birdstrikedataanalysis

November 7, 2024

Objective :- Analyze the bird strikes during phase of flight between year 2000 to 2011 and study the some cases.

1 >> Requirements

Programming language:- python version 3.7.0 or greater

Code Editor/IDE:- Jupyter Notebook

System :- windows 32bit/64bit

software and libraries :- plolty,seaborn,matplotlib,pandas,numpy

[10]:
```
# Firstly You Have Install necessary libraries that we will use in this data␣
 ↪analysis project
"""Install Libraries Using pip"""
# pip install plotly
# pip install seaborn
# pip install matplotlib
# pip install pandas
# pip install numpy
```

[10]:
```
'Install Libraries Using pip'
```

Import necessary libraries

[11]:
```
import plotly.express as px
import matplotlib.pyplot as plt
import seaborn as sb
import plotly.graph_objects as go
from plotly.subplots import make_subplots
import numpy as np
import pandas as pd
```

2 >> Data Collection

Load The Dataset

We Already have bird_strike_dataset_2000_2011. we will load this dataset directly in our notebook using pandas

[12]:
```
# Load Amazon Sales DataSet Using pandas
# Replace with the original path of your dataset
BirdStrike = pd.read_csv("D:\\UnifiedMentorInternship\Bird Strikes data.xlsx - Bird Strikes.csv")
```

[13]:
```
#  Show first 5 values of Dataset
BirdStrike.head(5)
```

[13]:

	Record ID	Aircraft: Type	Airport: Name	Altitude bin	\
0	202152	Airplane	LAGUARDIA NY	> 1000 ft	
1	208159	Airplane	DALLAS/FORT WORTH INTL ARPT	< 1000 ft	
2	207601	Airplane	LAKEFRONT AIRPORT	< 1000 ft	
3	215953	Airplane	SEATTLE-TACOMA INTL	< 1000 ft	
4	219878	Airplane	NORFOLK INTL	< 1000 ft	

	Aircraft: Make/Model	Wildlife: Number struck	\
0	B-737-400	Over 100	
1	MD-80	Over 100	
2	C-500	Over 100	
3	B-737-400	Over 100	
4	CL-RJ100/200	Over 100	

	Wildlife: Number Struck	Actual	Effect: Impact to flight	FlightDate	\
0	859		Engine Shut Down	11/23/00 0:00	
1	424		NaN	7/25/01 0:00	
2	261		NaN	9/14/01 0:00	
3	806		Precautionary Landing	9/5/02 0:00	
4	942		NaN	6/23/03 0:00	

	Effect: Indicated Damage	…	Remains of wildlife sent to Smithsonian	\
0	Caused damage	…	False	
1	Caused damage	…	False	
2	No damage	…	False	
3	No damage	…	False	
4	No damage	…	False	

	Remarks	Wildlife: Size	\
0	FLT 753. PILOT REPTD A HUNDRED BIRDS ON UNKN T…	Medium	
1	102 CARCASSES FOUND. 1 LDG LIGHT ON NOSE GEAR …	Small	
2	FLEW UNDER A VERY LARGE FLOCK OF BIRDS OVER AP…	Small	
3	NOTAM WARNING. 26 BIRDS HIT THE A/C, FORCING A…	Small	
4	NO DMG REPTD.	Small	

	Conditions: Sky	Wildlife: Species	Pilot warned of birds or wildlife?	\
0	No Cloud	Unknown bird - medium	N	
1	Some Cloud	Rock pigeon	Y	
2	No Cloud	European starling	N	

```
3      Some Cloud      European starling                                  Y
4        No Cloud      European starling                                  N

   Cost: Total $ Feet above ground Number of people injured Is Aircraft Large?
0         30,736             1,500                        0                Yes
1              0                 0                        0                 No
2              0                50                        0                 No
3              0                50                        0                Yes
4              0                50                        0                 No

[5 rows x 26 columns]
```

[14]:
```
# Show Columns Of DataFrame
BirdStrike.columns
```

[14]:
```
Index(['Record ID', 'Aircraft: Type', 'Airport: Name', 'Altitude bin',
       'Aircraft: Make/Model', 'Wildlife: Number struck',
       'Wildlife: Number Struck Actual', 'Effect: Impact to flight',
       'FlightDate', 'Effect: Indicated Damage',
       'Aircraft: Number of engines?', 'Aircraft: Airline/Operator',
       'Origin State', 'When: Phase of flight', 'Conditions: Precipitation',
       'Remains of wildlife collected?',
       'Remains of wildlife sent to Smithsonian', 'Remarks', 'Wildlife: Size',
       'Conditions: Sky', 'Wildlife: Species',
       'Pilot warned of birds or wildlife?', 'Cost: Total $',
       'Feet above ground', 'Number of people injured', 'Is Aircraft Large?'],
      dtype='object')
```

[15]:
```
# Check DataType of every column to understand the structure of our DataFrame
BirdStrike.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25558 entries, 0 to 25557
Data columns (total 26 columns):
 #   Column                                 Non-Null Count  Dtype
---  ------                                 --------------  -----
 0   Record ID                              25558 non-null  int64
 1   Aircraft: Type                         25429 non-null  object
 2   Airport: Name                          25429 non-null  object
 3   Altitude bin                           25429 non-null  object
 4   Aircraft: Make/Model                   25558 non-null  object
 5   Wildlife: Number struck                25429 non-null  object
 6   Wildlife: Number Struck Actual         25558 non-null  int64
 7   Effect: Impact to flight               2078 non-null   object
 8   FlightDate                             25429 non-null  object
 9   Effect: Indicated Damage               25558 non-null  object
 10  Aircraft: Number of engines?           25291 non-null  object
```

```
 11  Aircraft: Airline/Operator                25429 non-null  object
 12  Origin State                              25109 non-null  object
 13  When: Phase of flight                     25429 non-null  object
 14  Conditions: Precipitation                 2015 non-null   object
 15  Remains of wildlife collected?            25558 non-null  bool
 16  Remains of wildlife sent to Smithsonian   25558 non-null  bool
 17  Remarks                                   20787 non-null  object
 18  Wildlife: Size                            25429 non-null  object
 19  Conditions: Sky                           25558 non-null  object
 20  Wildlife: Species                         25558 non-null  object
 21  Pilot warned of birds or wildlife?        25429 non-null  object
 22  Cost: Total $                             25558 non-null  object
 23  Feet above ground                         25429 non-null  object
 24  Number of people injured                  25558 non-null  int64
 25  Is Aircraft Large?                        25429 non-null  object
dtypes: bool(2), int64(3), object(21)
memory usage: 4.7+ MB
```

[16]:
```
# Take A look on dataFrame  numerical columns to understand basics Summery like
 ↪count,mean,min,max  of each column etc.
BirdStrike.describe()
```

[16]:

	Record ID	Wildlife: Number Struck Actual	Number of people injured
count	25558.000000	25558.000000	25558.000000
mean	253916.085609	2.691525	0.001056
std	38510.453382	12.793975	0.050420
min	1195.000000	1.000000	0.000000
25%	225783.750000	1.000000	0.000000
50%	248749.000000	1.000000	0.000000
75%	269168.750000	1.000000	0.000000
max	321909.000000	942.000000	6.000000

3 >> Data Preprocessing

[17]:
```
# Check nan Values
 print("nan values In All Coulmn:-",BirdStrike.isna().sum())
```

```
nan values In All Coulmn:- Record ID                                0
Aircraft: Type                          129
Airport: Name                           129
Altitude bin                            129
Aircraft: Make/Model                      0
Wildlife: Number struck                 129
Wildlife: Number Struck Actual            0
Effect: Impact to flight              23480
FlightDate                              129
Effect: Indicated Damage                  0
```

```
Aircraft: Number of engines?                 267
Aircraft: Airline/Operator                   129
Origin State                                 449
When: Phase of flight                        129
Conditions: Precipitation                  23543
Remains of wildlife collected?                 0
Remains of wildlife sent to Smithsonian        0
Remarks                                     4771
Wildlife: Size                               129
Conditions: Sky                                0
Wildlife: Species                              0
Pilot warned of birds or wildlife?           129
Cost: Total $                                  0
Feet above ground                            129
Number of people injured                       0
Is Aircraft Large?                           129
dtype: int64
```

In Above Dataset We can Clearly see that 4 columns (Effect: Impact to flight,Conditions: Precipitation,Remarks,Origin State) contain too much nan values so for now we will excludes this columns and process other data.In Above some columns also have total 129 nan in same row comapre to other some columns we will drop that row.

