Project Overview

Project Goal

The primary goal of this project is to analyze aviation accident data to identify trends, visualize key metrics, and provide actionable insights into aircraft safety. By cleaning and visualizing the data, we aim to understand accident patterns, aircraft performance, and potential safety improvements.

Importing various libraries for data cleaning and visualisation

In [16]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

Loading the Dataset and analysing the data.

In [17]:
```
df = pd.read_csv("AviationData.csv", encoding='ISO-8859-1', low_memory=False)
df.head()
```

Out[17]:

	Event.Id	Investigation.Type	Accident.Number	Event.Date	Location	Country	Latitude	Longitude	Airport.Code	Airport.Name	...	Purpose.of.flight	Air.carrier	Total.Fatal.Injuries	Tota
0	20001218X45444	Accident	SEA87LA080	1948-10-24	MOOSE CREEK, ID	United States	NaN	NaN	NaN	NaN	...	Personal	NaN	2.0	
1	20001218X45447	Accident	LAX94LA336	1962-07-19	BRIDGEPORT, CA	United States	NaN	NaN	NaN	NaN	...	Personal	NaN	4.0	
2	20061025X01555	Accident	NYC07LA005	1974-08-30	Saltville, VA	United States	36.922223	-81.878056	NaN	NaN	...	Personal	NaN	3.0	
3	20001218X45448	Accident	LAX96LA321	1977-06-19	EUREKA, CA	United States	NaN	NaN	NaN	NaN	...	Personal	NaN	2.0	
4	20041105X01764	Accident	CHI79FA064	1979-08-02	Canton, OH	United States	NaN	NaN	NaN	NaN	...	Personal	NaN	1.0	

5 rows × 31 columns

In [18]:
```
df.describe()
```

Out[18]:

	Number.of.Engines	Total.Fatal.Injuries	Total.Serious.Injuries	Total.Minor.Injuries	Total.Uninjured
count	82805.000000	77488.000000	76379.000000	76956.000000	82977.000000
mean	1.146585	0.647855	0.279881	0.357061	5.325440
std	0.446510	5.485960	1.544084	2.235625	27.913634
min	0.000000	0.000000	0.000000	0.000000	0.000000
25%	1.000000	0.000000	0.000000	0.000000	0.000000
50%	1.000000	0.000000	0.000000	0.000000	1.000000
75%	1.000000	0.000000	0.000000	0.000000	2.000000
max	8.000000	349.000000	161.000000	380.000000	699.000000

