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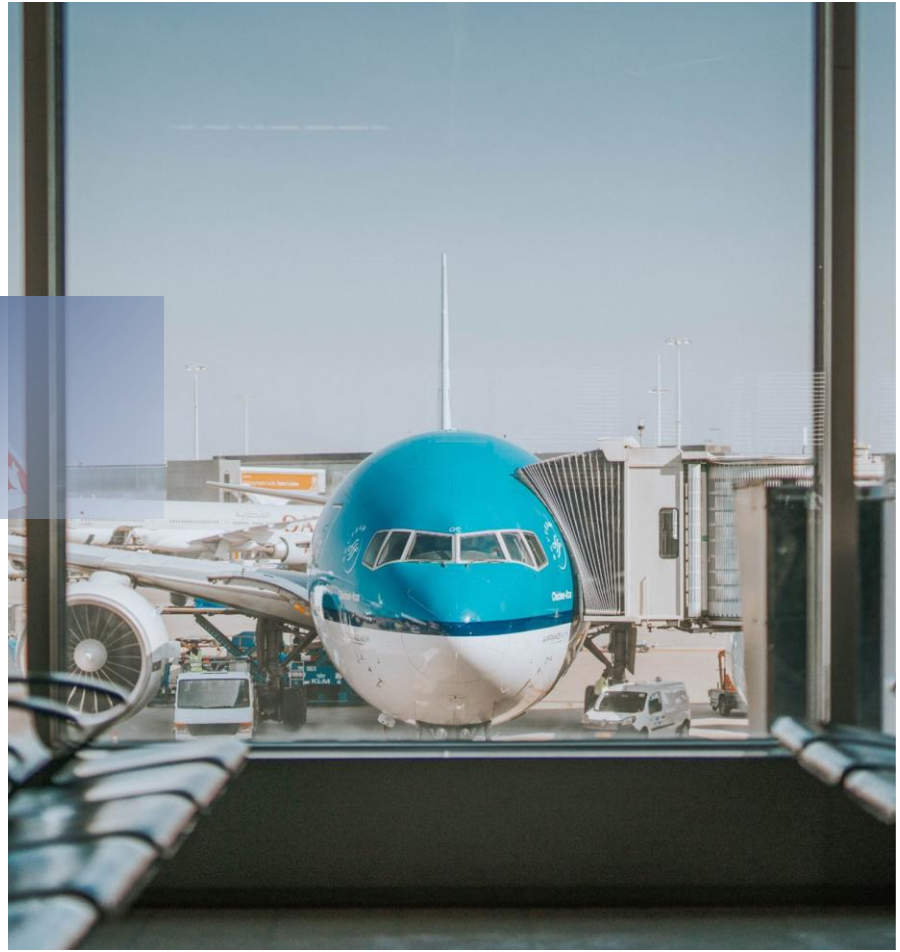
01 INTRODUCTION

Introduction

- Target audience: Airline executives
- Visualization function: Mostly explanatory, but some are exploratory
- Visualization tone: Analytical

- Objectives:
  - Provide key reasons for Falcon Airlines' overall excellent performance
  - Identify possible factors that may contribute to it
  - Compare the factors with other airlines, which in this case is Eagle Airlines. Falcon Airlines will be used as a benchmark
  - Recommend possible solutions for improvements to Eagle Airlines



02 OVERVIEW

Overall Performance between
Eagle Airlines & Falcon Airlines

Overview

- Figure 1 shows the brief overview of both flight profiles. It shows the proportion of the delayed and on-time/early of both airlines.
- Diverted flights are not included in the calculation since they are neither delayed, on-time, or early.
- Falcon Airlines is performing better as it has more on-time or early flights than Eagle Airlines