[18]:
```
# Assign All Dataset To New variable
BirdStrikeOrg = BirdStrike.copy()
```

[19]:
```
# Drop 4 Columns because they have alot of nan values that can impact on our␣
 ↪analysis
BirdStrike = BirdStrike.drop(['Remarks','Effect: Impact to flight','Conditions:␣
 ↪Precipitation'],axis=1)
```

[20]:
```
BirdStrike['Feet above ground']
```

[20]:
```
0        1,500
1            0
2           50
3           50
4           50
         …
25553    1,500
25554        0
25555      NaN
25556        0
25557        0
Name: Feet above ground, Length: 25558, dtype: object
```

[21]:
```
# Print the dataset after droping columns
BirdStrike.head(5)
```

[21]:

	Record ID	Aircraft: Type	Airport: Name	Altitude bin	\
0	202152	Airplane	LAGUARDIA NY	> 1000 ft	
1	208159	Airplane	DALLAS/FORT WORTH INTL ARPT	< 1000 ft	
2	207601	Airplane	LAKEFRONT AIRPORT	< 1000 ft	
3	215953	Airplane	SEATTLE-TACOMA INTL	< 1000 ft	
4	219878	Airplane	NORFOLK INTL	< 1000 ft	

	Aircraft: Make/Model	Wildlife: Number struck	\
0	B-737-400	Over 100	
1	MD-80	Over 100	
2	C-500	Over 100	
3	B-737-400	Over 100	
4	CL-RJ100/200	Over 100	

	Wildlife: Number Struck Actual	FlightDate	Effect: Indicated Damage	\
0	859	11/23/00 0:00	Caused damage	
1	424	7/25/01 0:00	Caused damage	
2	261	9/14/01 0:00	No damage	
3	806	9/5/02 0:00	No damage	
4	942	6/23/03 0:00	No damage	

	Aircraft: Number of engines?	…	Remains of wildlife collected?	\
0	2	…	False	
1	2	…	False	
2	2	…	False	
3	2	…	True	
4	2	…	False	

	Remains of wildlife sent to Smithsonian	Wildlife: Size	Conditions: Sky	\
0	False	Medium	No Cloud	
1	False	Small	Some Cloud	
2	False	Small	No Cloud	
3	False	Small	Some Cloud	
4	False	Small	No Cloud	

	Wildlife: Species	Pilot warned of birds or wildlife?	Cost: Total $	\
0	Unknown bird - medium	N	30,736	
1	Rock pigeon	Y	0	
2	European starling	N	0	
3	European starling	Y	0	
4	European starling	N	0	

	Feet above ground	Number of people injured	Is Aircraft Large?
0	1,500	0	Yes
1	0	0	No
2	50	0	No
3	50	0	Yes

```
4                50                          0                  No

[5 rows x 23 columns]
```

[22]:
```
# drop nan from all columns
BirdStrike = BirdStrike.dropna()
```

[23]:
```
# Check For Nan Values
BirdStrike.isna().sum()

# Check  Now we Have drop All row contains nan
```

[23]:
```
Record ID                                0
Aircraft: Type                           0
Airport: Name                            0
Altitude bin                             0
Aircraft: Make/Model                     0
Wildlife: Number struck                  0
Wildlife: Number Struck Actual           0
FlightDate                               0
Effect: Indicated Damage                 0
Aircraft: Number of engines?             0
Aircraft: Airline/Operator               0
Origin State                             0
When: Phase of flight                    0
Remains of wildlife collected?           0
Remains of wildlife sent to Smithsonian  0
Wildlife: Size                           0
Conditions: Sky                          0
Wildlife: Species                        0
Pilot warned of birds or wildlife?       0
Cost: Total $                            0
Feet above ground                        0
Number of people injured                 0
Is Aircraft Large?                       0
dtype: int64
```

[24]:
```
# Check null Values
 print("Null values In All Coulmns:-",BirdStrike.isnull().sum())
```

```
Null values In All Coulmns:- Record ID                                0
Aircraft: Type                           0
Airport: Name                            0
Altitude bin                             0
Aircraft: Make/Model                     0
Wildlife: Number struck                  0
Wildlife: Number Struck Actual           0
```

```
FlightDate                                  0
Effect: Indicated Damage                    0
Aircraft: Number of engines?                0
Aircraft: Airline/Operator                  0
Origin State                                0
When: Phase of flight                       0
Remains of wildlife collected?              0
Remains of wildlife sent to Smithsonian     0
Wildlife: Size                              0
Conditions: Sky                             0
Wildlife: Species                           0
Pilot warned of birds or wildlife?          0
Cost: Total $                               0
Feet above ground                           0
Number of people injured                    0
Is Aircraft Large?                          0
dtype: int64
```

[25]:
```
# Add new columns year and month from column FlightDate

# Convert  FlightDate column to datetime

BirdStrike['FlightDate'] = pd.to_datetime(BirdStrike['FlightDate'])
# Now We will Create Three New Columns of Year, Month and yearMonth
BirdStrike['year'] = BirdStrike['FlightDate'].dt.year
BirdStrike['month'] = BirdStrike['FlightDate'].dt.month
BirdStrike['year_month'] = BirdStrike['FlightDate'].dt.to_period('M')
```

```
C:\Users\mishr\AppData\Local\Temp\ipykernel_25804\275944927.py:5: UserWarning:
Could not infer format, so each element will be parsed individually, falling
back to `dateutil`. To ensure parsing is consistent and as-expected, please
specify a format.
  BirdStrike['FlightDate'] = pd.to_datetime(BirdStrike['FlightDate'])
```

Note:- In the above cell avoid the warning.

[26]:
```
print("Toatl Columns:- ",len(BirdStrike.columns))
```

```
Toatl Columns:-  26
```

[27]:
```
# Convert month number to month name

BirdStrike['month'] = pd.to_datetime(BirdStrike['month'], format='%m').dt.
 ↪month_name().str[:3]
```

[28]:
```
# Change Object data type to String
BirdStrikeOrg['Aircraft: Airline/Operator'] = BirdStrikeOrg['Aircraft: Airline/
 ↪Operator'].astype(str)
```

```
# Change object to float
BirdStrike['Cost: Total $'] = BirdStrike['Cost: Total $'].astype(str).str.
 ↪replace(",","").astype(int)

BirdStrike['Feet above ground'] = BirdStrike['Feet above ground'].astype(str).
 ↪str.replace(",","").astype(int)
```

