

```
In [13]: import csv
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from datetime import datetime
```

```
In [31]: data = pd.read_csv('clean_data_final_1.22.csv')
data
```

/opt/anaconda3/envs/learn-env/lib/python3.8/site-packages/IPython/core/interactiveshell.py:3145: DtypeWarning: Columns (18) 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,

Out[31]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	Number.
0	Accident	1948-10-24	MOOSE CREEK, ID	United States	Fatal	Destroyed	NaN	Stinson	108-3	No	
1	Accident	1962-07-19	BRIDGEPORT, CA	United States	Fatal	Destroyed	NaN	Piper	PA24-180	No	
2	Accident	1974-08-30	Saltville, VA	United States	Fatal	Destroyed	NaN	Cessna	172M	No	
3	Accident	1977-06-19	EUREKA, CA	United States	Fatal	Destroyed	NaN	Rockwell	112	No	
4	Accident	1979-08-02	Canton, OH	United States	Fatal	Destroyed	NaN	Cessna	501	No	
...	...	...	...	...	...	...	...	...	...	...	...
84601	Accident	2022-12-21	Reserve, LA	United States	Minor	NaN	NaN	GRUMMAN AMERICAN AVN. CORP.	AA-5B	No	
84602	Accident	2022-12-22	Brasnorte,	Brazil	Fatal	NaN	NaN	AIR TRACTOR	AT502	No	
84603	Accident	2022-12-26	Annapolis, MD	United States	Minor	NaN	NaN	PIPER	PA-28-151	No	
84604	Accident	2022-12-26	Payson, AZ	United States	Non-Fatal	Substantial	Airplane	AMERICAN CHAMPION AIRCRAFT	8GCBC	No	
84605	Accident	2022-12-29	Athens, GA	United States	Minor	NaN	NaN	PIPER	PA-24-260	No	

84606 rows x 20 columns

Seperating the Event.Date column by Month and Year

```
In [32]: data['Event.Date'] = pd.to_datetime(data['Event.Date'])

data['Year'] = data['Event.Date'].dt.year
data['Month'] = data['Event.Date'].dt.month

print(data[['Event.Date', 'Year', 'Month']])
```

	Event.Date	Year	Month
0	1948-10-24	1948	10
1	1962-07-19	1962	7
2	1974-08-30	1974	8
3	1977-06-19	1977	6
4	1979-08-02	1979	8
...	...	...	...
84601	2022-12-21	2022	12
84602	2022-12-22	2022	12
84603	2022-12-26	2022	12
84604	2022-12-26	2022	12
84605	2022-12-29	2022	12

[84606 rows x 3 columns]

```
In [33]: data['Number.of.Engines'].unique()
```

Out[33]: array([1., 2., 0., 4., 3., 8., 6.])

```
In [34]: filtered_df = data[(data['Year'] >= 2013) & (data['Year'] <= 2023)]
filtered_df
```

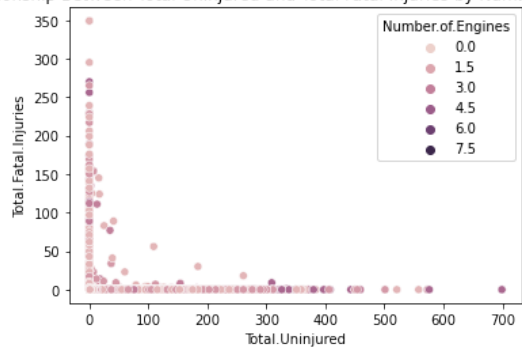
```
Out[34]:
```

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose
70205	Accident	2013-01-01	Chiloquin, OR	United States	Non-Fatal	Substantial	Airplane	CESSNA	182P	No	...	I
70206	Accident	2013-01-02	North Las Vegas, NV	United States	Non-Fatal	Substantial	Airplane	PIPER	PA-60-602P	No	...	I
70207	Accident	2013-01-02	Delano, CA	United States	Fatal	Destroyed	Helicopter	BELL	206	No	...	Other
70208	Accident	2013-01-02	Jasper, AL	United States	Fatal	Destroyed	Airplane	PIPER	PA-30	No	...	
70209	Accident	2013-01-02	Seminole, OK	United States	Non-Fatal	Substantial	Helicopter	EUROCOPTER	EC130 B4	No	...	
...	...	...	...	...	...	...	...	...	...	...	...	...
84601	Accident	2022-12-21	Reserve, LA	United States	Minor	NaN	NaN	GRUMMAN AMERICAN AVN. CORP.	AA-5B	No	...	I
84602	Accident	2022-12-22	Brasnorste,	Brazil	Fatal	NaN	NaN	AIR TRACTOR	AT502	No	...	
84603	Accident	2022-12-26	Annapolis, MD	United States	Minor	NaN	NaN	PIPER	PA-28-151	No	...	
84604	Accident	2022-12-26	Payson, AZ	United States	Non-Fatal	Substantial	Airplane	AMERICAN CHAMPION AIRCRAFT	8GCBC	No	...	
84605	Accident	2022-12-29	Athens, GA	United States	Minor	NaN	NaN	PIPER	PA-24-260	No	...	

14401 rows × 22 columns

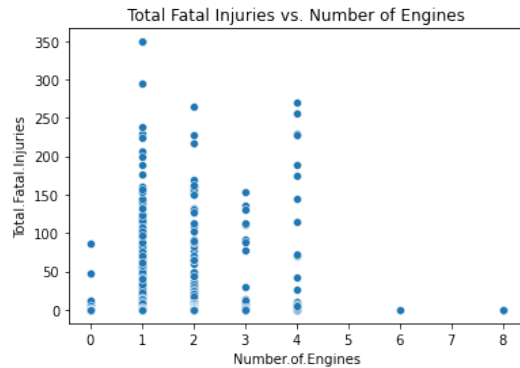
```
In [35]: sns.scatterplot(x = data['Total.Uninjured'], y = data['Total.Fatal.Injuries'].sort_values(ascending = True), hue =
plt.title("Relationship Between Total Uninjured and Total Fatal Injuries by Number of Engines")
plt.show()
```

Relationship Between Total Uninjured and Total Fatal Injuries by Number of Engines



```
In [36]: sns.scatterplot(x = data['Number.ofEngines'], y = data['Total.Fatal.Injuries'], data = data )
plt.title("Total Fatal Injuries vs. Number of Engines")
```

```
Out[36]: Text(0.5, 1.0, 'Total Fatal Injuries vs. Number of Engines')
```



```
In [37]: data['Number.ofEngines'].value_counts()
```

```
Out[37]: 1.0    72899
         2.0    10011
         0.0     1203
         4.0      249
         3.0      240
         8.0         3
         6.0         1
         Name: Number.ofEngines, dtype: int64
```

Examining the average Fatal Injuries for planes with 1-4 engines

```
In [38]: def average_FI(x):
          sum_of_column_1 = data[data['Number.ofEngines'] == x]['Total.Fatal.Injuries'].sum()
          count_of_column = data[data['Number.ofEngines'] == x]['Total.Fatal.Injuries'].count()
          print('Average Fatal Injuries for Planes with', x , 'Engine : ', sum_of_column_1/count_of_column)

          print(average_FI(1))
          print(average_FI(2))
          print(average_FI(3))
          print(average_FI(4))
```

```
Average Fatal Injuries for Planes with 1 Engine :  0.4710489855827926
None
Average Fatal Injuries for Planes with 2 Engine :  1.2343422235540904
None
Average Fatal Injuries for Planes with 3 Engine :  4.2375
None
Average Fatal Injuries for Planes with 4 Engine :  8.040160642570282
None
```

```
In [39]: print(data[data['Number.ofEngines'] == 1].mean())
```

```
<ipython-input-39-0bc54f72b4fb>:1: FutureWarning: DataFrame.mean and DataFrame.median with numeric_only=None will
include datetime64 and datetime64tz columns in a future version.
  print(data[data['Number.ofEngines'] == 1].mean())

Number.ofEngines      1.000000
Total.Fatal.Injuries  0.471049
Total.Serious.Injuries 0.227013
Total.Minor.Injuries  0.227013
Total.Uninjured      1.394765
Year                 1999.017792
Month                 6.610530
dtype: float64
```

```
In [40]: top_5_make = filtered_df['Make'].value_counts().head(5)
top_5_make
```

```
Out[40]: CESSNA    2864
         PIPER     1645
         Cessna    754
         BEECH     582
         Piper     465
         Name: Make, dtype: int64
```

```
In [41]: filtered_df['Make'].value_counts().quantile(.9)
```