In [19]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 88889 entries, 0 to 88888
Data columns (total 31 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Event.Id                88889 non-null  object 
 1   Investigation.Type      88889 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            50132 non-null  object 
 9   Airport.Name            52704 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     87507 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             81793 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           82505 non-null  object 
 30  Publication.Date        75118 non-null  object 
dtypes: float64(5), object(26)
memory usage: 21.0+ MB
```

In [20]:
```
df.shape
```

Out[20]: (88889, 31)

In [21]:
```
df.isnull().sum()
```

Out[21]:
```
Event.Id                    0
Investigation.Type          0
Accident.Number             0
Event.Date                  0
Location                   52
Country                   226
Latitude                54507
Longitude               54516
Airport.Code            38757
Airport.Name            36185
Injury.Severity          1000
Aircraft.damage          3194
Aircraft.Category       56602
Registration.Number      1382
Make                       63
Model                      92
Amateur.Built             102
Number.of.Engines        6084
Engine.Type              7096
FAR.Description         56866
Schedule                76307
Purpose.of.flight        6192
Air.carrier             72241
Total.Fatal.Injuries    11401
Total.Serious.Injuries  12510
Total.Minor.Injuries    11933
Total.Uninjured          5912
Weather.Condition        4492
Broad.phase.of.flight   27165
Report.Status            6384
Publication.Date        13771
dtype: int64
```

Missing data identification and dropping

In [22]:
```
df = df.dropna(subset = ['Make', 'FAR.Description', 'Injury.Severity','Purpose.of.flight','Location'])
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 27884 entries, 7 to 88888
Data columns (total 31 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Event.Id                27884 non-null  object 
 1   Investigation.Type      27884 non-null  object 
 2   Accident.Number         27884 non-null  object 
 3   Event.Date              27884 non-null  object 
 4   Location                27884 non-null  object 
 5   Country                 27872 non-null  object 
 6   Latitude                23589 non-null  object 
 7   Longitude               23578 non-null  object 
 8   Airport.Code            17988 non-null  object 
 9   Airport.Name            18599 non-null  object 
 10  Injury.Severity         27884 non-null  object 
 11  Aircraft.damage         27520 non-null  object 
 12  Aircraft.Category       27780 non-null  object 
 13  Registration.Number     27714 non-null  object 
 14  Make                    27884 non-null  object 
 15  Model                   27858 non-null  object 
 16  Amateur.Built           27878 non-null  object 
 17  Number.of.Engines       26512 non-null  float64
 18  Engine.Type             24828 non-null  object 
 19  FAR.Description         27884 non-null  object 
 20  Schedule                1154 non-null   object 
 21  Purpose.of.flight       27884 non-null  object 
 22  Air.carrier             11056 non-null  object 
 23  Total.Fatal.Injuries    24400 non-null  float64
 24  Total.Serious.Injuries  24406 non-null  float64
 25  Total.Minor.Injuries    24804 non-null  float64
 26  Total.Uninjured         26907 non-null  float64
 27  Weather.Condition       26938 non-null  object 
 28  Broad.phase.of.flight   7214 non-null   object 
 29  Report.Status           24707 non-null  object 
 30  Publication.Date        27364 non-null  object 
dtypes: float64(5), object(26)
memory usage: 6.8+ MB
```

In [23]:
```
Rows = len(df)
MissingData = df.isna().sum()
MissingPercentage = MissingData / Rows
```

In [24]:
```
Missing_df = pd.DataFrame({'Missing' : MissingPercentage})
Missing_df.sort_values('Missing', ascending= False, inplace= True)
Missing_df
```

Out[24]:

	Missing
Schedule	0.958614
Broad.phase.of.flight	0.741285
Air.carrier	0.603500
Airport.Code	0.354899
Airport.Name	0.332987
Longitude	0.154425
Latitude	0.154031
Total.Fatal.Injuries	0.124946
Total.Serious.Injuries	0.124731
Report.Status	0.113936
Total.Minor.Injuries	0.110458
Engine.Type	0.109597
Number.of.Engines	0.049204
Total.Uninjured	0.035038
Weather.Condition	0.033926
Publication.Date	0.018649
Aircraft.damage	0.013054
Registration.Number	0.006097
Aircraft.Category	0.003730
Model	0.000932
Country	0.000430
Amateur.Built	0.000215
FAR.Description	0.000000
Purpose.of.flight	0.000000
Investigation.Type	0.000000
Make	0.000000
Injury.Severity	0.000000
Location	0.000000
Event.Date	0.000000
Accident.Number	0.000000
Event.Id	0.000000

In [25]:
```
