
55.0
[Bombardier Inc]
56.0
[Cirrus Design Corp]
58.0
[Atr]
87.0
[Eurocopter]
88.0
[Sikorsky]
89.0
[Tupolev]
100.0
[Embraer]
130.0
[Robinson]
183.0


```
[Airbus Industrie]
271.0
[Bell]
474.0
[Beech]
667.0
[Piper]
826.0
[Airbus]
1056.0
[Cessna]
2115.0
[Boeing]
Name: Total.Fatal.Injuries, dtype: object
```

2.3.3 Total Serious Injuries

```
In [38]: # Group by Make and sum total serious injuries
serious_injuries = aviation_data.groupby('Make')['Total.Serious.Injuries'].sum()

# Group by total serious injury count and list all aircraft makes for each
serious_injury_examples = (
    serious_injuries.groupby(serious_injuries)
    .apply(lambda x: list(x.index)) # list all makes with same number of injuries
)

# Ensure full display
pd.set_option('display.max_colwidth', None)

# Display
serious_injury_examples
```

```
Out[38]: Total.Serious.Injuries
0.0      [2021Fx3 Llc, 737, Adams, Adams Balloons Llc, Adams John R Jr, Adolphson, A
dvertising Mgmt & Consulting, Aero Adventure, Aero At Sp Zoo, Aero Sp Z O O (Gobosh),
Aero Vodochody, Aero Vodochody Aero. Works, Aero Works, Aerofab, Aerofab Inc, Aeromo
t, Aeros Ltd, Aerosport Ltd, Aerostar Aircraft Corporation, Aerostar S A, Aerotek, Ae
rotrek, Aerovodochody, Ag-Cat Corporation, Agusta Aerospace Corp, Agusta Spa, Agusta/
Westland, Agustawestland, Agustawestland Philadelphia, Agustawestland Philadelphia C
o, Agustawestland Spa, Air Gulfstream Airlines Inc, Air Tractor, Inc., Airborne, Airb
orne (Australia), Airborne Australia, Airborne Windsport, Airborne Windsports, Airbus
Helicopters (Eurocopte, Airbus Helicopters Inc, Airbus/Eurocopter, Aircraft Industrie
s A.S., Aircraft Mfg & Design Llc, Aircraft Mfg & Dev. Co., Airframes Unlimited, Airm
ax Construcoes Aeronautica, Airplane Factory (Pty) Ltd, Albright Stan, Alex Michael B
antum/Tercel Usa, Alexander, Alexander Schleicher Gmbh & Co, Alexander Thomas P, Alie
v Bulent, Allen Raymond H, Alliant, Alliant Aviation, Allstar Pzl Glider, Alvarez Mar
vin R, Amen, American Aviation, American Aviation Corp. (Aac), American Champion, Ame
rican Champion (Acac), American Champion Aircraft Cor, American Legend, American Lege
nd Aircraft Co., Ams-Flight D.O.O., Anatra Bart T, Andre Kostrzewa, Andrews, Angus Wa
tt, Antares Us, Antonov, Antonovich Anton B, Apollo, Arado-Flugzeugwerke Gmbh, Arbc I
nc DbA Lindstrand, Argence, Arion Aircraft Llc, Arrow Falcon Exporters, Inc., Arrow-F
alcon Exporters, Inc., Art Lee Delano, As+ Ltd, Ashcraft, Attaway Robert H, Auman Jl,
Aurora, Aveko Sro, Aventura, Avia Stroitel, Aviamilano, Avian Balloon, Aviat Aircraft
Inc., Aviat Inc, Aviate, Aviocar Casa, Avions Fairey, Avions Robin, Avro, Ayers, ...]
1.0      [Ab Sportine
Aviacija, Aermacchi, Aero Smart Solutions Inc, Aero Sp Z O O, Aerospatiale Alenia, Ae
rostar Acft Corp Of Texas, Air Tractor Inc., Airborne Windsports Pty Ltd, Aircraft Mf
g & Dev. Co. (Amd), Aircraft Mfg & Development Co, Alon, American Eurocopter, America
n Legend Aircraft Co, Amirkhanian Shahram Charl, Anderas, Andrew Mckimmon, Ankestar,
Bradley D., Antares, Apollo Aircraft Inc, Atkins John, Atkinson, Aviat Aircraft, Ayre
s, Bailey Robert, Baker Wayne, Balloon Works, Barche, Bartholomew, Bereznak, Better B
urn Llc/Startube Div, Bibbee, Billy Amerson, Birchler Boyd, Bombardier Canadair, Brew
er, British Aircraft Corp., Brown Michael, Brown Mitch, Buckeye Aviation Inc, Buhl, B
unker, Burkhart Grob Flugzeugbau, Burrill Steven E, Burton, Buschmann Robert E, Capel
la Aircraft Corporation (, Celier Aviation, Cessna Ector, Cgs Aviation Llc, Charles P
eet, Cirrus Design Corporation, Clamar Floats Inc, Clark James T, Consolidated Aerna
utics Inc, Continental Copters, Continental Copters Inc., Cook, Cosmos, Cotter, Croma
n, Cub Crafters Inc, Czech Aircraft Works, Czech Sport, Czech Sport Aircraft A S, D &
```