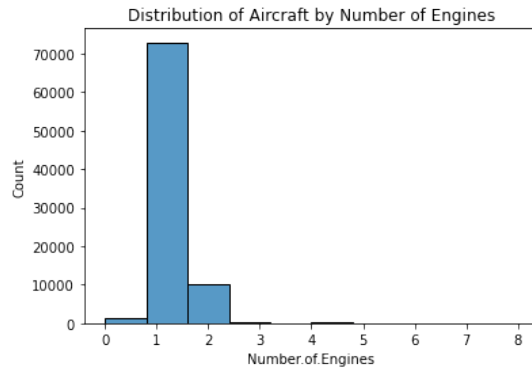
```
Out[41]: 4.0
```

```
In [42]: print((data['Number.of.Engines']).dtype)
```

```
float64
```

```
In [43]: sns.histplot(data['Number.of.Engines'], bins = 10)
plt.title("Distribution of Aircraft by Number of Engines")
```

```
Out[43]: Text(0.5, 1.0, 'Distribution of Aircraft by Number of Engines')
```



```
In [44]: data['Make'].value_counts()
```

```
Out[44]: Cessna      21969
Piper       11882
CESSNA      4724
Beech       4170
PIPER       2764
...
Ryskamp      1
STEINMAN MARK E  1
Mahoney      1
BREEZER AIRCRAFT  1
ERICKSON LARRY D  1
Name: Make, Length: 8145, dtype: int64
```

Creating a filtered data fram with what we decdied are the safest manufactuers

```
In [45]: focused_makes = ['Cessna', 'Airbus', 'Piper', 'Beech', 'Bell ', 'Boeing', 'Robinson']
make_focused_df = filtered_df[filtered_df['Make'].isin(focused_makes)]
make_focused_df
```

Out [45]:

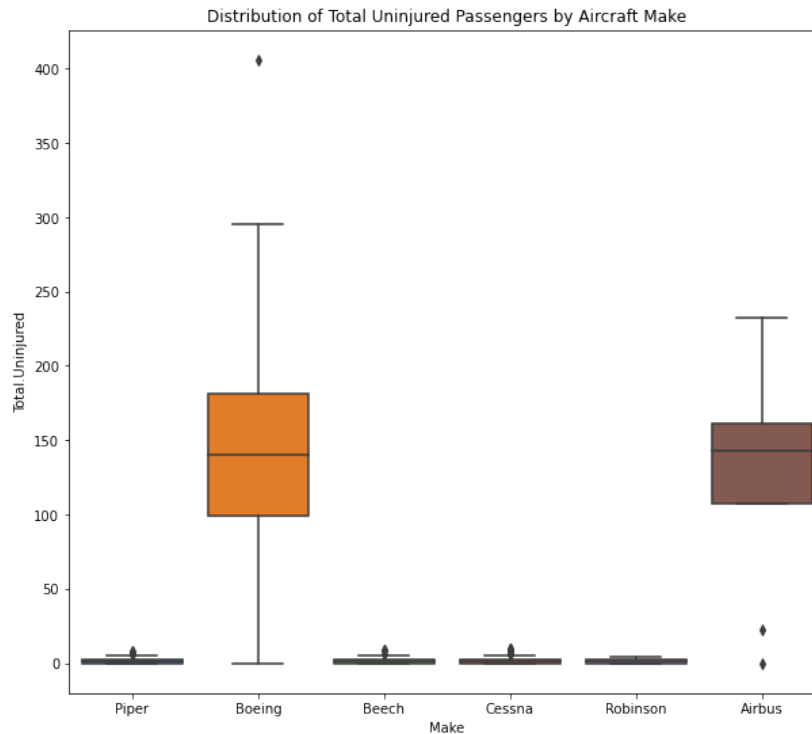
	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.of
70249	Accident	2013-01-17	Tuxtla Gutierrez, Mexico	Mexico	Fatal	Substantial	Airplane	Piper	PA-31-325	No	...	
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
70734	Accident	2013-05-31	Cochenour, Canada	Canada	Fatal	Substantial	Airplane	Beech	3N	No	...	Unk
70777	Accident	2013-06-08	Mosca, CO	United States	Fatal	Substantial	Airplane	Piper	PA-28-140	No	...	Pei
71064	Accident	2013-07-31	Jonesboro, AR	United States	Non-Fatal	Substantial	Airplane	Cessna	140	No	...	Pei
...	...	...	...	...	...	...	...	...	...	...	...	
81555	Accident	2020-09-22	Lincolnton, GA	United States	Fatal	Substantial	Airplane	Cessna	182	No	...	Pei
81557	Accident	2020-09-22	Pacific City, OR	United States	Non-Fatal	Substantial	Airplane	Piper	PA 12	No	...	Pei
81563	Accident	2020-09-23	Floral City, FL	United States	Fatal	Destroyed	Airplane	Piper	PA25	No	...	Aerial Appli
81574	Accident	2020-09-25	Rogers, AR	United States	Non-Fatal	Substantial	Airplane	Piper	PA46R-350T	No	...	Instruc
81804	Accident	2020-12-08	Dillon, MT	United States	Non-Fatal	Substantial	Airplane	Cessna	172	No	...	Pei

1530 rows × 22 columns

In [ ]:

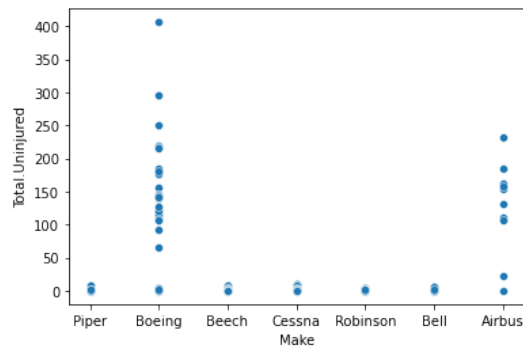
```
In [54]: plt.figure(figsize=(10, 9))
sns.boxplot(x = make_focused_df['Make'], y = make_focused_df['Total.Uninjured'], data = make_focused_df, orient =
plt.title('Distribution of Total Uninjured Passengers by Aircraft Make')
```

```
Out[54]: Text(0.5, 1.0, 'Distribution of Total Uninjured Passengers by Aircraft Make')
```



```
In [192]: sns.scatterplot(x = make_focused_df['Make'], y = data['Total.Uninjured'], data = make_focused_df )
```

```
Out[192]: <AxesSubplot:xlabel='Make', ylabel='Total.Uninjured'>
```



Examining the average Fatal Injuries per Manufacturer

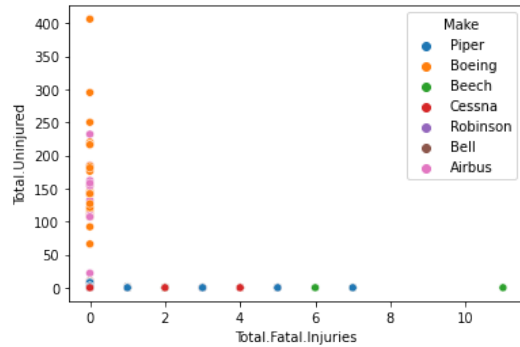
```
In [197]: def average_FI(x):
sum_of_column_1 = data[data['Make'] == x]['Total.Fatal.Injuries'].sum()
count_of_column = data[data['Make'] == x]['Total.Fatal.Injuries'].count()
print('Average Fatal Injuries for Planes with', x , 'manufacturer : ', sum_of_column_1/count_of_column)

piper_avg = average_FI('Piper')
boeing_avg = average_FI('Boeing')
airbus_avg = average_FI('Airbus')
cessna_avg = average_FI('Cessna')
```

```
Average Fatal Injuries for Planes with Piper manufacturer : 0.4549739101161421
Average Fatal Injuries for Planes with Boeing manufacturer : 7.215469613259685
Average Fatal Injuries for Planes with Airbus manufacturer : 6.277777777777778
Average Fatal Injuries for Planes with Cessna manufacturer : 0.3498110974555055
```