4 >>Data Analysis and visualization

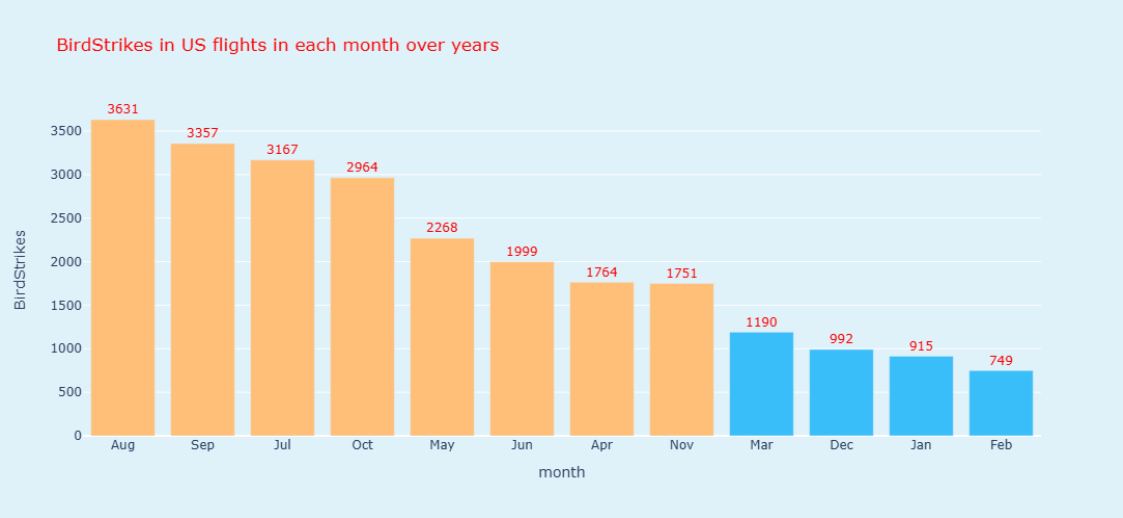
[101]:
```
# Count the frequency of each month
print("Average bird strikes in US in each month over all the years :-␣
 ↪",BirdStrike['month'].value_counts().mean())
```

```
Average bird strikes in US in each month over all the years :-  2062.25
```

5 Month-vise birdstrikes in US flight

[102]:
```
#  value_counts() function will count the each month frequncy and month_vise␣
 ↪will store data in dict. type

month_vise = {'month':BirdStrike['month'].value_counts().keys(),'BirdStrikes':
 ↪BirdStrike['month'].value_counts().values}
```

[103]:
```
# set color to all markers
colors = ['#FFBF78',] * 12

# set Colors To loweset markers
colors[8:] = ['#3ABEF9']*4

# create bar chart

fig = px.bar(month_vise,x= 'month',y= 'BirdStrikes',height=500, text =␣
 ↪'BirdStrikes',title='BirdStrikes in US flights in each month over years')

# update text
fig.update_traces(textfont_size=12, textangle=0, textposition="outside",␣
 ↪cliponaxis=False,textfont=dict(color='red'),marker_color=colors)
# update layout
fig.update_layout(paper_bgcolor = '#dff2fa',plot_bgcolor='rgba(100, 100, 50,␣
 ↪0)',title_font_color="red")


# show Chart
fig.show()
```



KeyInsights :- these months(Nov,dec,january,februery,march,april) contain less cases of bird-strikes.mostly bird strikes occur during the month (may,june,july,august,septempber,october) there is a seasonal changes in birdstrikes.

6 Year-Wise BirdStrikes in US

Count The frequency year to understand number of birdStrikes on that each year

[32]:
```
# This Function Will update the color according threshold.

# Function will take two parameters value and threshold
def ChangeColors(values:list,threshold):

    # strike=0

    # index=0

    colors = []

    check_std = []

    mean = np.mean(values)

    index=0

    for i in (values):



        if((mean-i) >threshold):
```

```
            colors.append('#30E3DF')


        elif((mean-i) <-threshold):


                    colors.append('#FF6969')

        else :

             colors.append('#F6EEC9')


        index+=1

    return colors
```

[104]:
```
# Count the frequency of each year

print("Average bird Strikes in US between year 2000-2011:- ",BirdStrike['year'].
 ↪value_counts().mean())
```

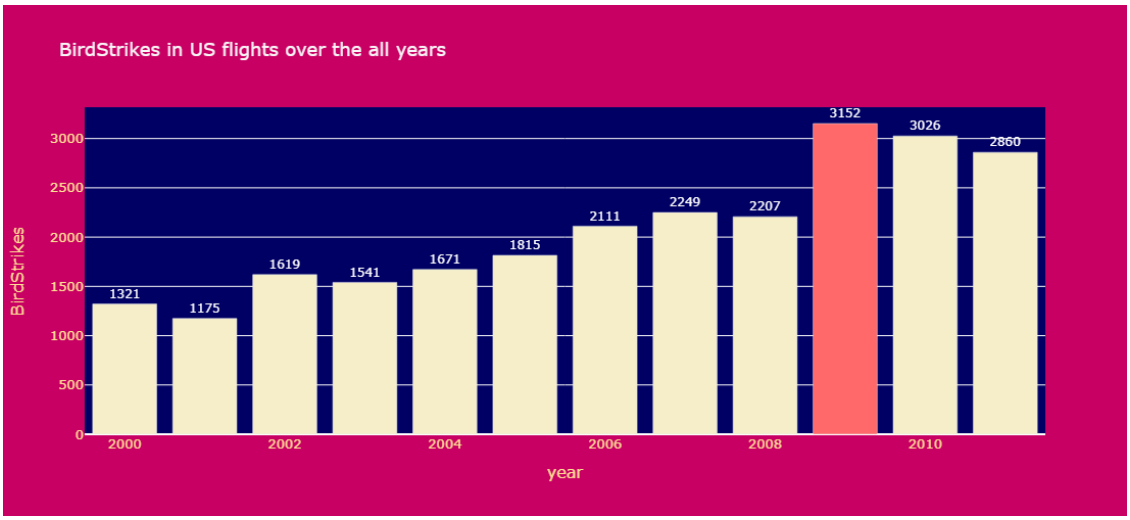
```
Average bird Strikes in US between year 2000-2011:-  2062.25
```

[82]:
```
#  value_counts() function will count the each year  frequncy
Year_dict = BirdStrike['year'].value_counts().to_dict()
np.mean(list(Year_dict.values()))
```

[82]:
```
2062.25
```

[35]:
```
# use Year_dict keys and values in dict. year_wise
year_wise = {'year':Year_dict.keys(),'BirdStrikes':Year_dict.values()}

# Chnge The color of marker on threshold
colors = ChangeColors(list(Year_dict.values()),1000)

# Create bar chart
fig = px.bar(year_wise,x='year',y='BirdStrikes',height = 500,title =␣
 ↪'BirdStrikes in US flights over the all years',text='BirdStrikes')

# Update text
fig.update_traces(textfont_size=12, textangle = 0,␣
 ↪textposition='outside',cliponaxis=False,textfont=dict(color='white'),marker_color=colors)

# Update layout
```

```
fig.update_layout(paper_bgcolor = 'rgba(200, 0, 100,␣
 ↪222)',title_font_color="#F9F5F6",plot_bgcolor = 'rgba(0, 0, 100,␣
 ↪222)',legend_title_font_color='rgba(200, 200, 50,␣
 ↪222)',font_color='#FFE194',hoverlabel_grouptitlefont_color='#5755FE'
                  ,font_size=13)
# Show Chart
fig.show()
```



KeyInsights :- In above chart we can see that between year 2000-2008 little bit differences on numbers of birdstrikes but after year 2008 in 2009(red marker) there around 1000 bird strikes increased that usually we have not seen in past years.