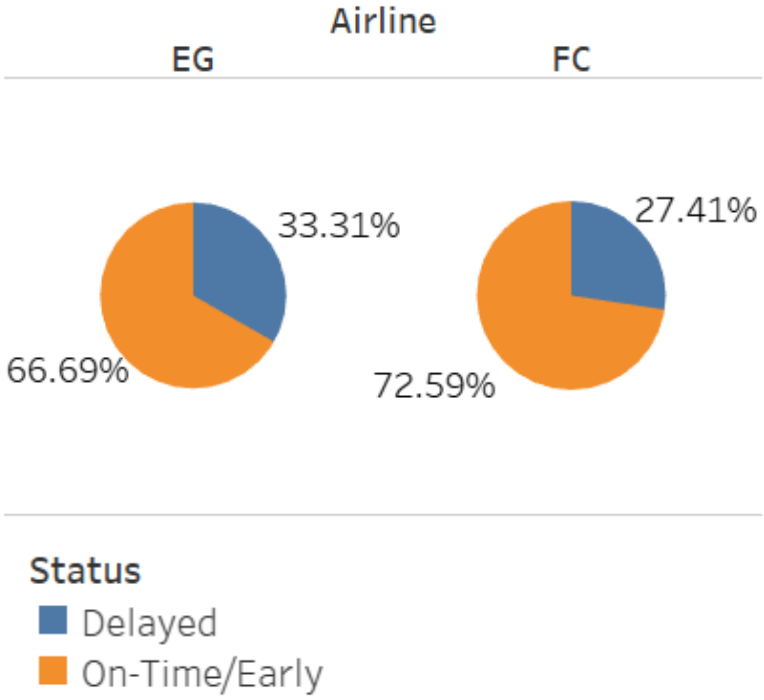


Figure 1. Data on Delay Profile

Overview

- Since the actual data is different from the estimated data, we cannot say that the estimated data is accurate. In the actual data, the proportion of delayed of both airlines are around 5% less than the estimated data.
- However, for both the estimated data and the actual data, **Falcon Airlines performs better overall** as it has lower proportion of flights delayed compared to Eagle Airlines, with 27.41% and 33.31% respectively in the actual data.

	On-time/Early	**Delayed**
Eagle Airlines	61.16%	38.84%
Falcon Airlines	67.03%	32.97%

Figure 2.1. Estimated Data on Delay Profile

	On-time/Early	**Delayed**
Eagle Airlines	66.69%	33.31%
Falcon Airlines	72.59%	27.41%

Figure 2.2 Actual Data on Delay Profile

03 FACTORS

1. Flight Schedules
2. Aircraft Utilisation and Airports
3. Types of Arrival Delays

3.1 Flights Schedules

1. Flight Schedules

- The first possible factor of Eagle Airlines performing worse off as compared to Falcon Airlines might be due to **flight scheduling, either daily or hourly**. The number of flights during a certain time of a day or a week may subsequently affect the delay time depending on the traffic of the airport.
- For instance, during peak hour, insufficient airplanes may cause delay in departure if the previous plane arrived late and there is no other airplanes to be used.
- We will further analyse the difference in the distribution of flight schedules by Eagle Airlines and Falcon Airlines, by looking at the **number of flights and the average arrival delay time across the week** between both Airlines.