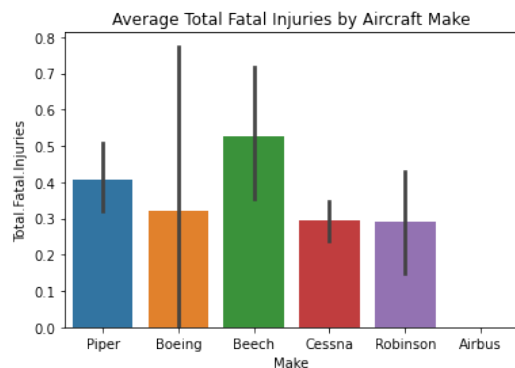
```
In [198]: sns.scatterplot(x = make_focused_df['Total.Fatal.Injuries'], y = data['Total.Uninjured'], hue = 'Make', data = make_focused_df)
```

```
Out[198]: <AxesSubplot:xlabel='Total.Fatal.Injuries', ylabel='Total.Uninjured'>
```



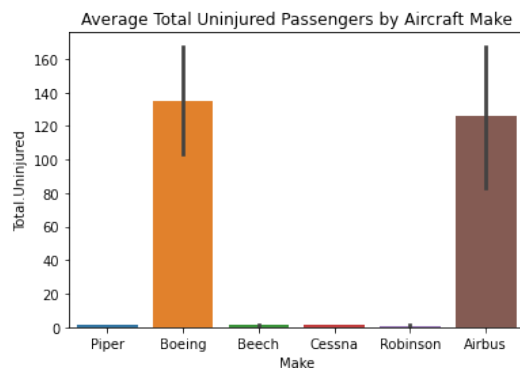
```
In [52]: sns.barplot(x = 'Make', y = 'Total.Fatal.Injuries', data = make_focused_df)
plt.title("Average Total Fatal Injuries by Aircraft Make")
```

```
Out[52]: Text(0.5, 1.0, 'Average Total Fatal Injuries by Aircraft Make')
```



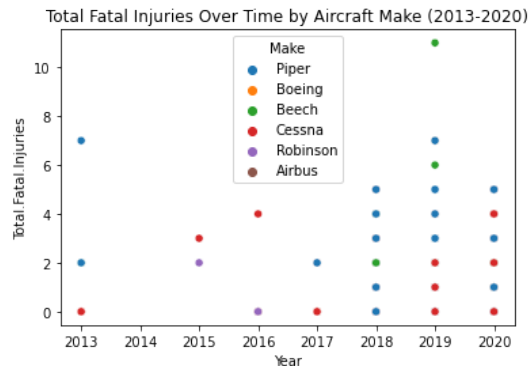
```
In [55]: sns.barplot(x = 'Make', y = 'Total.Uninjured', data = make_focused_df)
plt.title('Average Total Uninjured Passengers by Aircraft Make')
```

```
Out[55]: Text(0.5, 1.0, 'Average Total Uninjured Passengers by Aircraft Make')
```



```
In [59]: plt.title('Total Fatal Injuries Over Time by Aircraft Make (2013-2020)')
sns.scatterplot(x = make_focused_df['Year'], y = data['Total.Fatal.Injuries'], hue = 'Make', data = make_focused_
```

```
Out[59]: <AxesSubplot:title={ 'center': 'Total Fatal Injuries Over Time by Aircraft Make (2013-2020)', xlabel='Year', ylabel='Total.Fatal.Injuries'>
```



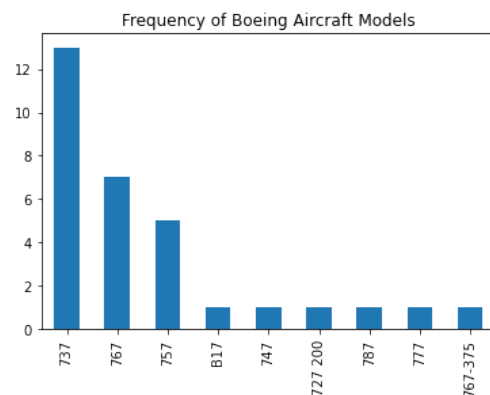
```
In [61]: list_of_make = ['Boeing', 'Airbus']
boeing_data = make_focused_df[make_focused_df['Make'].isin(['Boeing'])]
Airbus_data = make_focused_df[make_focused_df['Make'].isin(['Airbus'])]
B_A_data = make_focused_df[make_focused_df['Make'].isin(list_of_make)]
```

```
In [62]: boeing_data
```

```
Out[62]:
```

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
74695	Accident	2016-02-17	Detroit, MI	United States	Non-Fatal	Minor	Airplane	Boeing	737	No	...	
77044	Accident	2017-08-15	Queens, NY	United States	Non-Fatal	Substantial	Airplane	Boeing	757	No	...	
77184	Accident	2017-09-12	Los Angeles, CA	United States	Non-Fatal	Substantial	Airplane	Boeing	767-375	No	...	

```
In [63]: boeing_data['Model'].value_counts().plot(
kind = 'bar')
plt.title('Frequency of Boeing Aircraft Models')
plt.show()
```



```
In [64]: print((boeing_data['Model']).dtype)
```

```
object
```



```
In [65]: list_of_models = ['737', '767', '757']
models_boeing_data = boeing_data[boeing_data['Model'].isin(list_of_models)]
```

```
In [66]: models_boeing_data['Model'].unique()
```

```
Out[66]: array(['737', '757', '767'], dtype=object)
```

```
In [68]: boeing_data
```

```
Out[68]:
```

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
74695	Accident	2016-02-17	Detroit, MI	United States	Non-Fatal	Minor	Airplane	Boeing	737	No	...	
77044	Accident	2017-08-15	Queens, NY	United States	Non-Fatal	Substantial	Airplane	Boeing	757	No	...	
77184	Accident	2017-09-12	Los Angeles, CA	United States	Non-Fatal	Substantial	Airplane	Boeing	767-375	No	...	

```
In [69]: data['Make'].value_counts()
```

```
Out[69]: Cessna      21969
Piper      11882
CESSNA     4724
Beech      4170
PIPER      2764
...
Ryskamp          1
STEINMAN MARK E  1
Mahoney          1
BREEZER AIRCRAFT 1
ERICKSON LARRY D 1
Name: Make, Length: 8145, dtype: int64
```

```
In [71]: B_A_data
```

```
Out[71]:
```

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
74695	Accident	2016-02-17	Detroit, MI	United States	Non-Fatal	Minor	Airplane	Boeing	737	No	...	
77044	Accident	2017-08-15	Queens, NY	United States	Non-Fatal	Substantial	Airplane	Boeing	757	No	...	
77184	Accident	2017-09-12	Los Angeles, CA	United States	Non-Fatal	Substantial	Airplane	Boeing	767-375	No	...	

```
In [261]: B_A_data['Model'].unique()
```

```
Out[261]: array(['737', '757', '767-375', 'A319', '767', 'A321', '747', 'A320',
                '727 200', '787', '777', 'B17'], dtype=object)
```

In [73]: B\_A\_data

80613	Accident	2020-01-10	New Orleans, LA	United States	Non-Fatal	NaN	Airplane	Airbus	A320	No ...
80790	Accident	2020-03-08	Shannon, Ireland	Ireland	Non-Fatal	Substantial	Airplane	Boeing	767	No ...
80817	Accident	2020-03-21	Las Vegas, NV	United States	Non-Fatal	Substantial	Airplane	Boeing	757	No ...
81404	Accident	2020-08-19	Los Angeles, CA	United States	Non-Fatal	Substantial	Airplane	Boeing	767	No ...
81442	Accident	2020-08-28	Bucharest, Romania	Romania	Non-Fatal	Substantial	Airplane	Boeing	767	No ...