7 Top 10 US Airlines in terms of having encountered bird strikes

[36]:
```
print("Top 10 US airlines in terms of having encountered bird strikes:-")
Top10US = BirdStrikeOrg['Aircraft: Airline/Operator'].value_counts()

Top10US[:10]
```

```
Top 10 US airlines in terms of having encountered bird strikes:-
```

[36]:
```
Aircraft: Airline/Operator
SOUTHWEST AIRLINES          4628
BUSINESS                    3074
AMERICAN AIRLINES           2058
DELTA AIR LINES             1349
AMERICAN EAGLE AIRLINES      932
SKYWEST AIRLINES             891
US AIRWAYS*                  797
```

```
JETBLUE AIRWAYS                 708
UPS AIRLINES                    590
US AIRWAYS                      540
Name: count, dtype: int64
```

[37]:
```
Top10US = Top10US[:10].to_dict()
```

[2]:
```
# use Year_dict keys and values in dict. Top10US
Top10US ={'airline':list(Top10US.keys()),'BirdStrikes':list(Top10US.values())}

# Create bar chart with Plotly Express
fig = px.bar(Top10US, x='airline', y='BirdStrikes', height=500, title='Top 10␣
 ↪US airlines in terms of having encountered bird strikes', text='BirdStrikes')

# URL of a image
image_url = 'https://upload.wikimedia.org/wikipedia/commons/thumb/9/91/
 ↪N24976%40PEK_%2820200421150836%29.jpg/
 ↪1200px-N24976%40PEK_%2820200421150836%29.jpg'


# set color to all markers
colors = ['#B3E2A7'] * len(Top10US['airline'])


# Add image as background
fig.add_layout_image(
    dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,  # Adjust width
        sizey=2,  # Adjust height
        sizing="stretch",
        opacity=0.5,
        layer="below"
    )
)

fig.update_layout(paper_bgcolor =␣
 ↪'#5C88C4',title_font_color="#F9F5F6",plot_bgcolor = 'rgba(0, 0, 100,␣
 ↪100)',legend_title_font_color='rgba(200, 200, 50,␣
 ↪222)',font_color='#C3FF93',hoverlabel_grouptitlefont_color='#FF8F00'
                  ,font_size=13)
```

```
# Update layout to ensure the image covers the full background
fig.update_layout(
    template="plotly_white",
    images=[dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,
        sizey=2,
        sizing="stretch",
        opacity=0.4,
        layer="below"
    )],
    margin=dict(l=0, r=0, t=50, b=0)  )

# Update text
fig.update_traces(textfont_size=12, textangle = 0,␣
 ↪textposition='outside',cliponaxis=False,textfont=␣
 ↪dict(color='white'),marker_color=colors)

# Show chart

fig.show()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[2], line 2
      1 # use Year_dict keys and values in dict. Top10US
----> 2 Top10US ={'airline':list(Top10US.keys()),'BirdStrikes':list(Top10US.
 ↪values())}
      4 # Create bar chart with Plotly Express
      5 fig = px.bar(Top10US, x='airline', y='BirdStrikes', height=500,␣
 ↪title='Top 10 US airlines in terms of having encountered bird strikes',␣
 ↪text='BirdStrikes')

NameError: name 'Top10US' is not defined
```

Top 50 Airports with most incidents of bird strikes

[39]:
```
print("Top 50 Airports with most incidents of bird strikes:-")
Top50Airport = BirdStrike['Airport: Name'].value_counts()[:50]

print(Top50Airport)
```

Top 50 Airports with most incidents of bird strikes:-

Airport: Name	
DALLAS/FORT WORTH INTL ARPT	802
SACRAMENTO INTL	676
SALT LAKE CITY INTL	479
DENVER INTL AIRPORT	476
KANSAS CITY INTL	452
PHILADELPHIA INTL	442
ORLANDO INTL	408
BALTIMORE WASH INTL	401
LOUISVILLE INTL ARPT	394
JOHN F KENNEDY INTL	389
CHARLOTTE/DOUGLAS INTL ARPT	367
NASHVILLE INTL	364
LAMBERT-ST LOUIS INTL	363
CHICAGO O'HARE INTL ARPT	331
PORTLAND INTL (OR)	313
NEWARK LIBERTY INTL ARPT	305
CINCINNATI/NORTHERN KENTUCKY INTL ARPT	302
ATLANTA INTL	296
CHICAGO MIDWAY INTL ARPT	295
HOUSTON-HOBBY	293
DETROIT METRO WAYNE COUNTY ARPT	281
FORT LAUDERDALE/HOLLYWOOD INTL	277
WASHINGTON DULLES INTL ARPT	269
EPPLEY AIRFIELD	269
LAGUARDIA NY	263
LOGAN INTL	254
DALLAS LOVE FIELD ARPT	253
METRO OAKLAND INTL	251
MINNEAPOLIS-ST PAUL INTL	244
GREATER PITTSBURGH	237
AUSTIN-BERGSTROM INTL	236
SAN FRANCISCO INTL ARPT	226
NEW ORLEANS INTL	219
LOS ANGELES INTL	216
SOUTHWEST FLORIDA INTL ARPT	215
CLEVELAND-HOPKINS INTL ARPT	212
BIRMINGHAM-SHUTTLESWORTH INTL	209
MIAMI INTL	202
MINETA SAN JOSE INTL	201
GEORGE BUSH INTERCONTINENTAL	199
PHOENIX SKY HARBOR	196
LIHUE ARPT	195
SAN ANTONIO INTL	194
BUFFALO-NIAGARA INTL	182
HONOLULU INTL ARPT	169
PORT COLUMBUS INTL	166

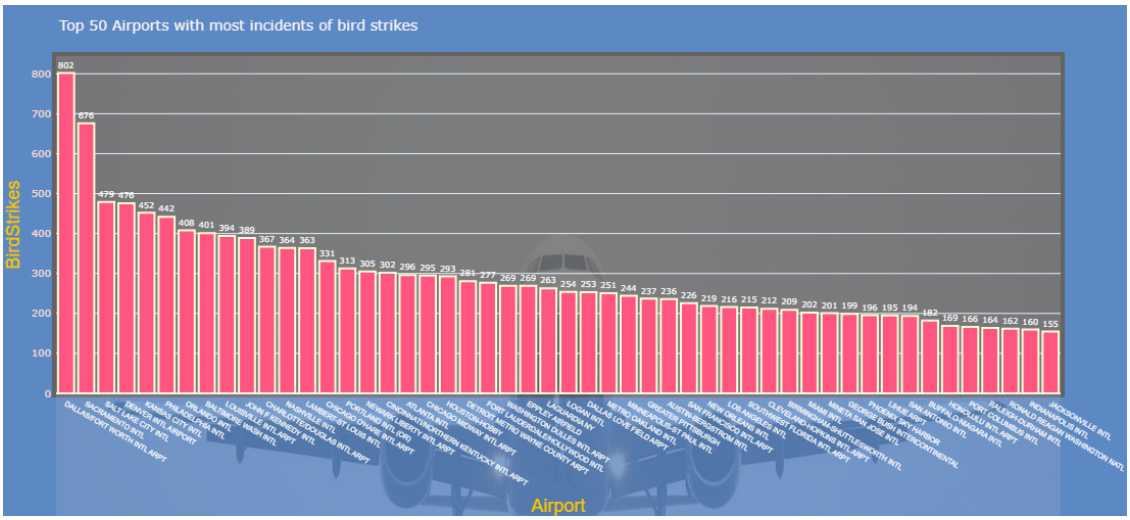
```
RALEIGH-DURHAM INTL                    164
RONALD REAGAN WASHINGTON NATL          162
INDIANAPOLIS INTL                      160
JACKSONVILLE INTL                      155
Name: count, dtype: int64
```