D Aircraft, Daniel L Patrick, Darney, Dassault Aviation, Davis Mark, Dean Patrick G, Deitz, Dekkinga, Delconte Emidio J, Dg Flugzeugbau Gmbh, Dg-Flugzeugbau Gmbh, Diamond Aircraft Industries Inc, Diamond Aircraft Ind Gmbh, Dixon, Dova Aircraft Sro, Dykas, E asler Kelly, Eastabrooks John T, Eccker, Eichhorn Gary L, Eipper, Ercoupe (Eng & Rese arch Corp.), Eslinger C W/Eslinger S M, Eurocopter France, Experimental, Fairchild He li-Porter, Fisher Michael H, Flaglor Tom, Flightstar, Flightstar Inc, Flynn Van, Fox Jack G, Fpna Llc, Freeman Heritage Collection, Fuhrmann-Super Emeraude, Garland, ...]

2.0

[Abbett Gerry, Aeropro Cz, Agusta, Agusta Bell, Air Creation, Air Creation Usa Llc, A merican, Arrow Falcon Exporters Inc, Atr, Autogyro, Avid, Beechcraft, Bell Helicopter Textron Canada, Bertagna John, Bice, Bielawa, Boswell John J, British Aerospace, Brit ten-Norman, Buckeye, Burkhart Grob, Canadair, Centrair, Cessna Aircraft, Cessna Aircr aft Co, Christen Industries Inc, Construcciones Aeronauticas Sa, Cubcrafters Inc, Cur nutt Elton E, Dart, Doppelt Fredric F, Dratbe Shmiel Amir, Eads Socata, Elemdorf, Eve ktor-Aerotechnik As, Extra Flugzeugbau Gmbh, Fairchild(Howard), Flight Design, Gates Lear Jet Corp., Gates Learjet Corp., Gippsaero Pty Ltd, Glasflugel, Globe, Gn-1 Airca mper, Great Lakes, Gulfstream Aerospace, Gulfstream-Schweizer A/C Corp, Henrie Raymon d, Jimenez, Johnson Garret W, K Copters, Karns, Lake, Lancair Company, Lepow David A, Let, Marlman, Maxair Drifter, Mcdonnell Douglas Helicopters, Mckay Gene, Md Helicopte r Inc, Md Helicopters Inc, Mitsubishi, New Piper Aircraft Inc, Norton Claude C, Peter son-Feder-Splinter, Piper Aircraft Corporation, Questair, Inc., Quicksilver, Rans Emp loyee Flying Club, Remos Aircraft Gmbh, Rgj Aviation Llc, Robert Golding, Rockwell, R otherwick, Rotorway, Sanderson Herbert H, Smith, Stearman, Sweet Wayne A, Temco, Texa s Helicopter Corp, Thrush Aircraft Inc, Univair Aircraft Corporation, Vans Aircraft, Venus, Weatherly Aviation Co Inc, Weber, Wohaska John, Yost Edwin S]