1. Flight Schedules

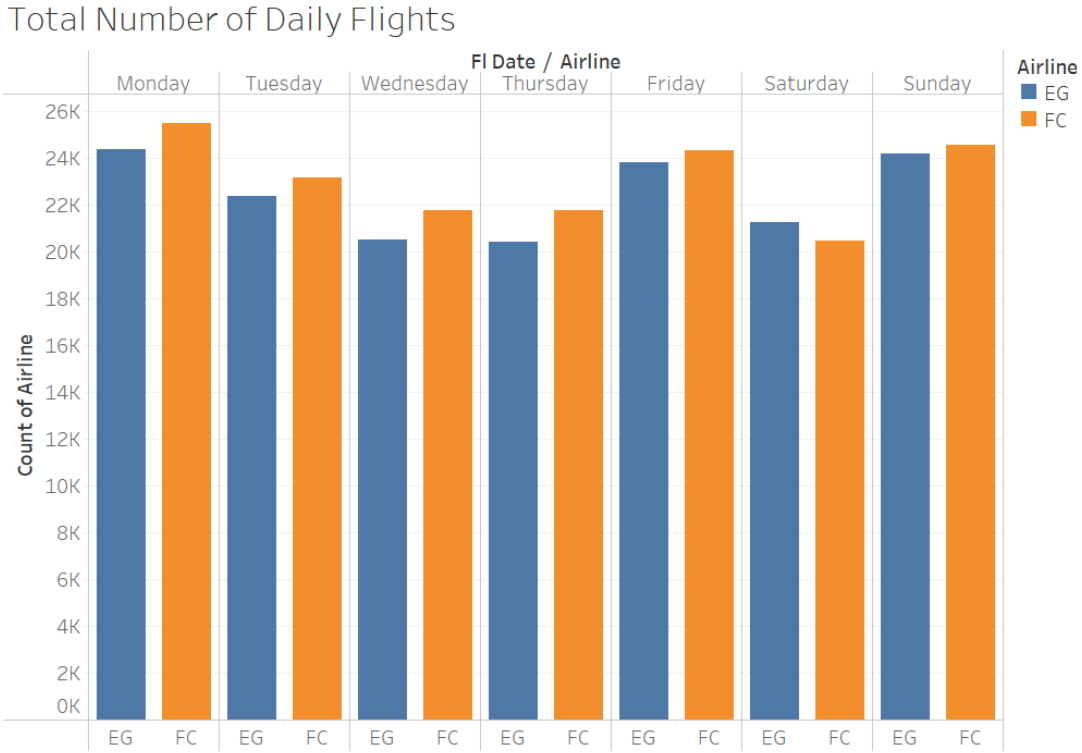


Figure 3. Total number of Flights (Daily)

EG = Eagle Airlines
FC = Falcon Airlines

- The Falcon Airlines tend to have slightly higher number of daily flights compared to the Eagle Airlines