[40]:
```
Top50Airport = Top50Airport.to_dict()
```

[41]:
```
# use Year_dict keys and values in dict. Top10US
TopAirport ={'airport':list(Top50Airport.keys()),'BirdStrikes':
 ↪list(Top50Airport.values())}

# Create bar chart with Plotly Express
fig = px.bar(TopAirport, x='airport', y='BirdStrikes', height=500, title='Top␣
 ↪50 Airports with most incidents of bird strikes', text='BirdStrikes')

# URL of a image
image_url = 'https://images.pexels.com/photos/358319/pexels-photo-358319.jpeg?
 ↪auto=compress&cs=tinysrgb&w=1260&h=750&dpr=1'


# set color to all markers
colors = ['#FF5580'] * len(TopAirport['airport'])


# Add image as background
fig.add_layout_image(
    dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,  # Adjust width
        sizey=2,  # Adjust height
        sizing="stretch",
        opacity=0.5,
        layer="below"   ))


# Update outer layout
fig.update_layout(width=1000,
    height=500,legend_borderwidth=10,margin=dict(
        l=50,
        r=50,
        b=100,
        t=100,
```

```
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#5C88C4',legend_bgcolor='#FFDB00',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(100, 100, 100, 100)',legend_title_font_color='rgba(1, 1, 50,␣
 ↪222)',hoverlabel_grouptitlefont_color='#FF8F00'
                  ,font_size=10)




# Update layout to ensure the image covers the full background
fig.update_layout(
    template="plotly_white",
    images=[dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,
        sizey=2,
        sizing="stretch",
        opacity=0.2,
        layer="below"
    )],
    margin=dict(l=10, r=0, t=50, b=5)  )

# Update text
fig.update_traces(textfont_size=12, textangle = 0,␣
 ↪marker=dict(line=dict(color="#FFFBDA",␣
 ↪width=1)),textposition='outside',cliponaxis=False,textfont=␣
 ↪dict(color='white'),marker_color=colors, marker_line_width=2)

# Show chart


# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="Airport", title_font=dict(family="Arial", size=18,␣
 ↪color="#FFC700"),tickfont=dict(
        family="sans-serif",
        size=7,
        color="white"  ,
    # Change the color of the x-axis category labels
    ))
```

```
# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="BirdStrikes", title_font=dict(family="Arial",␣
 ↪size=18, color="#FFC700" ))


fig.show()
```



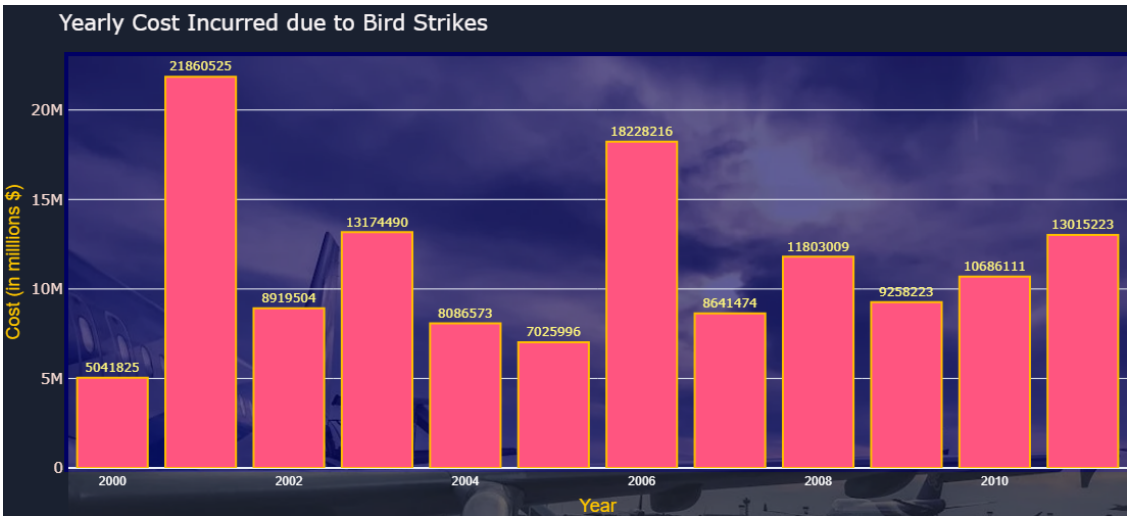
Yearly Cost Incurred due to Bird Strikes

[42]:
```
# Calcualte the Year from here and add in a dictionary

Year = []

Cost = []

for year in BirdStrike['year'].unique():

    CostByYear = BirdStrike[BirdStrike['year']==year]['Cost: Total $'].sum()

    Year.append(year)

    Cost.append(CostByYear)
```

[43]:
```
# use Year_dict keys and values in dict. Top10US
YearCost ={'year':Year,'cost':Cost}

# Create bar chart with Plotly Express
fig = px.bar(YearCost, x='year', y='cost', height=500, title='Yearly Cost␣
 ↪Incurred due to Bird Strikes', text='cost')
```

```
# URL of a image
image_url = 'https://images.pexels.com/photos/912050/pexels-photo-912050.jpeg?
 ↪auto=compress&cs=tinysrgb&w=1260&h=750&dpr=1'


# set color to all markers
colors = ['#FF5580'] * len(YearCost['year'])


# Add image as background
fig.add_layout_image(
    dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,  # Adjust width
        sizey=2,  # Adjust height
        sizing="stretch",
        opacity=0.5,
        layer="below"   ))


# Update outer layout
fig.update_layout(width=1000,
    height=500,legend_borderwidth=10,margin=dict(
        l=50,
        r=50,
        b=100,
        t=100,
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#1A2130',legend_bgcolor='#FFDB00',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(0, 0,100, 200)',legend_title_font_color='rgba(1, 1, 50,␣
 ↪222)',hoverlabel_grouptitlefont_color='#FF8F00'
                  ,font_size=15)




# Update layout to ensure the image covers the full background
fig.update_layout(
    template="plotly_white",
```

```
    images=[dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,
        sizey=2,
        sizing="stretch",
        opacity=0.4,
        layer="below"
    )],
    margin=dict(l=10, r=0, t=50, b=5)  )

# Update text
fig.update_traces(textfont_size=12, textangle = 0,␣
 ↪marker=dict(line=dict(color="#FFBF00",␣
 ↪width=1)),textposition='outside',cliponaxis=False,textfont=␣
 ↪dict(color='#FFF67E'),marker_color=colors, marker_line_width=2)

# Show chart


# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="Year", title_font=dict(family="Arial", size=18,␣
 ↪color="#FFC700"),tickfont=dict(
        family="sans-serif",
        size=12,
        color="white"  ,
    # Change the color of the x-axis category labels
    ))


# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="Cost (in milllions $)",␣
 ↪title_font=dict(family="Arial", size=18, color="#FFC700" ))


fig.show()
```

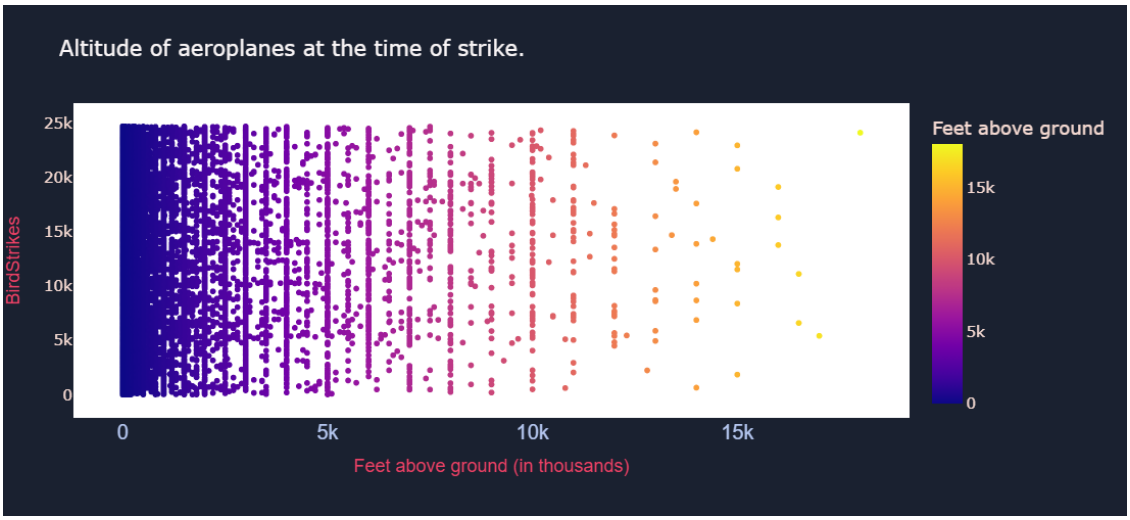


Key Insights :- year 2001 and 2006 is too costly incurred due to birdstrikes and year 2000 is less costly.

