

# **2015 Flight Delays and Cancellations Analysis Report**

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## 1.0. Introduction

The purpose of this report is to analyze the 2015 Flight delays and cancellations data to generate valuable insights using the theory and practice of data visualization. These insights will help airline management make salient business decisions from the recommendations to reduce the causes of delays/cancellations thereby reducing cost of compensations, reputational damage and improve overall flight schedule efficiency.

## 2.0. Preliminary Data Information

- Data Source – [Kaggle Dataset](#)
- Data Cleaning Assumptions
  - Replacement of null entries because other data points are relevant
  - Airline codes expanded to reflect Airline Names
  - Negative Values for Departure and Arrival delays cleaned to reflect no delays for those days
  - Cancellation reasons depicted by Alphabets replaced with actual reasons from legend provided
  - Etc.
- Final Data Visualization Story published at [Tableau Public Link](#)

## 3.0. Total Delay Time by Airlines

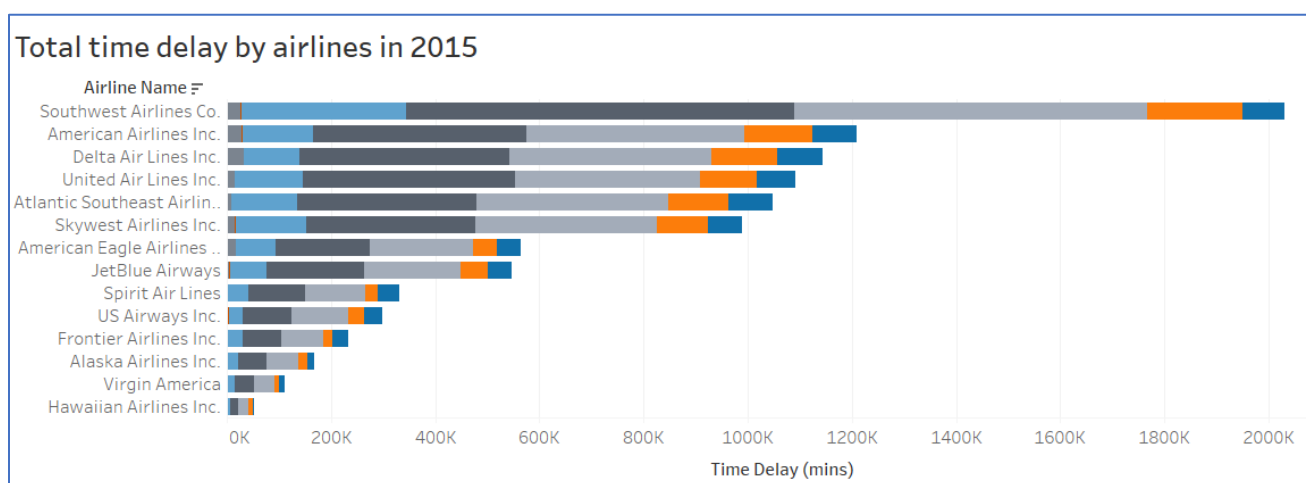


Figure 3-1: Chart showing Total Time Delay by Airlines in 2015

- [Link: Tableau Link 3.1](#)
- **Summary:**

Overall, the airline with the **worst delays** in 2015 is **Southwest Airlines Co.** with a total of **2,031,535 mins** while the airline with the **least delays** is **Hawaiian Airlines Inc.** with a total of **50,385 mins** (See Figure 3.1).

These delays have been categorized in the chart above using the various causes of delays to enable a drill down of what component is contributing to the total delay for each airline so it can be addressed specifically. The identified causes of delays are **Air System delay, Airline delay, Arrival delay, Departure delay, Late Aircraft delay, Security Delay and Weather delay.**

Further analysis on these categories can be found in Section 4.0.

To visualize the total delay time by categories, I selected the **measure values** of interest as listed above and inserted into my **Columns** field while I inserted the **Airline name** into the **Rows** field. For chart design, different colours were used to clearly depict the 7 categories.

- **Design Comments:**

The Bar Chart was chosen to allow the comparison between categorical and numerical variables. My reader can clearly see and interpret my work easily by using a colour palette that is colorblind-friendly. The horizontal barchart was also chosen over the vertical type to allow for enough vertical space to compare 14 airlines and the Legend helped to distinguish the different categories.