1. Flight Schedules

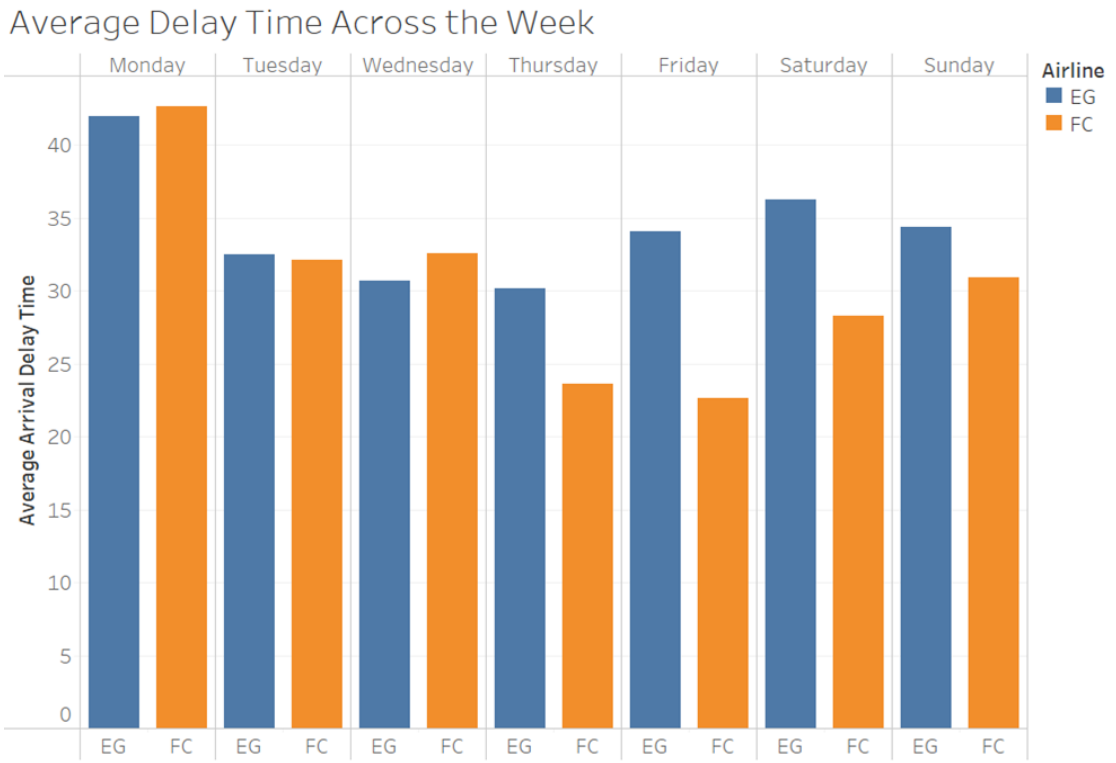


Figure 4. Average Delay Time across the Week

EG = Eagle Airlines
FC = Falcon Airlines

- The Eagle Airlines tend to have **more delays** from Thursday to Sunday compared to the Falcon Airlines.

Analysis

- From Figure 4, Eagle Airlines tend to have more delays **from Thursday to Sunday** as compared to the Falcon Airlines.

- Although Falcon Airlines has a **higher average number of flights daily** (Figure 3) for the aforementioned days, Falcon Airlines still **has less average delays** than Eagle Airlines. This suggests that Falcon Airlines are operating at a much **more efficient level**.

- We will further look into the average delay time for every hour of departure to analyse if Eagle Airlines are operating efficiently.