Altitude of aeroplanes at the time of strike

[44]:
```
# use Year_dict keys and values in dict. Top10US
Altitude ={'Feet above ground':BirdStrike['Feet above ground'],'BirdStrike':[i␣
 ↪for i in range(len(BirdStrike['Feet above ground']))] }

# Create bar chart with Plotly Express
fig = px.scatter(Altitude,height=600,x='Feet above ground',y='BirdStrike',␣
 ↪color='Feet above ground',title='Altitude of aeroplanes at the time of␣
 ↪strike.')

# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="Feet above ground (in thousands)",␣
 ↪title_font=dict(family="Arial", size=18, color="#EE4266"),tickfont=dict(
        family="sans-serif",
        size=20,
        color="#B7C9F2"  ,
    # Change the color of the x-axis category labels
    ))


# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="BirdStrikes", title_font=dict(family="Arial",␣
 ↪size=18, color="#EE4266" ))
```

```
# Update outer layout
fig.update_layout(width=1000,
    height=500,legend_borderwidth=10,margin=dict(
        l=50,
        r=50,
        b=100,
        t=100,
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#1A2130',legend_bgcolor='#FFDB00',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(255, 255,255, 200)',legend_title_font_color='rgba(1, 1, 50,␣
 ↪222)',hoverlabel_grouptitlefont_color='#FF8F00'
                  ,font_size=15)



fig.show()
```



Key Insights :- In above chart we found that mostly birdstrikes occur during altitude(feet above ground) of flight between 0 to 5k (thousands) feet.number of feet increasing threre are less chances of birdstrike.

Altitude bin of aeroplanes at the time of strike

[45]:
```
# Count the altitude bin
Altitude = BirdStrike['Altitude bin'].value_counts()

# Get Altitude < 1000 ft and Calculate percentage from all strikes
less_1000ft = (Altitude['< 1000 ft']/len(BirdStrike['Altitude bin'])*100).
 ↪round(2)
```

```
great_1000ft = (Altitude['> 1000 ft']/len(BirdStrike['Altitude bin'])*100).
 ↪round(2)

print('when Altitude bin < 1000 ft birdstrikes percentaege:-␣
 ↪',str(less_1000ft)+' %')
print('when Altitude bin > 1000 ft birdstrikes percentaege:-␣
 ↪',str(great_1000ft)+' %')
```

```
when Altitude bin < 1000 ft birdstrikes percentaege:-  80.72 %
when Altitude bin > 1000 ft birdstrikes percentaege:-  19.28 %
```

Key Insights:- above we can clearly see that approx 80.76 % birdstrikes occur when altitude in <1000 ft and 19.24 % strikes on > 1000 ft.

8 Phase of flight at the time of the strike.

[46]:
```
phase_count = BirdStrike['When: Phase of flight'].value_counts()
```

[47]:
```
print("Strikes on different phases:-",phase_count)
```

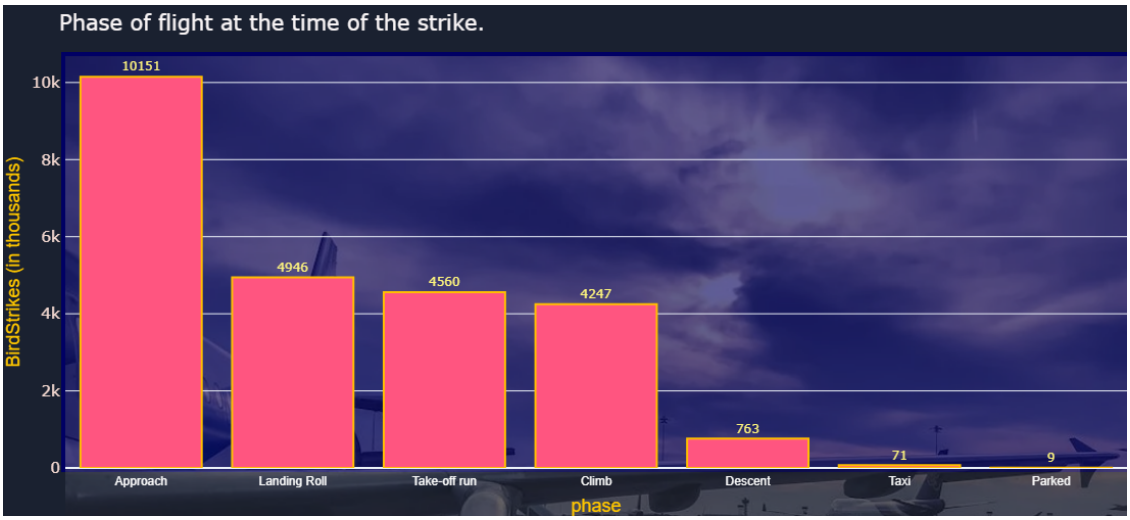
```
Strikes on different phases:- When: Phase of flight
Approach        10151
Landing Roll     4946
Take-off run     4560
Climb            4247
Descent           763
Taxi               71
Parked              9
Name: count, dtype: int64
```

[48]:
```
phase_flight = phase_count.to_dict()
```

[49]:
```
# use Year_dict keys and values in dict. Top10US
Phase ={'phase':phase_flight.keys(),'BirdStrikes':phase_flight.values()}

# Create bar chart with Plotly Express
fig = px.bar(Phase, x='phase', y='BirdStrikes', height=500, title='Phase of␣
 ↪flight at the time of the strike.', text='BirdStrikes')

# URL of a image
image_url = 'https://images.pexels.com/photos/912050/pexels-photo-912050.jpeg?
 ↪auto=compress&cs=tinysrgb&w=1260&h=750&dpr=1'


# set color to all markers
colors = ['#FF5580'] * len(Phase['phase'])
```

```
# Add image as background
fig.add_layout_image(
    dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,  # Adjust width
        sizey=2,  # Adjust height
        sizing="stretch",
        opacity=0.5,
        layer="below"   ))


# Update outer layout
fig.update_layout(width=1000,
    height=500,legend_borderwidth=10,margin=dict(
        l=50,
        r=50,
        b=100,
        t=100,
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#1A2130',legend_bgcolor='#FFDB00',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(0, 0,100, 200)',legend_title_font_color='rgba(1, 1, 50,␣
 ↪222)',hoverlabel_grouptitlefont_color='#FF8F00'
                  ,font_size=15)




# Update layout to ensure the image covers the full background
fig.update_layout(
    template="plotly_white",
    images=[dict(
        source=image_url,
        xref="paper",
        yref="paper",
        x=0,
        y=1,
        sizex=1,
        sizey=2,
        sizing="stretch",
```

```
        opacity=0.4,
        layer="below"
    )],
    margin=dict(l=10, r=0, t=50, b=5)  )

# Update text
fig.update_traces(textfont_size=12, textangle = 0,␣
 ↪marker=dict(line=dict(color="#FFBF00",␣
 ↪width=1)),textposition='outside',cliponaxis=False,textfont=␣
 ↪dict(color='#FFF67E'),marker_color=colors, marker_line_width=2)

# Show chart


# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="phase", title_font=dict(family="Arial", size=18,␣
 ↪color="#FFC700"),tickfont=dict(
        family="sans-serif",
        size=12,
        color="white"  ,
    # Change the color of the x-axis category labels
    ))


# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="BirdStrikes (in thousands)",␣
 ↪title_font=dict(family="Arial", size=18, color="#FFC700" ))


fig.show()
```



Key Insights:- In Approach phase of flight 10205 birdstrikes occur compare to other phases.