## 4.0. Causes of Delays and Impact

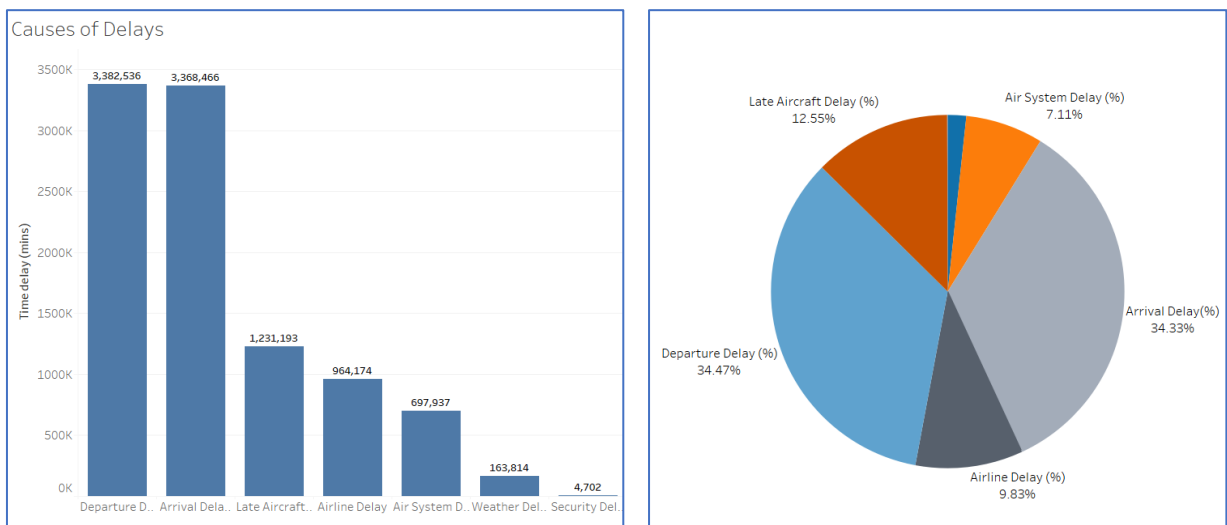


Figure 4-1: Charts showing Causes of Delay

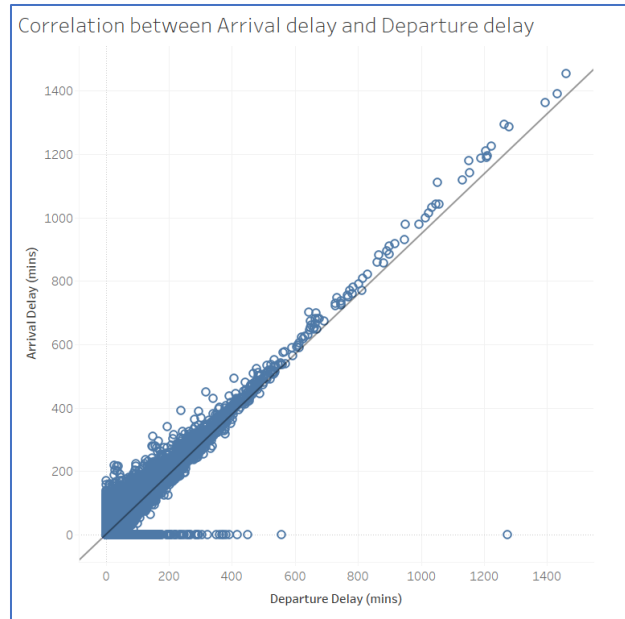


Figure 4-2: [Scatter plot showing correlation between Departure and Arrival Delays](#)

- [Links: Tableau Link 4.1a](#), [Tableau Link 4.1b](#), [Tableau Link 4.2](#)
- **Summary:**

There are seven causes delays identified but the cause with the worst impact for most airlines is Departure delay with a total of **3,382,536 mins** which constitutes **34.5%** of the total delays in 2015, closely followed by Arrival delay with a total of **3,368,486 mins** which constitutes **34.33%** while the Security delay with **4,702 mins** is almost non-existent because it constitutes only **0.05%** to the overall causes of delay ([See Figure 4.1](#)).

I suggest the airline management investigate the causes of departure delays to identify the root cause because reducing this category of delay will significantly reduce the overall delays. It will reduce the cost of flight delay compensation paid to customers.

Some of the investigations could be the following:

- Arrival Delay
- Punctuality of flight crew e.g., pilots
- Flow of Air Traffic Control
- Obstructions on the Tarmac
- Aircraft preparation
- Industrial strike actions in aviation industry
- Passenger bag transfers for connecting flights
- Maintenance faults

Since Arrival Delay can lead to Departure delays and vice-versa, I created a scatterplot to analyze the relationship between these two variables and it was observed that the plot is positively correlated and statistically significant with  $R^2=0.92$  (See Figure 4.2). This means the longer the arrival delays, the longer the departure delays as well and this relationship is forecasted to continue if no intervention happens. From the plot, it is seen that there were only few times arrival delay did not impact on departure which implies other reasons were responsible for those days.