41 rows × 22 columns

```
In [74]: boeing_data['sum_fatal_serious']
         boeing_data['Total.Uninjured']
```

```
Out[74]: 70315    107.0
         74695    155.0
         77044    295.0
         77184    140.0
         78456    250.0
         78489    181.0
         78717    112.0
         78738     2.0
         78788    176.0
         78857    121.0
         78883    142.0
         78963     4.0
         79048    146.0
         79049     92.0
         79180     4.0
         79191    220.0
         79193    117.0
         79223    143.0
         79239     0.0
         79248    217.0
         79291    406.0
         79388    107.0
         79482    142.0
         79935    216.0
         80290     0.0
         80545    184.0
         80609    121.0
         80790    181.0
         80817    127.0
         81404     1.0
         81442     66.0
         Name: Total.Uninjured, dtype: float64
```

In [286]: final\_makes

Out[286]: ['Cessna', 'Airbus', 'Piper', 'Beech', 'Boeing']

```
In [79]: final_makes = ['Cessna', 'Airbus', 'Piper', 'Beech', 'Boeing']
         final_make_focused_df = filtered_df[filtered_df['Make'].isin(final_makes)]
```

In [80]: `final_make_focused_df`

Out[80]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.of
70249	Accident	2013-01-17	Tuxtla Gutierrez, Mexico	Mexico	Fatal	Substantial	Airplane	Piper	PA-31-325	No	...	
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
70734	Accident	2013-05-31	Cochenour, Canada	Canada	Fatal	Substantial	Airplane	Beech	3N	No	...	Unk
70777	Accident	2013-06-08	Mosca, CO	United States	Fatal	Substantial	Airplane	Piper	PA-28-140	No	...	Pei
71064	Accident	2013-07-31	Jonesboro, AR	United States	Non-Fatal	Substantial	Airplane	Cessna	140	No	...	Pei
...	...	...	...	...	...	...	...	...	...	...	...	
81555	Accident	2020-09-22	Lincolnton, GA	United States	Fatal	Substantial	Airplane	Cessna	182	No	...	Pei
81557	Accident	2020-09-22	Pacific City, OR	United States	Non-Fatal	Substantial	Airplane	Piper	PA 12	No	...	Pei
81563	Accident	2020-09-23	Floral City, FL	United States	Fatal	Destroyed	Airplane	Piper	PA25	No	...	Aerial Appli
81574	Accident	2020-09-25	Rogers, AR	United States	Non-Fatal	Substantial	Airplane	Piper	PA46R-350T	No	...	Instruc
81804	Accident	2020-12-08	Dillon, MT	United States	Non-Fatal	Substantial	Airplane	Cessna	172	No	...	Pei

1437 rows x 22 columns

In [81]: `final_make_focused_df['Weather.Condition'].isna().value_counts()`

Out[81]: False 1328  
True 109  
Name: Weather.Condition, dtype: int64

In [82]: `final_make_focused_df['Number.of.Engines'].value_counts()`

Out[82]: 1.0 1201  
2.0 232  
4.0 2  
3.0 2  
Name: Number.of.Engines, dtype: int64

In [83]: `print((final_make_focused_df['Number.of.Engines']).dtype)`

float64

In [84]: final\_make\_focused\_df

Out[84]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.of
70249	Accident	2013-01-17	Tuxtla Gutierrez, Mexico	Mexico	Fatal	Substantial	Airplane	Piper	PA-31-325	No	...	
70315	Accident	2013-02-11	Muscat, Mauritius	Mauritius	Non-Fatal	Minor	NaN	Boeing	737	No	...	
70734	Accident	2013-05-31	Cochenour, Canada	Canada	Fatal	Substantial	Airplane	Beech	3N	No	...	Unk
70777	Accident	2013-06-08	Mosca, CO	United States	Fatal	Substantial	Airplane	Piper	PA-28-140	No	...	Pei
71064	Accident	2013-07-31	Jonesboro, AR	United States	Non-Fatal	Substantial	Airplane	Cessna	140	No	...	Pei
...	...	...	...	...	...	...	...	...	...	...	...	
81555	Accident	2020-09-22	Lincolnton, GA	United States	Fatal	Substantial	Airplane	Cessna	182	No	...	Pei
81557	Accident	2020-09-22	Pacific City, OR	United States	Non-Fatal	Substantial	Airplane	Piper	PA 12	No	...	Pei
81563	Accident	2020-09-23	Floral City, FL	United States	Fatal	Destroyed	Airplane	Piper	PA25	No	...	Aerial Appli
81574	Accident	2020-09-25	Rogers, AR	United States	Non-Fatal	Substantial	Airplane	Piper	PA46R-350T	No	...	Instruc
81804	Accident	2020-12-08	Dillon, MT	United States	Non-Fatal	Substantial	Airplane	Cessna	172	No	...	Pei

1437 rows x 22 columns

In [85]: two\_E\_df = final\_make\_focused\_df[final\_make\_focused\_df['Number.of.Engines'].isin([2,0])]  
two\_E\_df['Aircraft.damage'].value\_counts()

Out[85]: Substantial 152  
Destroyed 53  
Minor 5  
Name: Aircraft.damage, dtype: int64

In [86]: two\_E\_df['Model'].unique()

Out[86]: array(['PA-31-325', '737', '757', '767-375', '414', 'PA34', 'B100', '402',  
'PA31', '320', '337', '421', '58', '76', '90', '310', '560', '750',  
'A319', 'C90', '767', 'PA60', 'B300', 'T337', 'A188', '33', 'PA44',  
'200', 'T310', '340A', '335', 'A185', 'A321', '340', 'V35', '1900',  
'55', 'PA31T', 'PA23', '441', 'PA 30', '525', '550', 'A320',  
'PA 23', '400', 'D55', '65', '777', 'A100', 'E55', '650', '50',  
'L19', '95B55', '60', 'PA28R', 'A60', '425', 'E90', '65-A90', '95',  
'T303', 'PA 31P', 'J3C', 'AEROSTAR 602P', '205', 'PA-34-200T',  
'350', 'PA 31T', '501', '510', '404', 'TU206', 'PA-23-250', 'F90',  
'PA 15', '95 55', '35'], dtype=object)

```
In [87]: final_make_focused_df['Model'].unique()
```

```
Out[87]: array(['PA-31-325', '737', '3N', 'PA-28-140', '140', '172', '182G', '180',
'500', '182T', 'PA 18A', '177RG', '757', '767-375', '150J', '414',
'PA34', '35', 'A188', 'B100', 'PA28R', 'R172', '402', 'PA31', 'PA',
'PA22', 'PA18', 'D17', '182', 'T210', '320', 'PA28', 'PA32',
'35B33', 'A36', 'PA 25', '152', '337', 'A185', '421', '58', 'PA46',
'208', '76', 'T34', '90', '150', 'E162', 'PA 20', 'PA185', 'V35',
'CESSNA R182', '170', '310', '210C', '195', '560', '750', 'A319',
'PA32R', 'C90', 'PA24', '767', '210', '177', 'PA 12', 'PA60',
'B300', 'PA-31', '188', '185', '120', '207', 'T337', 'R182',
'U206', 'A36TC', '525', 'J3C', 'R172E', '36', 'PA-28-235', 'T206',
'P210', 'B60', '55', 'P210N', 'PA32RT', '33', 'PA44', '200',
'150L', '206', '305', 'T310', '340A', '335', 'TU206', 'PA-12-150',
'PA-32RT', 'A321', '340', '210 5', 'PA 24-180', '1900', '205',
'PA 16', 'F172', 'F33', 'PA 18-135', 'PA31T', '747', 'PA23', '441',
'C23', 'PA 30', '550', 'J4', '172P', 'A320', 'PA-24-250', 'R172K',
'PA 23', '24', 'PA25', 'PA-32R-300', 'PA 18', 'PA-22-150', 'B19',
'727 200', '787', '400', '172RG', 'D55', '65', 'T182', '777',
'L19', 'A100', 'E55', '650', 'PA 11', '50', 'PA 24', '95B55',
'175', 'PA-32-300', '60', 'PA-28R-200', 'PA 18 225 DD', 'A60',
'162', 'TR182', '425', 'E90', '182M', 'PA-11', 'L21', '65-A90',
'77', '95', '23', 'A23', '19', 'T188', 'P206', 'PA36',
'210 5(205)', 'PA19', '305A', 'PA22-150', 'T303', '208B', 'PA 31P',
'560XL', 'PA28RT', 'PA-18', '510', 'PA38', '195A', 'C24', '172F',
'PA 22', 'B17', 'AEROSTAR 602P', 'N35', 'E35', 'PA-31-350',
'PA-34-200T', '350', 'PA 31T', '172H', '172Q', 'B36TC', '501',
'TP206', '404', 'PA-32RT-300T', 'PA-23-250', 'T210L', 'F90',
'35-A33', 'PA-24-180', '182J', 'D 45', 'PA 15', 'J3C-65',
'PA18A-150', 'PA 18A-135', 'FR172', '95 55', 'A23-24', '170B',
'A185F', 'PA 14', 'PA 20-135', 'PA28-140', 'PA46R-350T'],
dtype=object)
```

```
In [88]: percent_reduced = len(two_E_df['Model'].unique())/(len(two_E_df['Model'].unique()) + len(final_make_focused_df['Mo
```

```
In [ ]: After deciding that planes with two engines were the safest. This reduced the amount of available engines by 3/4ths
```

```
In [89]: percent_reduced
```

```
Out[89]: 0.265993265993266
```

```
In [92]: boeing_data_2E = final_make_focused_df[final_make_focused_df['Make'].isin(['Boeing'])]
airbus_data_2E = final_make_focused_df[final_make_focused_df['Make'].isin(['Airbus'])]
beech_data_2E = final_make_focused_df[final_make_focused_df['Make'].isin(['Beech'])]
cessna_data_2E = final_make_focused_df[final_make_focused_df['Make'].isin(['Cessna'])]
piper_data_2E = final_make_focused_df[final_make_focused_df['Make'].isin(['Piper'])]
```