9 Average Altitude of the aeroplanes in different phases at the time of strike

[50]:
```
# Compute the average altitude in diifer. phases
for phase in BirdStrike['When: Phase of flight'].unique():

    # Compute the mean of column Feet above ground (altitude) for the flight␣
 ↪phase
    altitude_phase = BirdStrike[BirdStrike['When: Phase of␣
 ↪flight']==phase]['Feet above ground'].mean()

    # print the avg. altitude in differ. phase
    print(f'in {phase.upper()} phase Average Altitude of the aeroplanes :-␣
 ↪',int(altitude_phase))
```

```
in CLIMB phase Average Altitude of the aeroplanes :-  1204
in LANDING ROLL phase Average Altitude of the aeroplanes :-  0
in APPROACH phase Average Altitude of the aeroplanes :-  1004
in TAKE-OFF RUN phase Average Altitude of the aeroplanes :-  0
in DESCENT phase Average Altitude of the aeroplanes :-  5924
in TAXI phase Average Altitude of the aeroplanes :-  0
in PARKED phase Average Altitude of the aeroplanes :-  0
```

10 Effect of Bird Strikes & Impact on Flight

Average economical loss due to birdstrikes

[51]:
```
print("Average economical loss from year 2000-2011 due to birdstrikes effects:-␣
 ↪",(np.mean(YearCost['cost'])/1000000).round(2),"million $")
```

```
Average economical loss from year 2000-2011 due to birdstrikes effects:-  11.31
million $
```

11 People injured due to birdstrikes

[52]:
```
print("people injured due to birdstrikes:- ",BirdStrike[BirdStrike['Number of␣
 ↪people injured']!=0]['Number of people injured'].sum())
```

```
people injured due to birdstrikes:-  21
```

12 Impact on Flight

[53]:
```
# BirdStrikeOrg.dropna()[,'',Effect: Impact to flight']
```

[54]:
```
Effect_in_flight = BirdStrikeOrg.dropna()
```

[106]:
```
print("due to birdstrikes most chances of impact:-")
# Calcualte the percentage chances of possible imapact on flight due to bird␣
 ↪strikes
for (k,v) in Effect_in_flight['Effect: Impact to flight'].value_counts().
 ↪to_dict().items():


            print(k,(v/(Effect_in_flight.value_counts().values.sum())*100).
 ↪round(2)," %")
```

```
due to birdstrikes most chances of impact:-
Precautionary Landing 43.33  %
Aborted Take-off 29.44  %
Other 22.22  %
Engine Shut Down 5.0  %
```

Key Insights :- in above analysis we can clearly see that birdstrikes on flight can impact on financially and physically.

13 Effect of Strike at Different Altitude

[ ]:
```

```

[56]:
```
Effect_in_flight = Effect_in_flight[['Effect: Impact to flight','Cost: Total␣
 ↪$','Feet above ground','Effect: Indicated Damage']].sort_values(by = 'Feet␣
 ↪above ground')
```

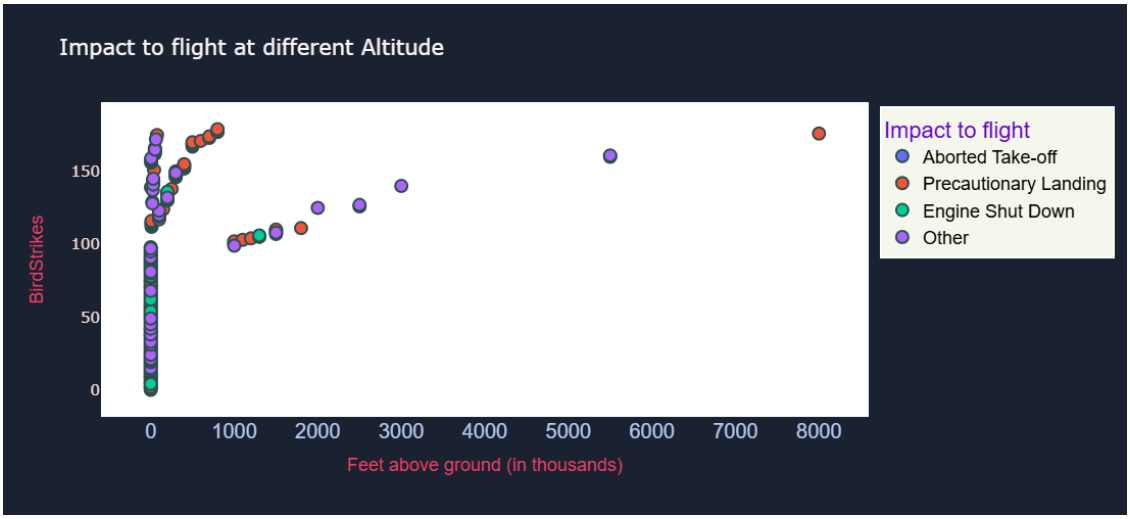
[57]:
```
# Change Data type with replace , character
Effect_in_flight['Feet above ground'] = Effect_in_flight['Feet above ground'].
 ↪astype(str).str.replace(",","").astype(int)
```

[ ]:
```

```

[58]:
```
# Create a dictionary for visualization of data
Altitude ={'Feet above ground':Effect_in_flight['Feet above␣
 ↪ground'],'BirdStrike':[i for i in range(len(Effect_in_flight['Feet above␣
 ↪ground']))] }

# Create bar chart with Plotly Express
```

```
fig = px.scatter(Altitude,height=600,x='Feet above ground',y='BirdStrike',color␣
 ↪= Effect_in_flight['Effect: Impact to flight'],title='Impact to flight at␣
 ↪different Altitude')


# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="Feet above ground (in thousands)",␣
 ↪title_font=dict(family="Arial", size=18, color="#EE4266"),tickfont=dict(
        family="sans-serif",
        size=20,
        color="#B7C9F2",
    # Change the color of the x-axis category labels
    ))


# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="BirdStrikes", title_font=dict(family="Arial",␣
 ↪size=18, color="#EE4266" ))



# Update outer layout
fig.update_layout(legend=dict(title="Impact to flight",
        font=dict(
            family="Arial",
            size=18,
            color="black"
        ),
        bgcolor="LightSteelBlue",
        bordercolor="white",
        borderwidth=2
    ),width=1000,
    height=500,legend_borderwidth=2,margin=dict(
        l=100,
        r=50,
        b=100,
        t=100,
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#1A2130',legend_bgcolor='#F3F7EC',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(255, 255,255, 200)',legend_title_font_color='rgba(100,0, 200,␣
 ↪200)',hoverlabel_grouptitlefont_color='#1A2130'
                  ,font_size=15)


fig.update_traces(marker=dict(size=12,
                              line=dict(width = 2,
```

```
                                        color = 'DarkSlateGrey')),
                  selector=dict(mode='markers'))
fig.show()
```