- **Design Comments:**

- **Bar Chart:** The simple Vertical Bar chart was chosen to allow for comparison between 7 variables, no colour difference was required here because it does not add any extra value to the analysis and, no further drill down is required.
- **Pie-chart:** This was chosen to express the visual as a percentage to give a quick view of what portion is contributing the most and the different colours helped to distinguish the reasons clearly using colorblind friendly palette. It was done to augment the Bar chart visualization.
- **Scatterplot:** This is the best plot to determine whether the two variables have a relationship or correlation.

## 5.0. Reasons for Cancellations

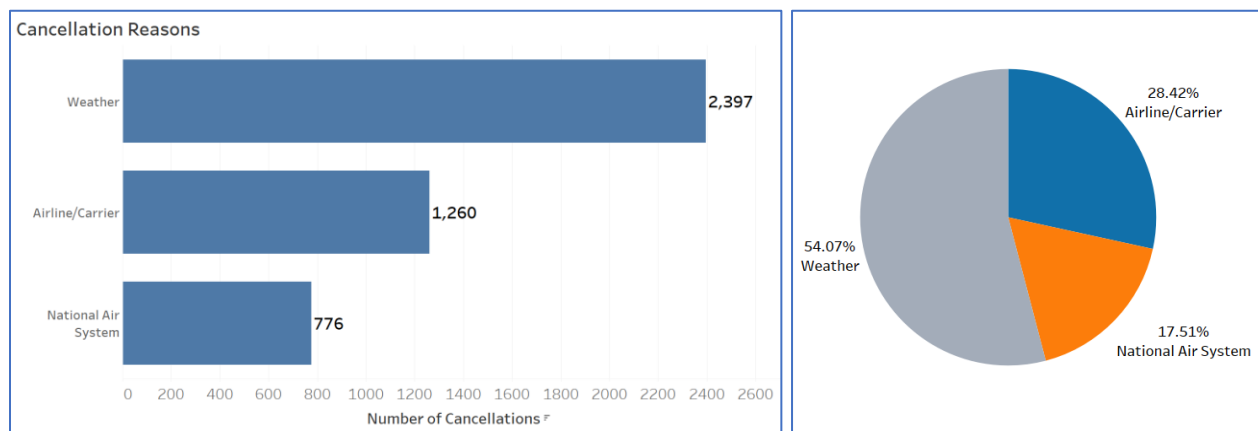


Figure 5-1: [Charts showing Flight Cancellation Reasons](#)

- **Link:** [Tableau Link 5.1](#)
- **Summary:**

From the charts above, it can be observed that the reason for the most flight cancellations is due to **Weather** which occurred **2,397** times. Weather is responsible for about half of all cancellations because it constitutes about **54%** of the total number of times cancellations occurred. Unless newer technologies are invented for airplanes to navigate severe weather

conditions, there is not much to be done about it as this is a natural occurrence. Alternatively, airlines can leverage on more robust weather forecast technology to schedule flights.

However, it is recommended that investigation should be carried out on the other two reasons for the cancellations which are Airline/Carrier that occurred **1,260 times (28.4%)** and National Air System which occurred **776 times (17.51%)** (See Figure 5.1).

Security did not contribute to cancellations at all which is very good.

Some of the reasons for flight cancellations could include the following.

- Unforeseen circumstances (e.g., global pandemic)
  - Air Traffic restrictions
  - Aircraft technical issues
  - Computer glitches
  - Insufficient aircrafts to high handle demand
  - Strike action
  - Low passenger turnouts
  - Lack of flight crew members
- 
- **Design Comments:**
    - **Bar Chart:** The simple horizontal bar chart was chosen because it allows the reader easily identify trends than a table of numerical data
    - **Pie Chart:** Pie chart was chosen to augment the Bar chart visualization because it is great for showing the relationship of parts of a whole and the number of variables is small

## 6.0. Conclusion

In conclusion, it is obvious that some of the reasons for flight delays and cancellations are avoidable. Airline management needs to investigate some of these causes and make deliberate decisions to resolve the issues causing these delays. This will improve overall flight efficiency, save cost on claims, improve reputation, and increase overall profitability.

## 7.0. References

- Project Data (<https://www.kaggle.com/datasets/usdot/flight-delays/discussion/35193?resource=download>)
- Tableau Software (<https://public.tableau.com/en-us/s/download/>)
- Aircraft Background Image (<https://guardian.ng/life/impromptu-flight-cancellations-delays-how-much-is-too-much/>)