3.0

[781569 Inc, American Eurocopter Llc, Bell Helicopter, Cirrus Design Corp., Costruzio ni Aeronautiche Tecna, Czech Aircraft Works Spol Sro, Eclipse Aviation Corp, Engineer ing & Research, Eurocopter Deutschland, Evolution Aircraft Inc, Evolution Trikes, Gar lick, Goodacre, Grumman American, Gulfstream, Head Balloons Inc., Hiller-Tri-Plex In d.Inc., Infinity, Linstrand, Mbb, Mcdonnell Douglas Heli Co, Partenavia, Pilatus Airc raft Ltd, Piper/Cub Crafters, Quest Aircraft Company, Rans, Rockwell International, S aab, Swearingen, Textron Aviation Inc, Ultramagic Sa]

4.0

[Aerostar International, Airbus Helicopters, American Eurocopter Corp, Cameron Balloo ns, Embraer S A, Eurocopter Deutschland Gmbh, Garlick Helicopters Inc, Helicopteres G uimbal, Lindstrand Balloons, Piaggio Aero Industries Spa, Ryan, Schempp-Hirth, Schlei cher, Schweizer Aircraft Corp, Siai Marchetti, Siai-Marchetti, Six Chuter, Stol]

5.0

[Airbus Helicopters Deutschland, American Champion Aircraft, Aviat, Brantly, Mcdonnel l Douglas Helicopter, Navion, Piper Aircraft Inc, Socata, Vans]

6.0

[Aerostar International Inc, Aviat Aircraft Inc, Balony Kubicek Spol, Bell Helicopter Textron, Curtiss Wright, Fairchild, Israel Aircraft Industries, Lancair, Learjet Inc, Md Helicopter, Waco]

7.0

[Ayres Corporation, Douglas, Helio]

8.0

[Cameron, Diamond, Flight Design Gmbh, North American]

9.0

[Britten Norman, Champion, Enstrom, Grumman Acft Eng Cor-Schweizer, Taylorcraft, Ultr amagic]

10.0

[Aero Commander, Cameron Balloons Us, Ercoupe, Grumman American Avn. Corp.]

11.0

[Diamond Aircraft Ind Inc, Sikorsky]

12.0

[Luscombe]

13.0

[Aerospatiale]

14.0

[Hiller, Lindstrand]

15.0

[Bombardier Inc, Kubicek]

16.0

[Aeronca, Bellanca, Cirrus, Maule]

17.0

[Air Tractor, Raytheon Aircraft Company]

19.0

```

[Boeing Company, Stinson]
22.0
[Cirrus Design Corp]
23.0
[Grumman]
25.0
[Mooney]
26.0
[Airbus Industrie, De Havilland]
30.0
[Air Tractor Inc, Bombardier, Dehavilland, Hughes]
34.0
[Mcdonnell Douglas]
39.0
[Schweizer]
43.0
[Robinson Helicopter Company]
45.0
[Eurocopter]
60.0
[Robinson Helicopter]
63.0
[Fokker]
64.0
[Robinson]
122.0
[Embraer]
161.0
[Bell]
163.0
[Beech]
176.0
[Airbus]
397.0
[Piper]
843.0
[Cessna]
1091.0
[Boeing]
Name: Total.Serious.Injuries, dtype: object

```

Objective 2.4: Relation between aircraft make and Mechanical reliability and environmental susceptibility of the aircraft (aircraft damage)

```

In [39]: # In the case of damage, the company needs to be aware of the extent of damage to th

# Group aircraft makes by damage type and list all makes per damage
damage_examples = (
    aviation_data.groupby('Aircraft.damage')['Make']
    .unique() # get unique aircraft makes per damage type
    .apply(list) # convert to list for easier display
)

# Set max column width to display full content
pd.set_option('display.max_colwidth', None)

# Display the table
damage_examples