[59]:
```
BirdStrike.columns
```

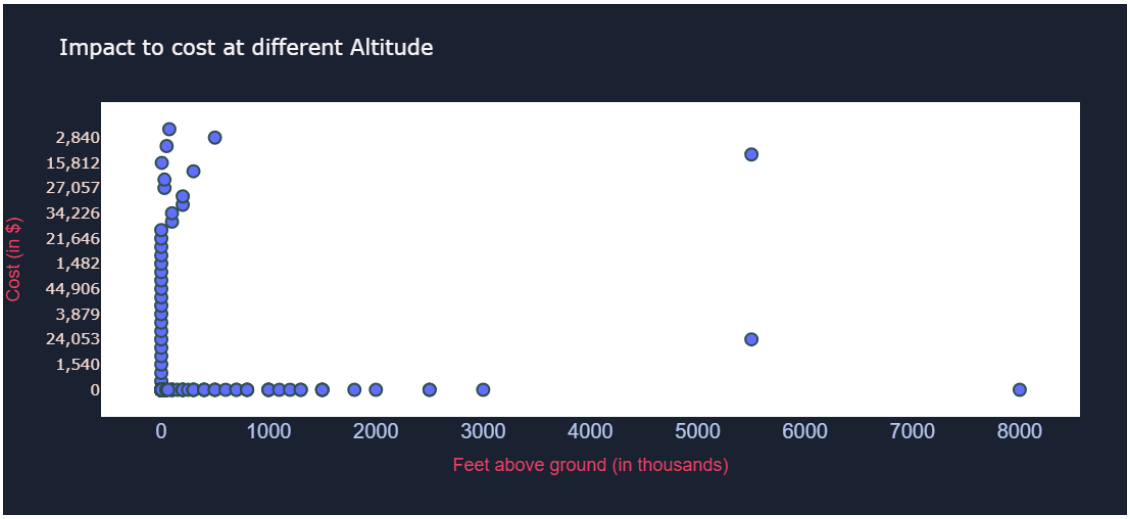
[59]:
```
Index(['Record ID', 'Aircraft: Type', 'Airport: Name', 'Altitude bin',
       'Aircraft: Make/Model', 'Wildlife: Number struck',
       'Wildlife: Number Struck Actual', 'FlightDate',
       'Effect: Indicated Damage', 'Aircraft: Number of engines?',
       'Aircraft: Airline/Operator', 'Origin State', 'When: Phase of flight',
       'Remains of wildlife collected?',
       'Remains of wildlife sent to Smithsonian', 'Wildlife: Size',
       'Conditions: Sky', 'Wildlife: Species',
       'Pilot warned of birds or wildlife?', 'Cost: Total $',
       'Feet above ground', 'Number of people injured', 'Is Aircraft Large?',
       'year', 'month', 'year_month'],
      dtype='object')
```

Key Insights:- above chart we have found that on altitude 0 most birdstrikes occur and there are more impact to flight compare to other altitude.

[60]:
```
# Create a dictionary for visualization of data
Altitude ={'Feet above ground':Effect_in_flight['Feet above␣
 ↪ground'],'BirdStrike':[i for i in range(len(Effect_in_flight['Feet above␣
 ↪ground']))] }

# Create bar chart with Plotly Express
```

```
fig = px.scatter(Effect_in_flight[['Feet above ground','Cost: Total␣
 ↪$']],height=600,x='Feet above ground',y=  'Cost: Total $',title='Impact to␣
 ↪cost at different Altitude')


# Update the layout to change the font of the x-axis label
fig.update_xaxes(title_text="Feet above ground (in thousands)",␣
 ↪title_font=dict(family="Arial", size=18, color="#EE4266"),tickfont=dict(
        family="sans-serif",
        size=20,
        color="#B7C9F2",
    # Change the color of the x-axis category labels
    ))


# Update the layout to change the font of the x-axis label
fig.update_yaxes(title_text="Cost (in $)", title_font=dict(family="Arial",␣
 ↪size=18, color="#EE4266" ))



# Update outer layout
fig.update_layout(legend=dict(title="Impact to flight",
        font=dict(
            family="Arial",
            size=18,
            color="black"
        ),
        bgcolor="LightSteelBlue",
        bordercolor="white",
        borderwidth=2
    ),width=1000,
    height=500,legend_borderwidth=2,margin=dict(
        l=100,
        r=50,
        b=100,
        t=100,
        pad=4
    ),font=dict(color='#F5DAD2'),paper_bgcolor =␣
 ↪'#1A2130',legend_bgcolor='#F3F7EC',title_font_color="#F9F5F6",plot_bgcolor =␣
 ↪'rgba(255, 255,255, 200)',legend_title_font_color='rgba(100,0, 200,␣
 ↪200)',hoverlabel_grouptitlefont_color='#1A2130'
                  ,font_size=15)


fig.update_traces(marker=dict(size=12,
                              line=dict(width = 2,
```

```
                                            color = 'DarkSlateGrey')),
                  selector=dict(mode='markers'))
fig.show()
```



Key Insights:- In above result we found that on between altitude 0-2000 too high cost due to bird strike effects.

[ ]:

Were Pilots Informed? & Prior Warning and Effect of Strike Relation

[61]:
```
pilot_inform = BirdStrikeOrg[['Effect: Impact to flight','Pilot warned of birds␣
↪or wildlife?','Cost: Total $','Effect: Indicated Damage']].dropna()
```

[62]:
```
# Check for pilots informed/warned or not
pilot_inform['Cost: Total $'] = pilot_inform['Cost: Total $'].astype(str).str.
↪replace(",","").astype(int)
```

[63]:
```
cost_y = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
↪']=='Y']['Cost: Total $'].sum()/1000000

print("cost when pilot informed:- ",cost_y,"Million $")
```

```
cost when pilot informed:-  47.210472 Million $
```

[64]:
```
cost_n = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
↪']=='N']['Cost: Total $'].sum()/1000000

print("cost when pilot not informed:- ",cost_n,"Million $")
```

```
cost when pilot not informed:-  59.121748 Million $
```

[65]:
```
flight_damage_y = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
  ↪']=='Y']['Effect: Indicated Damage'].value_counts()
print("damage indicated when pilot informed:_",flight_damage_y)
```

```
damage indicated when pilot informed:_ Effect: Indicated Damage
No damage        516
Caused damage    393
Name: count, dtype: int64
```

[66]:
```
flight_damage_n = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
  ↪']=='N']['Effect: Indicated Damage'].value_counts()

print("damage indicated when pilot not informed:_",flight_damage_n)
```

```
damage indicated when pilot not informed:_ Effect: Indicated Damage
No damage        651
Caused damage    518
Name: count, dtype: int64
```

[67]:
```
impact_flight_y = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
  ↪']=='Y']['Effect: Impact to flight'].value_counts()


print("Impact to flight when pilot informed:- ",impact_flight_y)
```

```
Impact to flight when pilot informed:-  Effect: Impact to flight
Precautionary Landing    502
Aborted Take-off         229
Other                    142
Engine Shut Down          36
Name: count, dtype: int64
```

[68]:
```
impact_flight_n = pilot_inform[pilot_inform['Pilot warned of birds or wildlife?
  ↪']=='N']['Effect: Impact to flight'].value_counts()
print("Impact to flight when pilot not informed:- ",impact_flight_n)
```

```
Impact to flight when pilot not informed:-  Effect: Impact to flight
Precautionary Landing    619
Aborted Take-off         250
Other                    248
Engine Shut Down          52
Name: count, dtype: int64
```

Key Insights:- In Above result of analysis we found that birdstrikes impact on cost ,flight damage,and other damage can be decreasable by prior waring to pilot about the strike.in cost effect we have found there around 12 million loss of cost has decreased,on 100 birdstriks there are no damage.

13.1 >>Project Summary

In overall analysis we haave found mostly birdstrikes occur between altitude 0-1000 above to ground.we also describe the all cases we have analyze in past process.

14 Conclusion:-

If pilot prior warned about the birdstrike event we can decrease the cost and impact due to birdstrikes,there are seasonal changes in birdstrikes in winter season we found number of birdstrikes go down.