1. Flight Schedules

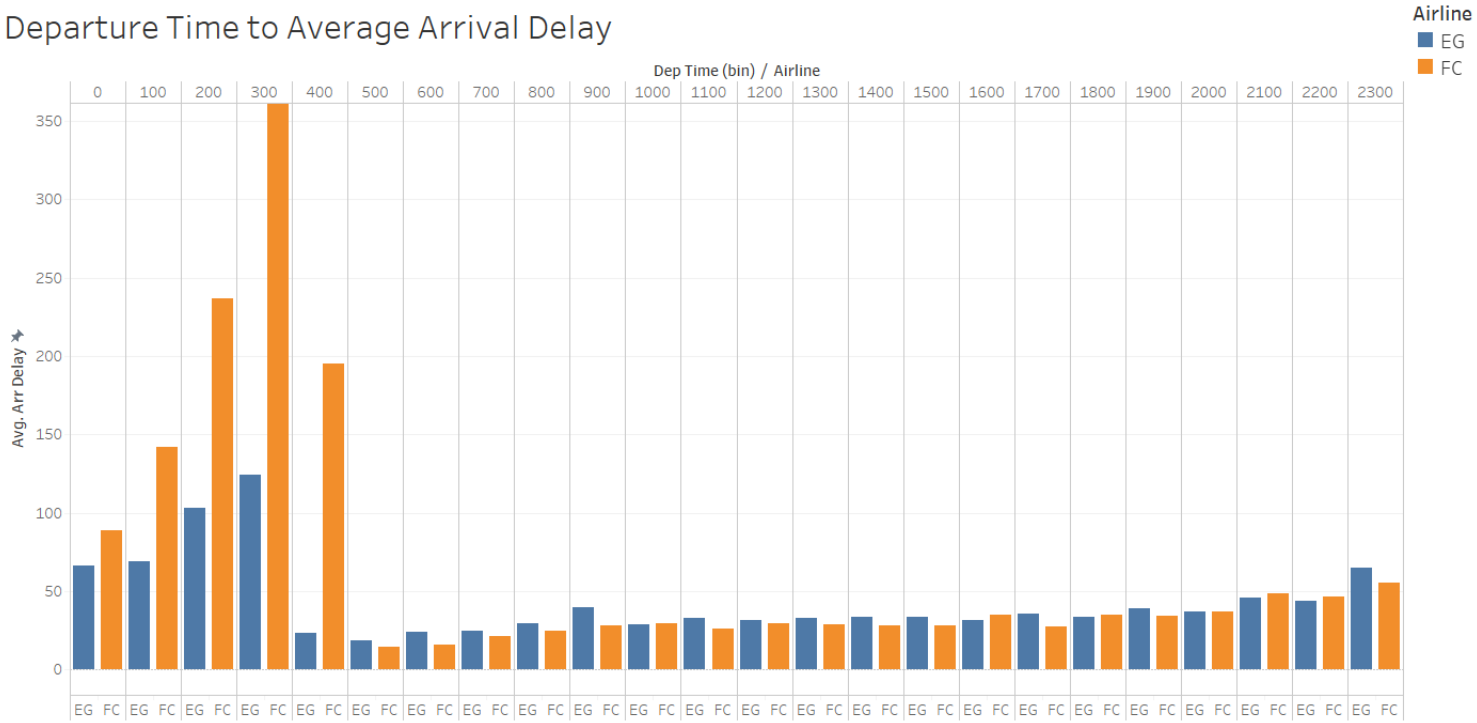


Figure 5. Average Arrival Delay Every Hour of Each Airlines

EG = Eagle Airlines

FC = Falcon Airlines

Note: Data excludes Arrival Delay < 1

Data is also cleaned to change “2400” to “0000” since they are the same.