```

```

Out[39]: Aircraft.damage
Destroyed
[Piper, Cessna, Eurocopter, Boeing, Beech, British Aerospace, Bell, Robinson Helicopt
er, Cirrus Design Corp, Kidd Chris, Lancair, Ulrich Christen, Mooney, Neiva, Cirrus D
esign Corp., Mcdonnell Douglas, Air Tractor, Carlton M. Cadwell, Robinson, Tromsness
Enterprises Inc, Agusta/Westland, Desalvatore Al, Eurocopter Deutschland Gmbh, Fairch
ild Hiller, Grumman American, Aerospatiale, Rotorway, Sikorsky, Poulin L/Cullen D, Ha
rms Robert M, Aero Commander, Airbus Industrie, Helton, Grumman, Schweizer, Raytheon
Aircraft Company, Iversen, Hughes, Schempp-Hirth, Raytheon Corporate Jets, Long, Dick

```

ey, Socata, Lockheed, Gulfstream American Corp, Piper Aerostar, Learjet, Nagel, Sproul, Maule, Rans, Silfvast, Universal, Airbus, Rockwell International, Hawker Beechcraft, Lantzair Flyers Inc, Lavigna, Gulfstream Aerospace Corp, Glaser-Dirks, Aeronca, Cirrus Design, Embraer, Bombardier Inc, Diamond Aircraft Ind Inc, Grumman American Avn. Corp., Burkholder Jimmy C, Argence, Curtiss Wright, Engineering And Research, Alexander Thomas P, Whitehead, Laseure, Gulfstream-Schweizer A/C Corp, Thornton, Agusta Spa, Cirrus Design Corporation, Ayres Corporation, Pietenpol, North American, Zenair Ltd, Md Helicopter Inc, Cirrus, Gray, Hooper James A, Air Tractor Inc, Sportflight International Llc, Hahn, Robinson Helicopter Company, Zenith Aircraft Co, Moore, Davis Michael J, Mitsubishi, Smith, Czech Aircraft Works Spol Sro, Tupolev, Hawker Beechcraft Corp., Dornier, Atr, Agusta, ...]

Minor [Boeing, Airbus Industrie, McDonnell Douglas, Airbus, Mitsubishi, Learjet, Bell Helicopter Textron, Embraer, Cessna, Aerospatiale, Raytheon Aircraft Company, Cameron Balloons, Fairchild, Cirrus, Agusta, Eclipse Aviation Corporation, Extra Flugzeugproduktions-Und, Md Helicopters Inc, Bell, Diamond, Indus Aviation Inc, McDonnell Douglas Helicopter, Cirrus Design Corp, Md Helicopter Inc, Dehavilland, Bombardier, Piper, Md Helicopter, North American, New Piper Aircraft Inc, McDonnell-Douglas, Liberty Aerospace Incorporated, T Bird, Aerostar International Inc, Bombardier Inc, Rolladen-Schneider Ohg, Cirrus Design Corporation, Mooney, Taylorcraft, Curtiss Wright, Beech, Univar, Krusmark David Homer, Atr, Hawker Beechcraft Corp., Douglas, Bae, Gulfstream American Corp., Smith Edward I, Sikorsky, Fokker, Lindstrand Balloons, Eurocopter, McDonnell Douglas Aircraft Co, Diamond Aircraft Ind Inc, Head Balloons Inc, Gulfstream Aerospace, Short Bros. & Harland, Aviat Inc, Eurocopter Deutschland Gmbh, Israel Aircraft Industries, Air Tractor Inc, Hughes, Starduster Ii, Gulfstream, Bombardier Learjet Corp., Powrachine Llc, Flight Design Gmbh, Arbc Inc Dba Lindstrand, Schleicher, British Aerospace, Mueller Michael Walter, Flight Design, Sorensen, Boeing Company, Ttx Air Llc, Cameron Balloons Us, Andrews, Piaggio, Schweizer Aircraft Corp, Rockwell International, Ultramagic Sa, Ultramagic, Iai, Kubicek, Bell Helicopter Textron Canada, Cessna Aircraft Company, Boeing Company, Long Beach Div, Pilatus Aircraft Ltd, Enstrom, Bae Systems (Operations) Limit, Schleicher Alexander, P&M Aviation Ltd, Cold Balloons, Schweizer, Evo13 Llc, Boeing 777-306ER, The Boeing Company, Short Brothers & Harland Ltd., Dassault-Breguet, ...]