Looking at the average mortality rate (people the died/total people on plane (fatal+major+minor+non-injured) for each model of each manufacturer

```
In [93]: boeing_data_2E['AMR'] = boeing_data_2E['Total.Fatal.Injuries']/((boeing_data_2E['Total.Fatal.Injuries'])+boeing_data_2E['Total.Serious.Injuries'])+boeing_data_2E['Total.Minor.Injuries']
boeing_data_2E['ASR'] = abs((boeing_data_2E['Total.Fatal.Injuries']/((boeing_data_2E['Total.Fatal.Injuries'])+boeing_data_2E['Total.Serious.Injuries'])+boeing_data_2E['Total.Minor.Injuries'])-1)
```

```
<ipython-input-93-aa6384208d78>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
boeing_data_2E['AMR'] = boeing_data_2E['Total.Fatal.Injuries']/((boeing_data_2E['Total.Fatal.Injuries'])+boeing_data_2E['Total.Serious.Injuries'])+boeing_data_2E['Total.Minor.Injuries']
```

```
<ipython-input-93-aa6384208d78>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
boeing_data_2E['ASR'] = abs((boeing_data_2E['Total.Fatal.Injuries']/((boeing_data_2E['Total.Fatal.Injuries'])+boeing_data_2E['Total.Serious.Injuries'])+boeing_data_2E['Total.Minor.Injuries'])-1))
```

```
Out[93]: 70315    1.000000
74695    1.000000
77044    1.000000
77184    1.000000
78456    1.000000
78489    1.000000
78717    1.000000
78738    1.000000
78788    1.000000
78857    1.000000
78883    1.000000
78963    1.000000
79048    1.000000
79049    1.000000
79180    1.000000
79191    1.000000
79193    1.000000
79223    1.000000
79239    0.000000
79248    1.000000
79291    1.000000
79388    1.000000
79482    1.000000
79935    1.000000
80290    0.222222
80545    1.000000
80609    1.000000
80790    1.000000
80817    1.000000
81404    1.000000
81442    1.000000
Name: ASR, dtype: float64
```

```
In [94]: cessna_data_2E['AMR'] = cessna_data_2E['Total.Fatal.Injuries']/(cessna_data_2E['Total.Fatal.Injuries']+cessna_data_2E['Total.Fatal.Injuries'])
airbus_data_2E['AMR'] = airbus_data_2E['Total.Fatal.Injuries']/(airbus_data_2E['Total.Fatal.Injuries']+airbus_data_2E['Total.Fatal.Injuries'])
piper_data_2E['AMR'] = piper_data_2E['Total.Fatal.Injuries']/(piper_data_2E['Total.Fatal.Injuries']+piper_data_2E['Total.Fatal.Injuries'])
beech_data_2E['AMR'] = beech_data_2E['Total.Fatal.Injuries']/(beech_data_2E['Total.Fatal.Injuries']+beech_data_2E['Total.Fatal.Injuries'])
##'Cessna', 'Airbus', 'Piper', 'Beech',
cessna_data_2E['ASR'] = abs((cessna_data_2E['Total.Fatal.Injuries']/(cessna_data_2E['Total.Fatal.Injuries']+cessna_data_2E['Total.Fatal.Injuries'])))
airbus_data_2E['ASR'] = abs((airbus_data_2E['Total.Fatal.Injuries']/(airbus_data_2E['Total.Fatal.Injuries']+airbus_data_2E['Total.Fatal.Injuries'])))
piper_data_2E['ASR'] = abs((piper_data_2E['Total.Fatal.Injuries']/(piper_data_2E['Total.Fatal.Injuries']+piper_data_2E['Total.Fatal.Injuries'])))
beech_data_2E['ASR'] = abs((beech_data_2E['Total.Fatal.Injuries']/(beech_data_2E['Total.Fatal.Injuries']+beech_data_2E['Total.Fatal.Injuries'])))
##xx3
```

```
<ipython-input-94-b39b89428abc>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
cessna_data_2E['AMR'] = cessna_data_2E['Total.Fatal.Injuries']/((cessna_data_2E['Total.Fatal.Injuries']+cessna_data_2E['Total.Serious.Injuries']+cessna_data_2E['Total.Minor.Injuries']+cessna_data_2E['Total.Uninjured']))
```

```
<ipython-input-94-b39b89428abc>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
airbus_data_2E['AMR'] = airbus_data_2E['Total.Fatal.Injuries']/((airbus_data_2E['Total.Fatal.Injuries']+airbus_data_2E['Total.Serious.Injuries']+airbus_data_2E['Total.Minor.Injuries']+airbus_data_2E['Total.Uninjured']))
```

```
<ipython-input-94-b39b89428abc>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
piper_data_2E['AMR'] = piper_data_2E['Total.Fatal.Injuries']/((piper_data_2E['Total.Fatal.Injuries']+piper_data_2E['Total.Serious.Injuries']+piper_data_2E['Total.Minor.Injuries']+piper_data_2E['Total.Uninjured']))
```

```
<ipython-input-94-b39b89428abc>:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
beech_data_2E['AMR'] = beech_data_2E['Total.Fatal.Injuries']/((beech_data_2E['Total.Fatal.Injuries']+beech_data_2E['Total.Serious.Injuries']+beech_data_2E['Total.Minor.Injuries']+beech_data_2E['Total.Uninjured']))
```

```
<ipython-input-94-b39b89428abc>:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
cessna_data_2E['ASR'] = abs((cessna_data_2E['Total.Fatal.Injuries']/((cessna_data_2E['Total.Fatal.Injuries']+cessna_data_2E['Total.Serious.Injuries']+cessna_data_2E['Total.Minor.Injuries']+cessna_data_2E['Total.Uninjured']))-100))
```

```
<ipython-input-94-b39b89428abc>:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
airbus_data_2E['ASR'] = abs((airbus_data_2E['Total.Fatal.Injuries']/((airbus_data_2E['Total.Fatal.Injuries']+airbus_data_2E['Total.Serious.Injuries']+airbus_data_2E['Total.Minor.Injuries']+airbus_data_2E['Total.Uninjured']))-100))
```

```
<ipython-input-94-b39b89428abc>:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
piper_data_2E['ASR'] = abs((piper_data_2E['Total.Fatal.Injuries']/((piper_data_2E['Total.Fatal.Injuries']+piper_data_2E['Total.Serious.Injuries']+piper_data_2E['Total.Minor.Injuries']+piper_data_2E['Total.Uninjured']))-100))
```

```
<ipython-input-94-b39b89428abc>:9: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
beech_data_2E['ASR'] = abs((beech_data_2E['Total.Fatal.Injuries']/((beech_data_2E['Total.Fatal.Injuries']+beech_data_2E['Total.Serious.Injuries']+beech_data_2E['Total.Minor.Injuries']+beech_data_2E['Total.Uninjured']))-100))
```