1. Flight Schedules

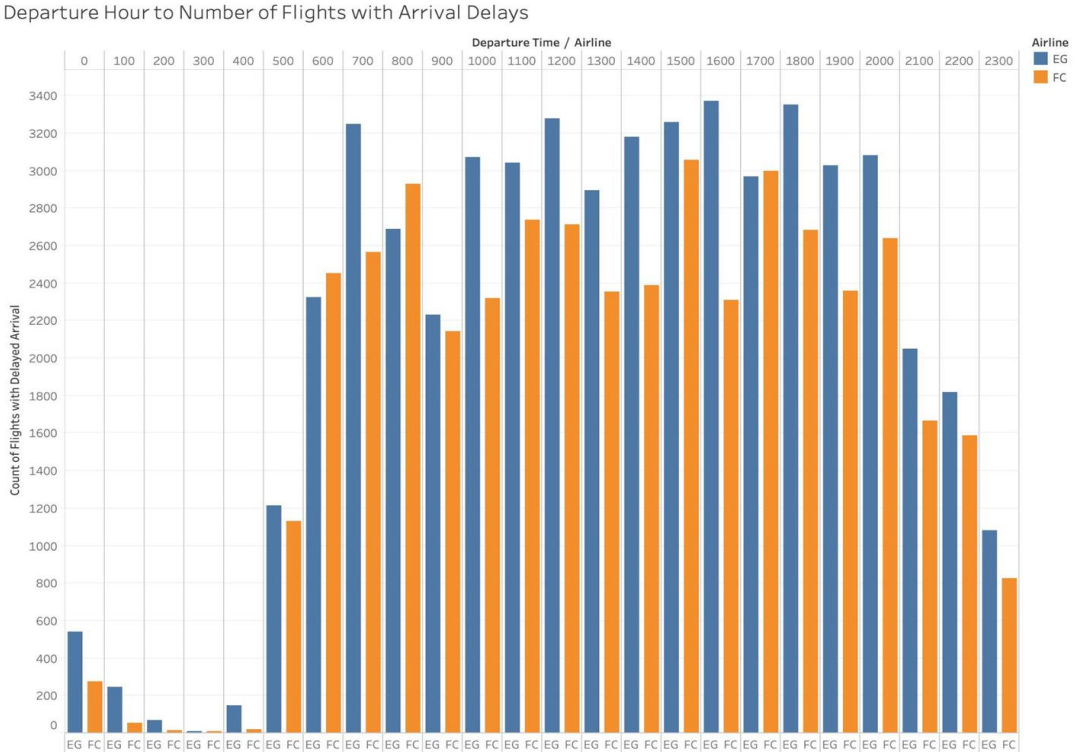


Figure 6. Number of Flights with Delayed Arrival for Every Hour

EG = Eagle Airlines

FC = Falcon Airlines

Note: Data excludes Arrival Delay > 1

Data is also cleaned to change “2400” to “0000” since they are the same.

Analysis

- From Figure 5, at the first glance, it seems that Falcon Airlines are performing worse than Eagle Airlines as the average arrival delay is high for some departure hours.
- However, when we look into the number of flights operating across the departure hours (Figure 6), we can see that Eagle Airlines actually have more flights operating than Falcon Airlines, thus it suggests that it may be due to the higher number of flights that is why it is bringing the average delay time down.
- Further look into Figure 5 & 6, Eagle Airlines are actually performing worse as **overall the total arrival delay** time (Number of Flights * Average Arrival Delay) is **higher for Eagle Airlines** than Falcon Airlines, thus we can say that Eagle Airlines are not as efficient as Falcon Airlines.

Analysis

Recommendations:

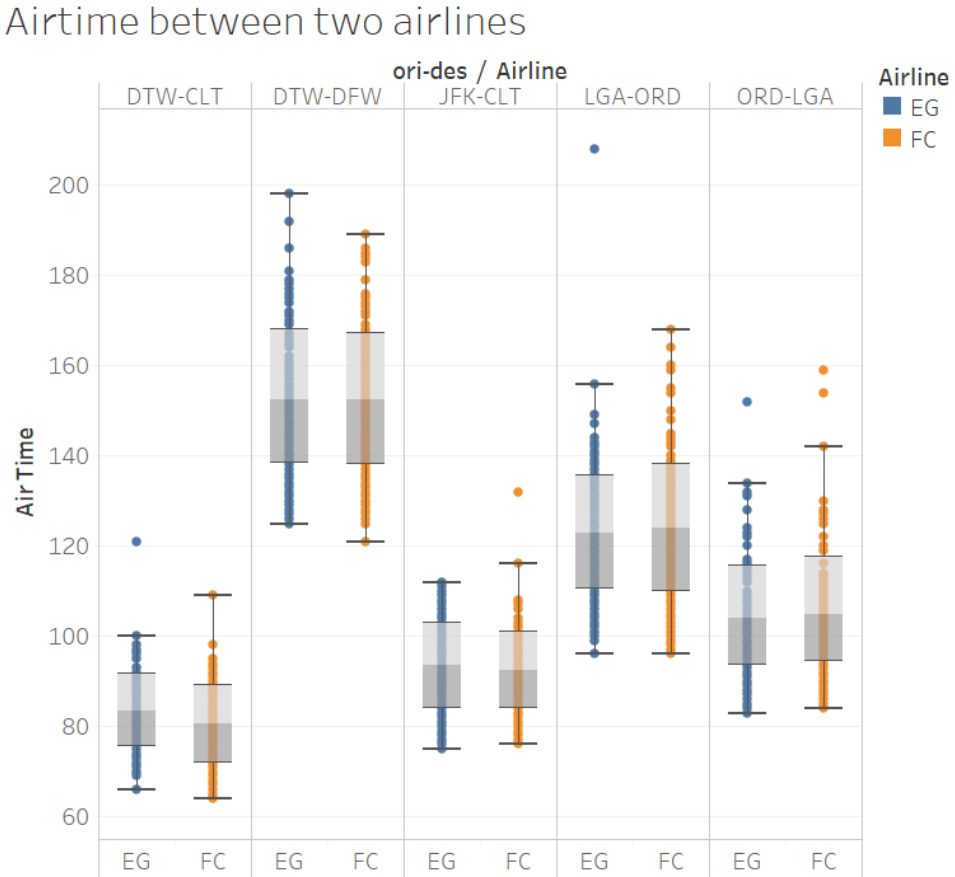
- The number of flights can be **increased**, generally on Mondays and during the night, where the average arrival delay is highest for both airlines. The airlines can also distribute the number of flights **more evenly** to mitigate the peak delay on Monday.
- Eagle Airlines should focus on the departures during the day, because they are performing well for departures at night. Eagle Airlines should also analyse the factors affecting late arrivals during the day.