Substantial

[McDonnell Douglas, Boeing, Hughes, Piper, British Aerospace, Cessna, De Havilland, Fairchild, Beech, Raytheon Corporate Jets, Bombardier, Aerospatiale, Bell, Airbus Industrie, Embraer, Hawker Siddeley, Saab-Scania Ab (Saab), Eurocopter, Aero Commander, Learjet, Bombardier, Inc., Canadair, Britten-Norman, Mbb, Learjet Inc, Eurocopter France, Barnard/Stancil, Dean Patrick G, Robinson, Hawker Beechcraft Corp., Grumman American, Beechcraft, Waltermire, Luscombe, Schweizer, Airbus, Raytheon Aircraft Company, Kaylor J E/Strahlmann R L, Wooters, Burkhart Grob, Maule, Steven Hardie, Clutton Eric, Wilson, Aviat, Raytheon, Piper Aircraft Inc, Waco, Bartle, Great Lakes, North American, Morrison, American Champion (Acac), Sikorsky, Aircraft Mfg & Dev. Co., Stinson, Air Tractor, Ercoupe (Eng & Research Corp.), Diamond Aircraft Industries, Rans, Inc., Grumman, Douglas D. Turner, Hatle, Hiller, Siai-Marchetti, American Aviation Corp. (Acac), Czech Aircraft Works Spol Sro, Hawker Beechcraft Corp, Curtiss-Wright, Fantasy Air, Snobird, Questair, Inc., Dayon, Ultramagic, Emory B. Wood, Aerofab, Let, Dragon Fly Aviation, Champion, Bombardier Inc, Aeronca, Bellanca, Mooney, Evекtor Aerotechnik, Rockwell, Vans Aircraft, Extra Flugzeugbau, Higher Class Aviation, Grumman-Schweizer, Shaffstall, Extra Flugzeugproduktions-Gmbh, Thorp, Robinson Helicopter Company, Schleicher, Thrush Aircraft, Inc., Hawker Beechcraft Corporation, Babcock, Scottish Aviation, Columbia Aircraft Mfg., Pilatus, ...]

Unknown

[Boeing, Cessna, Air Tractor Inc, Piper, Bell, Robinson, Britten Norman, Herrick David A, Helio, Airbus, Textron Aviation, Saab, Sikorsky, Schweizer, United Consultants, Luscombe, Uvify]

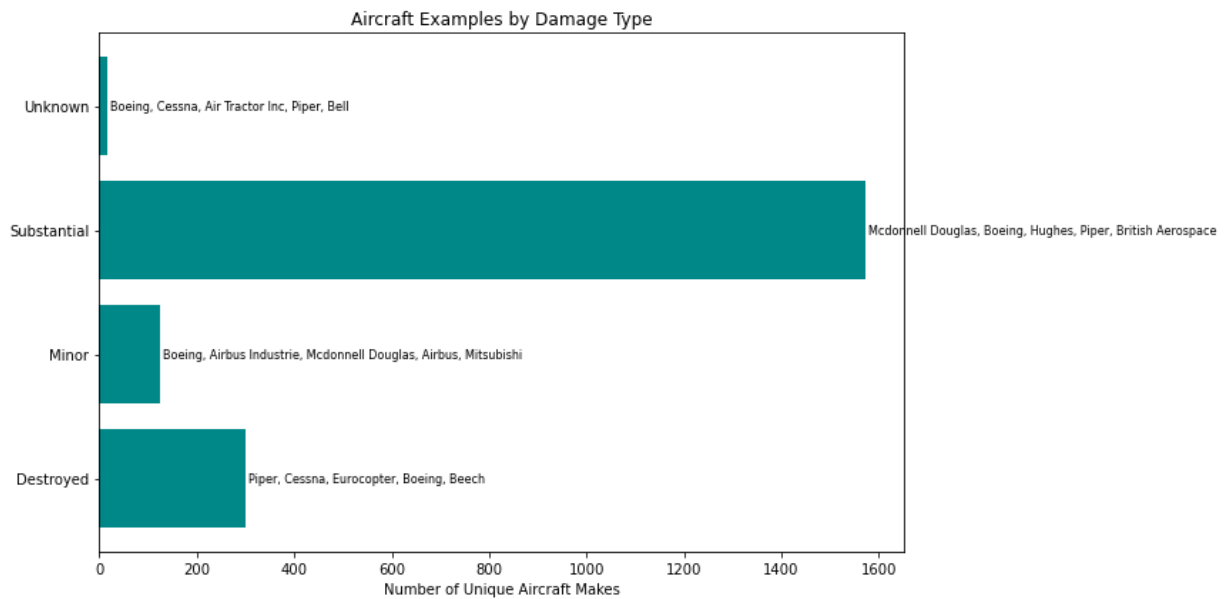
Name: Make, dtype: object

```
In [56]: # Illustrate in a horizontal bar graph (but since the figure is huge, we will plot t
plt.figure(figsize=(12,6))

for i, damage in enumerate(damage_examples.index):
    top_aircrafts = damage_examples[damage][:5] # show top 5 for readability
    plt.barh(i, len(damage_examples[damage]), color='darkcyan')
    plt.text(len(damage_examples[damage]) + 5.0, i, ', '.join(top_aircrafts), va='ce

plt.yticks(range(len(damage_examples)), damage_examples.index)
plt.xlabel("Number of Unique Aircraft Makes")
plt.title("Aircraft Examples by Damage Type")
```

```
plt.tight_layout()
plt.show()
```