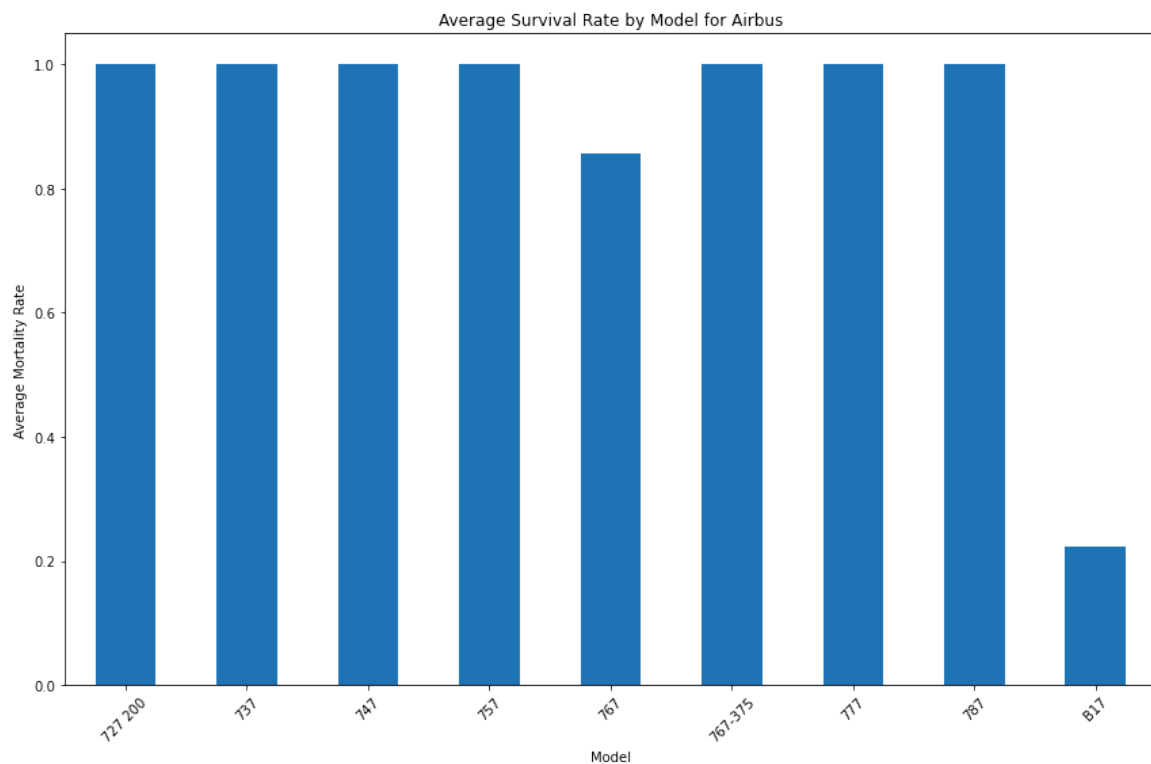


```
Out[94]: 70734      99.0
          77677      100.0
          77725      100.0
          78250      100.0
          78285      100.0
          ...
          81424      100.0
          81439      99.0
          81468      99.0
          81480      100.0
          81499      99.0
Name: ASR, Length: 177, dtype: float64
```

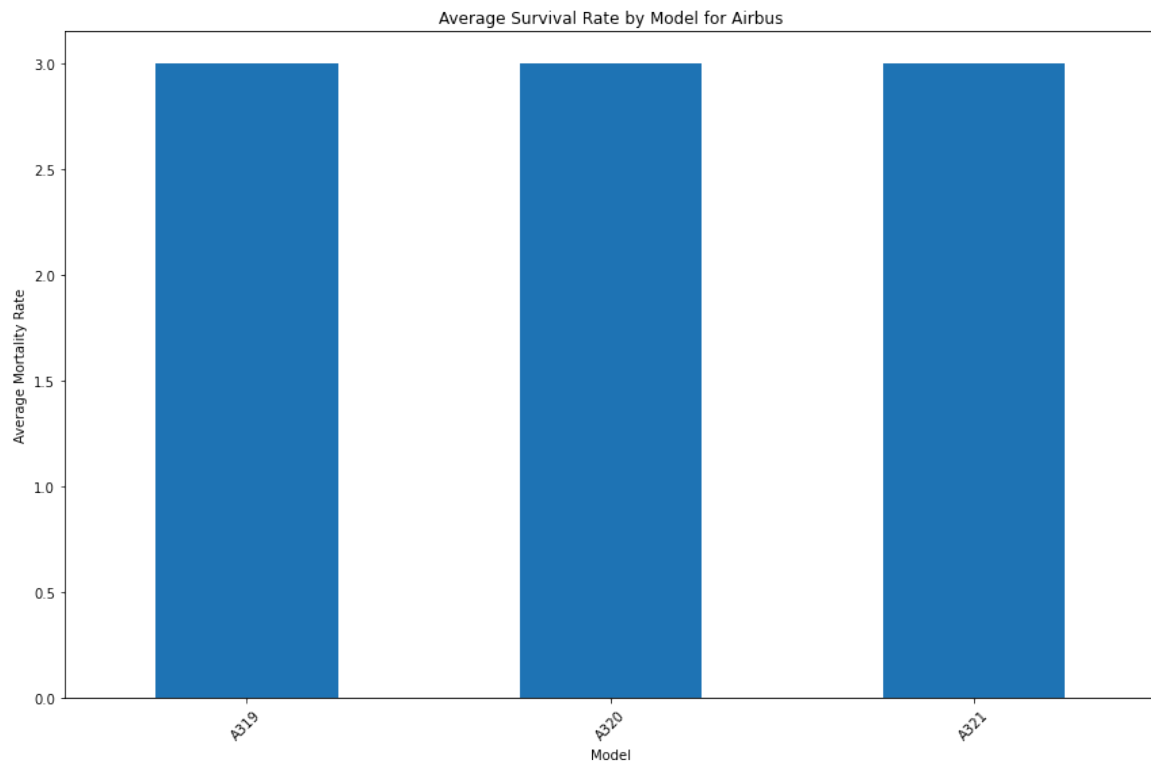
```
In [95]: beech_data_2E['Amateur.Built']
```

```
Out[95]: 70734      No
          77677      No
          77725      No
          78250      No
          78285      No
          ..
          81424      No
          81439      No
          81468      No
          81480      No
          81499      No
Name: Amateur.Built, Length: 177, dtype: object
```

```
In [96]: grouped_data_1 = boeing_data_2E.groupby('Model', as_index=False)['ASR'].mean()
grouped_data_2 = boeing_data_2E.groupby('Model', as_index=False)['ASR'].count()
# Create the bar graph
grouped_data_1.plot(
    kind='bar',
    x='Model', # Models on the x-axis
    y='ASR', # Average mortality rate on the y-axis
    figsize=(12, 8),
    title=f'Average Survival Rate by Model for Airbus', # Dynamic title
    legend=False
)
# Customize the plot
plt.xlabel('Model')
plt.ylabel('Average Mortality Rate')
plt.xticks(rotation=45) # Rotate x-axis labels for readability
plt.tight_layout()
plt.show()
```



```
In [100]: grouped_data_1 = airbus_data_2E.groupby('Model', as_index=False)['ASR'].mean()
grouped_data_2 = airbus_data_2E.groupby('Model', as_index=False)['ASR'].count()
# Create the bar graph
grouped_data_2.plot(
    kind='bar',
    x='Model', # Models on the x-axis
    y='ASR', # Average mortality rate on the y-axis
    figsize=(12, 8),
    title=f'Average Survival Rate by Model for Airbus', # Dynamic title
    legend=False
)
# Customize the plot
plt.xlabel('Model')
plt.ylabel('Average Mortality Rate')
plt.xticks(rotation=45) # Rotate x-axis labels for readability
plt.tight_layout()
plt.show()
```



```
In [102]: boeing_data_2E['Model'].unique()
```

```
Out[102]: array(['737', '757', '767-375', '767', '747', '727 200', '787', '777',
'B17'], dtype=object)
```

```
In [103]: boeing_data_2E
```

80545	Accident	2019-12-19	Chicago, IL	United States	Non-Fatal	NaN	Airplane	Boeing	737	No ...
80609	Accident	2020-01-08	New York, NY	United States	Non-Fatal	Substantial	Airplane	Boeing	737	No ...
80790	Accident	2020-03-08	Shannon, Ireland	Ireland	Non-Fatal	Substantial	Airplane	Boeing	767	No ...
80817	Accident	2020-03-21	Las Vegas, NV	United States	Non-Fatal	Substantial	Airplane	Boeing	757	No ...
81404	Accident	2020-08-19	Los Angeles, CA	United States	Non-Fatal	Substantial	Airplane	Boeing	767	No ...
81442	Accident	2020-08-28	Bucharest, Romania	Romania	Non-Fatal	Substantial	Airplane	Boeing	767	No ...