3.2 Aircraft Utilisation and Airports

3.2. Airplanes utilisation & Airports

- Another possible factor that may cause Eagle Airlines to encounter higher average arrival delay time than Falcon Airlines is the airlines' **aircraft utilisation.**
- Hence, we will first understand and compare the airtime fluctuations of the two airlines between airports that were identified to have high fluctuations.
- Moreover, we will analyse the most utilised and underutilised aircrafts to further understand the utilisation of the aircrafts.

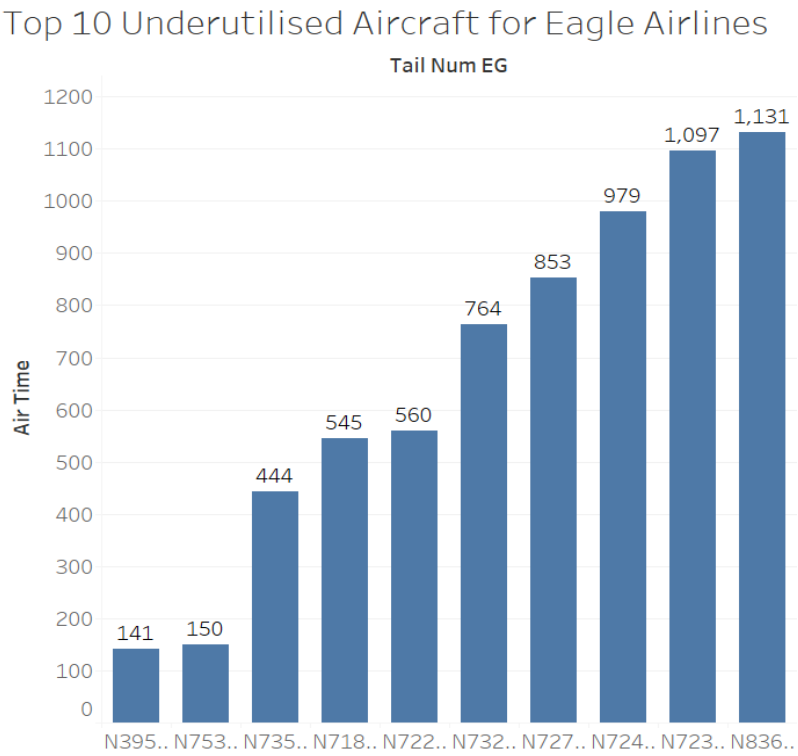
Figure 7. Airtime fluctuations between two airlines