DropColumns = list(Missing_df[Missing_df['Missing'] > 0.25].index)
df.drop(columns = DropColumns, inplace = True)
StrColumns = df.select_dtypes(include='object').columns
ObjColumns = df.select_dtypes(include='float').columns
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 27884 entries, 7 to 88888
Data columns (total 26 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Event.Id                27884 non-null  object 
 1   Investigation.Type      27884 non-null  object 
 2   Accident.Number         27884 non-null  object 
 3   Event.Date              27884 non-null  object 
 4   Location                27884 non-null  object 
 5   Country                 27872 non-null  object 
 6   Latitude                23589 non-null  object 
 7   Longitude               23578 non-null  object 
 8   Injury.Severity         27884 non-null  object 
 9   Aircraft.damage         27520 non-null  object 
 10  Aircraft.Category       27780 non-null  object 
 11  Registration.Number     27714 non-null  object 
 12  Make                    27884 non-null  object 
 13  Model                   27858 non-null  object 
 14  Amateur.Built           27878 non-null  object 
 15  Number.of.Engines       26512 non-null  float64
 16  Engine.Type             24828 non-null  object 
 17  FAR.Description         27884 non-null  object 
 18  Purpose.of.flight       27884 non-null  object 
 19  Total.Fatal.Injuries    24400 non-null  float64
 20  Total.Serious.Injuries  24406 non-null  float64
 21  Total.Minor.Injuries    24804 non-null  float64
 22  Total.Uninjured         26907 non-null  float64
 23  Weather.Condition       26938 non-null  object 
 24  Report.Status           24707 non-null  object 
 25  Publication.Date        27364 non-null  object 
dtypes: float64(5), object(21)
memory usage: 5.7+ MB
None
```

Ensuring there is no missing data

In [26]:
```
df[ObjColumns] = df[ObjColumns].fillna(df[ObjColumns].mean())
df[StrColumns] =df[StrColumns].fillna('unknown')
df.isnull().sum()
```

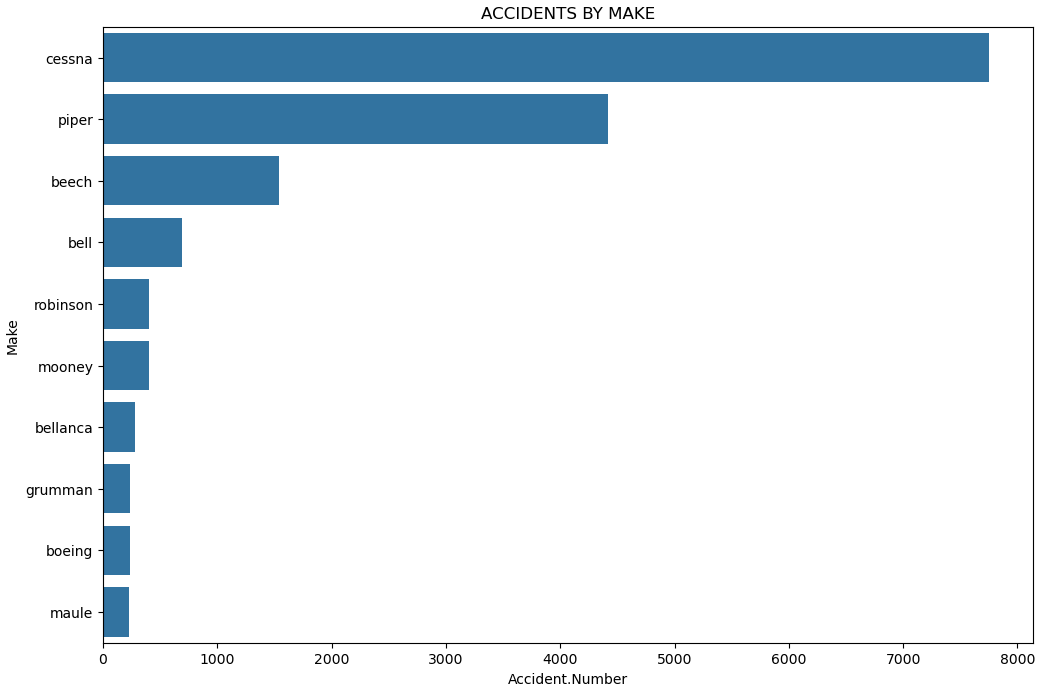
Out[26]:
```
Event.Id                0
Investigation.Type      0
Accident.Number         0
Event.Date              0
Location                0
Country                 0
Latitude                0
Longitude               0
Injury.Severity         0
Aircraft.damage         0
Aircraft.Category       0
Registration.Number     0
Make                    0
Model                   0
Amateur.Built           0
Number.of.Engines       0
Engine.Type             0
FAR.Description         0
Purpose.of.flight       0
Total.Fatal.Injuries    0
Total.Serious.Injuries  0
Total.Minor.Injuries    0
Total.Uninjured         0
Weather.Condition       0
Report.Status           0
Publication.Date        0
dtype: int64
```

Data cleaning and visualisation of Aircraft Accidents

In [27]:
```
df['Make']= df['Make'].str.lower().str.strip()
aircraft_accidents = df.groupby('Make').size().sort_values(ascending=False)
aircraft_summary = df['Make'].value_counts().reset_index()
aircraft_summary.columns = ['Make','Accident.Number']
top_ten_aircrafts = aircraft_summary.head(10)
```

In [28]:
```
plt.figure(figsize=(12, 8))
sns.barplot(x="Accident.Number", y='Make', data=top_ten_aircrafts)
plt.title('ACCIDENTS BY MAKE')
plt.xlabel('Accident.Number')
plt.ylabel('Make')
plt.show
```

Out[28]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



More fitering to enable plotting the line plot

In [29]:
```
df['Event.Date'] = pd.to_datetime(df['Event.Date'], errors='coerce')
df['year'] = df['Event.Date'].dt.year
accidents_by_year = df.groupby('year').size().reset_index(name='Accident.Count')
accident_trends = df.groupby(['year', 'Make']).size().reset_index(name='Accident.Count')
top_ten_makes=top_ten_aircrafts['Make'].tolist()
accident_trends_top_ten = accident_trends[accident_trends['Make'].isin(top_ten_makes)]
print(accident_trends)
```

```
      year              Make  Accident.Count
0     1982             adams               1
1     1982    aero commander              17
2     1982           aeronca              29
3     1982     aeronca champ               1
4     1982  aeronca champion               1
...    ...               ...             ...
7126  2022    wingren norman               1
7127  2022     wren ronnie d               1
7128  2022          yakovlev               2
7129  2022      yates mike e               1
7130  2022            zenith               5

[7131 rows x 3 columns]
```

In [30]:
```
plt.figure(figsize=(14,14))
sns.lineplot(x='year',y='Accident.Count', hue='Make', data=accident_trends_top_ten , marker='o',palette="tab10")
plt.title('ACCIDENT TRENDS OVER TIME FOR THE TOP TEN AIRCRAFTS')
plt.xlabel('Year')
plt.ylabel('Accident Count')
plt.legend(title='Aircraft Make')
plt.grid(True)
plt.show
```

Out[30]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```