31 rows × 24 columns

In [104]: beech\_data\_2E

Out [104]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Total.Serious.
70734	Accident	2013-05-31	Cochenour, Canada	Canada	Fatal	Substantial	Airplane	Beech	3N	No	...	
77677	Accident	2018-02-08	Batesville, AR	United States	Non-Fatal	Substantial	Airplane	Beech	35	No	...	
77725	Accident	2018-02-23	Abbotsford, Canada	Canada	Non-Fatal	Substantial	Airplane	Beech	B100	No	...	
78250	Accident	2018-06-22	Hamilton, MT	United States	Non-Fatal	Substantial	Airplane	Beech	D17	No	...	
78285	Accident	2018-06-29	Berlin, MD	United States	Non-Fatal	Substantial	Airplane	Beech	35B33	No	...	
...	...	...	...	...	...	...	...	...	...	...	...	...
81424	Accident	2020-08-24	Nashville, TN	United States	Non-Fatal	Substantial	Airplane	Beech	55	No	...	
81439	Accident	2020-08-27	Redding, CA	United States	Fatal	Destroyed	Airplane	Beech	A36	No	...	
81468	Accident	2020-09-04	Three Rivers, CA	United States	Fatal	Destroyed	Airplane	Beech	35	No	...	
81480	Accident	2020-09-07	Canyon Lake, TX	United States	Non-Fatal	Substantial	Airplane	Beech	35	No	...	
81499	Accident	2020-09-11	Jackson, TN	United States	Fatal	Substantial	Airplane	Beech	A36	No	...	

177 rows × 24 columns

In [105]: data['Make'].value\_counts()[:10]

Out [105]: Cessna 21969  
Piper 11882  
CESSNA 4724  
Beech 4170  
PIPER 2764  
Bell 2091  
Grumman 1080  
Mooney 1074  
BEECH 996  
Robinson 942  
Name: Make, dtype: int64

In [106]: cessna\_data\_2E['Model']

Out [106]: 71064 140  
71157 172  
74437 182G  
75009 180  
75825 500  
...  
81543 170  
81550 172RG  
81552 182  
81555 182  
81804 172  
Name: Model, Length: 754, dtype: object

In [107]: VMC\_df = final\_make\_focused\_df[final\_make\_focused\_df['Weather.Condition'].isin(['VMC'])]

In [108]: VMC\_df

Out [108]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Purpose.of.f
70777	Accident	2013-06-08	Mosca, CO	United States	Fatal	Substantial	Airplane	Piper	PA-28-140	No	...	Per
71064	Accident	2013-07-31	Jonesboro, AR	United States	Non-Fatal	Substantial	Airplane	Cessna	140	No	...	Per
71157	Accident	2013-08-18	Kankakee, IL	United States	Non-Fatal	Substantial	Airplane	Cessna	172	No	...	Per
74695	Accident	2016-02-17	Detroit, MI	United States	Non-Fatal	Minor	Airplane	Boeing	737	No	...	
75009	Accident	2016-05-15	St. George, UT	United States	Non-Fatal	Substantial	Airplane	Cessna	180	No	...	Per
...	...	...	...	...	...	...	...	...	...	...	...	
81555	Accident	2020-09-22	Lincolnton, GA	United States	Fatal	Substantial	Airplane	Cessna	182	No	...	Per
81557	Accident	2020-09-22	Pacific City, OR	United States	Non-Fatal	Substantial	Airplane	Piper	PA 12	No	...	Per
81563	Accident	2020-09-23	Floral City, FL	United States	Fatal	Destroyed	Airplane	Piper	PA25	No	...	Aerial Applic
81574	Accident	2020-09-25	Rogers, AR	United States	Non-Fatal	Substantial	Airplane	Piper	PA46R-350T	No	...	Instruct
81804	Accident	2020-12-08	Dillon, MT	United States	Non-Fatal	Substantial	Airplane	Cessna	172	No	...	Per

1234 rows × 22 columns

In [113]: two\_E\_df['ASR'] = abs((two\_E\_df['Total.Fatal.Injuries']/(two\_E\_df['Total.Fatal.Injuries']+two\_E\_df['Total.Serious.

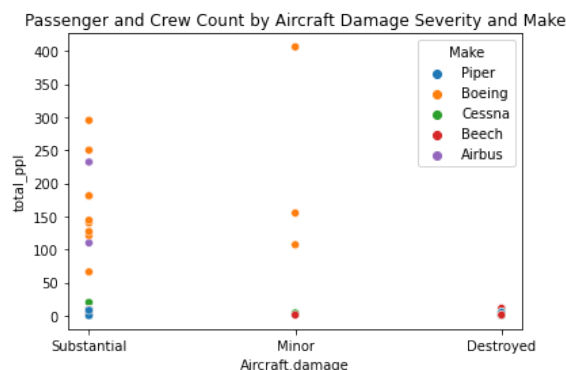
<ipython-input-113-e5430888c4cf>:1: SettingWithCopyWarning:  
A value is trying to be set on a copy of a slice from a DataFrame.  
Try using .loc[row\_indexer,col\_indexer] = value instead

See the caveats in the documentation: [https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy) ([https://pandas.pydata.org/pandas-docs/stable/user\\_guide/indexing.html#returning-a-view-versus-a-copy](https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy))

```
two_E_df['ASR'] = abs((two_E_df['Total.Fatal.Injuries']/(two_E_df['Total.Fatal.Injuries']+two_E_df['Total.Serious.Injuries']+two_E_df['Total.Minor.Injuries']+two_E_df['Total.Uninjured'])-1))
```

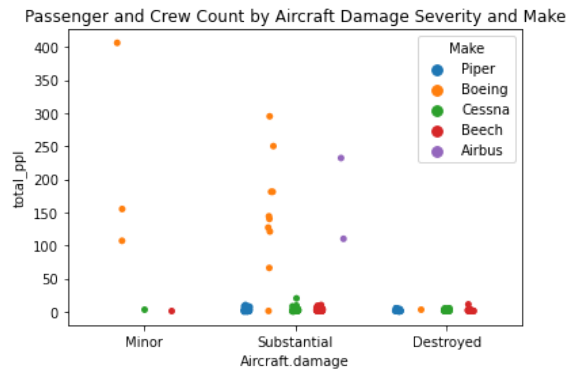
In [114]: sns.scatterplot( x = 'Aircraft.damage', y = 'total\_ppl', hue = 'Make', data = two\_E\_df)  
plt.title('Passenger and Crew Count by Aircraft Damage Severity and Make')

Out [114]: Text(0.5, 1.0, 'Passenger and Crew Count by Aircraft Damage Severity and Make')



```
In [135]: plt.title('Passenger and Crew Count by Aircraft Damage Severity and Make')
sns.stripplot(x='Aircraft.damage', y='total_ppl', hue='Make',dodge=True, order=["Minor", "Substantial", ""])
plt.show()
```

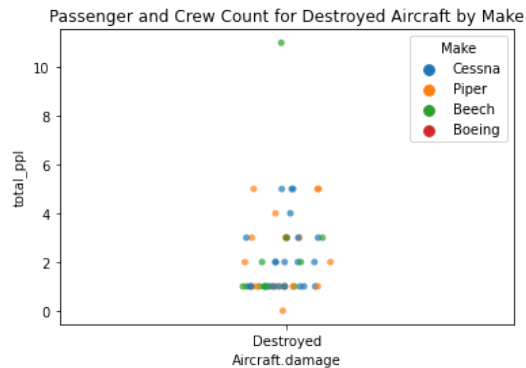
```
Out[135]: <AxesSubplot:title={'center':'Passenger and Crew Count by Aircraft Damage Severity and Make'}, xlabel='Aircraft.d
amage', ylabel='total_ppl'>
```



```
In [119]: df_D_only = two_E_df[two_E_df['Aircraft.damage'].isin(['Destroyed'])]
```

```
In [120]: sns.stripplot( x = 'Aircraft.damage', y = 'total_ppl', hue = 'Make', jitter = True, data = df_D_only, alpha=0.7)
plt.title('Passenger and Crew Count for Destroyed Aircraft by Make')
```

```
Out[120]: Text(0.5, 1.0, 'Passenger and Crew Count for Destroyed Aircraft by Make')
```



```
In [138]: df_D_only['Make']
```

```
Out[138]: 78282    Cessna
           78391    Piper
           78454    Piper
           78477    Beech
           78480    Piper
           78518    Cessna
           78687    Beech
           78727    Cessna
           78790    Beech
           78817    Beech
           78870    Piper
           78915    Piper
           78970    Cessna
           79002    Cessna
           79035    Piper
           79038    Cessna
           79042    Cessna
           79097    Beech
           79107    Piper
           79111    Piper
```