This marks the end of our analysis based on the objectives we had formulated in the beginning.

5. Recommendations

To finally recommend which aircraft would be the best to purchase, we will divide the crafts into:

a. For the safe planes (those which had the least number of crashes which we deemed as safest), we want to know those that are useful for:

Personal

Business

Other Work Use

Executive/corporate

Public Aircraft - Local

Public Aircraft - State

In each, we want to categorize:

1. Which is good for short, medium or long range flights based on engine type.
2. From this list, we want those with less injuries + less total fatal injuries + less total serious injuries (meaning less people succumbed) and:
3. From the above list, we want those with minor aircraft damage (meaning they are mechanically and structurally sound)

```
In [41]: # To do the above, we will first define a function

def get_safe_planes(data, makes, purpose, engine_type,
                    injury_severity='Non-Fatal', max_fatal=5, max_serious=5,
```

```

        damage='Minor'):
    """
    Returns aircraft makes that meet safety criteria for a given make, purpose, and

    Parameters:
        data (DataFrame): Aviation dataset.
        makes (list or str): Aircraft makes to include.
        purpose (str): Purpose of flight to filter.
        engine_type (str): Engine type to filter.
        injury_severity (str): Injury severity to filter (default 'Non-Fatal').
        max_fatal (int): Maximum allowed total fatal injuries (default 5).
        max_serious (int): Maximum allowed total serious injuries (default 5).
        damage (str): Aircraft damage category (default 'Minor').

    Returns:
        list: List of aircraft makes that meet the criteria.
    """
    if isinstance(makes, str):
        makes = [makes] # convert single make to list

    filtered = data[
        (data['Make'].isin(makes)) &
        (data['Purpose.of.flight'] == purpose) &
        (data['Engine.Type'] == engine_type) &
        (data['Injury.Severity'] == injury_severity) &
        (data['Total.Fatal.Injuries'] < max_fatal) &
        (data['Total.Serious.Injuries'] < max_serious) &
        (data['Aircraft.damage'] == damage)
    ]

    return filtered['Make'].tolist()

```

In [42]: *# Let us attempt all sorts of combinations to get the best version of planes suited ;
We shall use a nested for loop for this:*

```

# Lists of purposes and engine types
purposes = [
    'Personal',
    'Business',
    'Other Work Use',
    'Executive/corporate',
    'Public Aircraft - Local',
    'Public Aircraft - State'
]

engine_types = [
    'Reciprocating',
    'Turbo Prop',
    'Turbo Shaft',
    'Turbo Fan',
    'Turbo Jet'
]

# Dictionary to store results
safe_planes_dict = {}

# Loop through all combinations
for purpose in purposes:
    for engine in engine_types:
        key = (purpose, engine) # use tuple as dictionary key
        safe_planes_list = get_safe_planes(
            aviation_data,
            makes=safe_planes,
            purpose=purpose,

```

```

        engine_type=engine
    )
    safe_planes_dict[key] = safe_planes_list

# Print all combinations
for k, v in safe_planes_dict.items():
    print(f"{k}: {v}")

('Personal', 'Reciprocating'): ['T Bird', 'Rolladen-Schneider Ohg', 'Univar', 'Krusmark David Homer', 'Starduster Ii', 'Mueller Michael Walter', 'Schleicher Alexander', 'Boeing 777-306Er', 'Consolidated Vultee', 'Dji', 'Honda']
('Personal', 'Turbo Prop'): ['Evo13 Llc', 'Short Brothers & Harland Ltd.']
('Personal', 'Turbo Shaft'): []
('Personal', 'Turbo Fan'): ['Mcdonnell-Douglas', 'Bombardier Learjet Corp.', 'Boeing Company, Long Beach Div', 'Bae Systems (Operations) Limit', 'Avro']
('Personal', 'Turbo Jet'): ['Gulfstream American Corp.']
('Business', 'Reciprocating'): []
('Business', 'Turbo Prop'): []
('Business', 'Turbo Shaft'): []
('Business', 'Turbo Fan'): []
('Business', 'Turbo Jet'): []
('Other Work Use', 'Reciprocating'): ['Ultramagic S A']
('Other Work Use', 'Turbo Prop'): []
('Other Work Use', 'Turbo Shaft'): []
('Other Work Use', 'Turbo Fan'): []
('Other Work Use', 'Turbo Jet'): []
('Executive/corporate', 'Reciprocating'): []
('Executive/corporate', 'Turbo Prop'): []
('Executive/corporate', 'Turbo Shaft'): []
('Executive/corporate', 'Turbo Fan'): []
('Executive/corporate', 'Turbo Jet'): []
('Public Aircraft - Local', 'Reciprocating'): []
('Public Aircraft - Local', 'Turbo Prop'): []
('Public Aircraft - Local', 'Turbo Shaft'): []
('Public Aircraft - Local', 'Turbo Fan'): []
('Public Aircraft - Local', 'Turbo Jet'): []
('Public Aircraft - State', 'Reciprocating'): []
('Public Aircraft - State', 'Turbo Prop'): []
('Public Aircraft - State', 'Turbo Shaft'): []
('Public Aircraft - State', 'Turbo Fan'): []
('Public Aircraft - State', 'Turbo Jet'): []

```

From our dataset, it appears that the safest plane (one with the least number of accidents) were purposefully used for personal flights. These had the least number of fatal injuries, serious injuries while having a non-fatal injury severity and minor aircraft accidents.

In addition to the above, if the company wishes to procure a plane for long range flights, the 'GulfStream American Corp'. is the best.

For medium range flights, the 'Evo13 Llc', 'Short Brothers' & 'Harland Ltd' are the best options.

For short range flights, the 'T Bird', 'Rolladen-Schneider Ohg', 'Univar', 'Krusmark David Homer', 'Starduster Ii', 'Mueller Michael Walter', 'Schleicher Alexander', 'Boeing 777-306Er', 'Consolidated Vultee', 'Dji', 'Honda' are the best options.

6. Conclusions

In this notebook, we were able to suggest the most operational, safe and mechanically reliable plane for procurement for our company using data from the NTSB report of accidents from 1962 - 2023.

Suggestions for further study: Despite having analyzed this dataset to suggest which aircrafts Makes had the least air crashes while still being most operational, safe and mechanically sound, the best suggestions would have come from a dataset of commonly used aircrafts for better predictions.

```
In [43]: #To finalize the creation of the Tableau images, we need to use the Cleaned excel sh  
aviation_data.to_excel('aviation_data_cleaned.xlsx')
```

We finalized our analysis by creating a dashboard in Tableau summarizing the Airplane Makes that are:

1. Most operational based on engine type.
2. Safest based on having the least total fatal injuries.
3. Mechanically stable based on having a non-fatal injury severity.