In [139]: df\_D\_only

79578	Accident	2019-05-24	Atlantic Ocean, AO	United States	Fatal	Destroyed	Airplane	Cessna	560	No	...
79674	Accident	2019-06-10	Butler, MO	United States	Fatal	Destroyed	Airplane	Cessna	425	No	...
79739	Accident	2019-06-22	Mokuleia, HI	United States	Fatal	Destroyed	Airplane	Beech	65-A90	No	...
79762	Accident	2019-06-27	Hope Mills, NC	United States	Fatal	Destroyed	Airplane	Beech	E55	No	...
79904	Accident	2019-07-18	Mesquite, NV	United States	Non-Fatal	Destroyed	Airplane	Cessna	550	No	...

```
In [140]: df_D_only[15:35]
```

Out [140]:

	Investigation.Type	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Aircraft.Category	Make	Model	Amateur.Built	...	Total.Serious
79038	Accident	2018-11-30	Memphis, IN	United States	Fatal	Destroyed	Airplane	Cessna	525	No	...	
79042	Accident	2018-12-01	Fort Lauderdale, FL	United States	Fatal	Destroyed	Airplane	Cessna	335	No	...	
79097	Accident	2018-12-25	Sioux Falls, SD	United States	Fatal	Destroyed	Airplane	Beech	58	No	...	
79107	Accident	2018-12-31	Beaver Island, MI	United States	Fatal	Destroyed	Airplane	Piper	PA 23	No	...	
79141	Accident	2019-01-17	Ellensburg, WA	United States	Fatal	Destroyed	Airplane	Piper	PA23	No	...	
79190	Accident	2019-02-03	Yorba Linda, CA	United States	Fatal	Destroyed	Airplane	Cessna	414	No	...	
79216	Accident	2019-02-15	Canadian, TX	United States	Fatal	Destroyed	Airplane	Cessna	421	No	...	
79233	Accident	2019-02-22	Stallion Springs, CA	United States	Fatal	Destroyed	Airplane	Beech	D55	No	...	
79239	Accident	2019-02-23	Trinity Bay, TX	United States	Fatal	Destroyed	Airplane	Boeing	767	No	...	
79279	Accident	2019-03-09	Longview, TX	United States	Fatal	Destroyed	Airplane	Cessna	T337	No	...	
79315	Accident	2019-03-17	Plain City, OH	United States	Fatal	Destroyed	Airplane	Cessna	421	No	...	
79416	Accident	2019-04-19	Fullerton, CA	United States	Fatal	Destroyed	Airplane	Beech	60	No	...	
79519	Accident	2019-05-11	Naples, FL	United States	Fatal	Destroyed	Airplane	Piper	PA 30	No	...	
79543	Accident	2019-05-15	Loveland, CO	United States	Fatal	Destroyed	Airplane	Beech	60	No	...	
79578	Accident	2019-05-24	Atlantic Ocean, AO	United States	Fatal	Destroyed	Airplane	Cessna	560	No	...	
79674	Accident	2019-06-10	Butler, MO	United States	Fatal	Destroyed	Airplane	Cessna	425	No	...	
79739	Accident	2019-06-22	Mokuleia, HI	United States	Fatal	Destroyed	Airplane	Beech	65-A90	No	...	
79762	Accident	2019-06-27	Hope Mills, NC	United States	Fatal	Destroyed	Airplane	Beech	E55	No	...	
79904	Accident	2019-07-18	Mesquite, NV	United States	Non-Fatal	Destroyed	Airplane	Cessna	550	No	...	
79965	Accident	2019-07-28	Gainesville, TX	United States	Fatal	Destroyed	Airplane	Piper	PA34	No	...	

20 rows × 24 columns



```
In [141]: refined_test_df = df_D_only[df_D_only['total_ppl'] > 0 ]
```

```
In [142]: refined_test_df_2 = refined_test_df[refined_test_df['total_ppl'] < 11]
```

```
In [143]: len(refined_test_df)
```

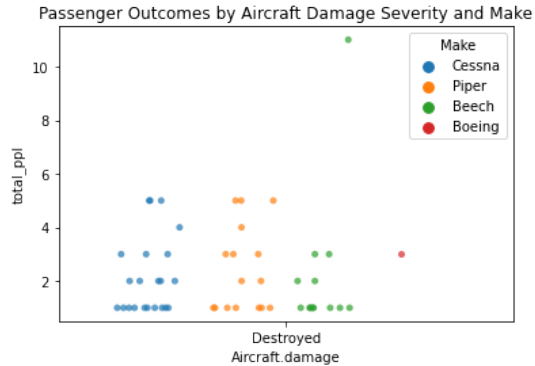
```
Out[143]: 52
```

```
In [144]: len(df_D_only)
```

```
Out[144]: 53
```

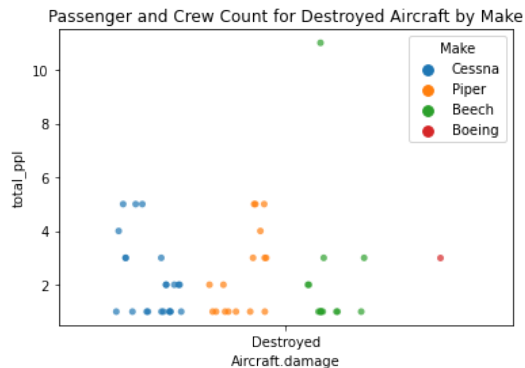
```
In [145]: sns.stripplot( x = 'Aircraft.damage', y = 'total_ppl', hue = 'Make', jitter = .3, dodge = True, data = refined_test_df)
plt.title("Passenger Outcomes by Aircraft Damage Severity and Make")
```

```
Out[145]: Text(0.5, 1.0, 'Passenger Outcomes by Aircraft Damage Severity and Make')
```



```
In [146]: plt.title('Passenger and Crew Count for Destroyed Aircraft by Make')
sns.stripplot( x = 'Aircraft.damage', y = 'total_ppl', hue = 'Make', jitter = .3, dodge = True, data = refined_test_df)
```

```
Out[146]: <AxesSubplot:title={'center':'Passenger and Crew Count for Destroyed Aircraft by Make'}, xlabel='Aircraft.damage', ylabel='total_ppl'>
```



```
In [147]: BOE_AIR_df = two_E_df[two_E_df['Make'].isin(['Boeing', 'Airbus'])]
```

In [148]: B0E\_AIR\_df

y	Make	Model	Amateur.Built	...	Total.Serious.Injuries	Total.Minor.Injuries	Total.Uninjured	Weather.Condition	Broad.phase.of.flight	Report.Status	Year	Month	ASR	total
N	Boeing	737	No	...	0.0	0.0	107.0	NaN	NaN	NaN	2013	2	1.0	1
ie	Boeing	737	No	...	0.0	0.0	155.0	VMC	NaN	N925NN flight crew's incorrect evaluation of t...	2016	2	1.0	1
ie	Boeing	757	No	...	0.0	0.0	295.0	VMC	NaN	the Delta B737 captain's failure to maintain p...	2017	8	1.0	2
ie	Boeing	767-375	No	...	0.0	0.0	140.0	VMC	NaN	the B737 flight crew's misjudgment of the clea...	2017	9	1.0	1

In [149]: df\_B0E\_AIR = final\_make\_focused\_df[final\_make\_focused\_df['Make'].isin(['Boeing', 'Airbus'])]

In [150]: df\_B0E\_AIR

Amateur.Built	...	Purpose.of.flight	Total.Fatal.Injuries	Total.Serious.Injuries	Total.Minor.Injuries	Total.Uninjured	Weather.Condition	Broad.phase.of.flight	Report.Status	Year	Month
No	...	NaN	0.0	0.0	0.0	107.0	NaN	NaN	NaN	2013	
No	...	NaN	0.0	0.0	0.0	155.0	VMC	NaN	N925NN flight crew's incorrect evaluation of t...	2016	
No	...	NaN	0.0	0.0	0.0	295.0	VMC	NaN	the Delta B737 captain's failure to maintain p...	2017	
No	...	NaN	0.0	0.0	0.0	140.0	VMC	NaN	the B737 flight crew's misjudgment of the clea...	2017	

In [151]: sns.stripplot(x='Model', y='total\_ppl', jitter=.3, dodge=True, data=B0E\_AIR\_df, alpha=0.7)  
plt.title("Passenger Outcomes by Aircraft Damage Severity and Make", fontsize=10)

Out[151]: Text(0.5, 1.0, 'Passenger Outcomes by Aircraft Damage Severity and Make')