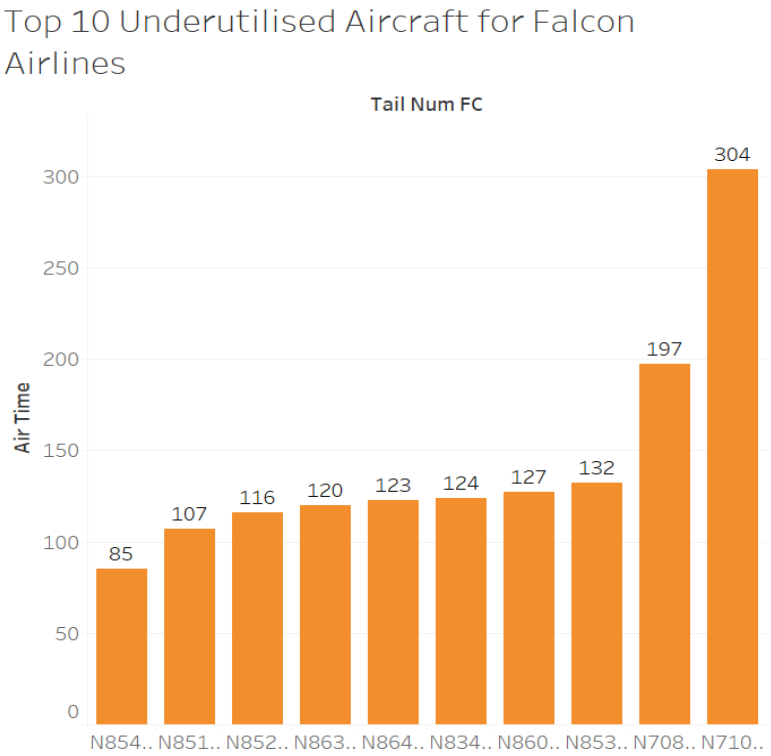


Analysis

- Interquartile range for Eagle Airlines and Falcon Airlines are not significantly different, indicating that **airtime fluctuation is not very significant** in comparing the two airlines
- Since there is not much to be gathered from this plotted diagram, we will shift our focus to the aircraft utilisation of the two airlines.

Figure 8. Top 10 Underutilised Aircrafts for Eagle Airlines (Left) and Falcon Airlines (Right)





Analysis

- As shown in Figure 8, the utilisation rate (derived from air time) for Eagle Airlines' under utilised aircrafts is higher than that of Falcon Airlines, however Eagle Airlines still has higher proportion of delay flights compared to Falcon Airlines. Thus, this shows that **Falcon Airlines is more efficient compared to Eagle Airlines**.
- Figure 9. shows that Eagle Airlines has a larger fleet size (number of aircrafts) compared to Falcon Airlines. However, the number of flights for Falcon Airlines is larger than Eagle Airlines, suggesting a **more efficient utilisation of aircrafts** by Falcon Airlines.

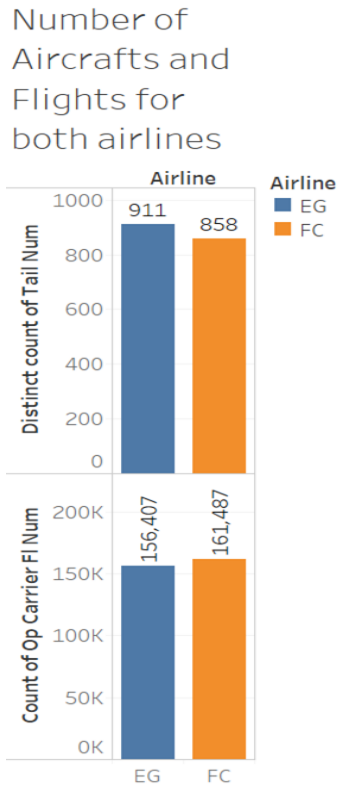


Figure 9: Number of Aircrafts and Flights for both Airlines

Analysis

- Although Falcon Airlines use less of its underutilised aircrafts, the airtime of **Falcon Airlines' most underutilised aircrafts** is more **widely spread out** as compared with Eagle Airlines', as shown in Figure 8.
- This shows **Falcon Airlines' ability to manage the aircrafts efficiently**, even though they have higher number of flights.

Suggested Improvements:

- Eagle Airlines could possibly **use the underutilised aircrafts more effectively** (eg. distributing more flights to the least 2 underutilised aircrafts) so that the **usage of their aircrafts is more spread out**.

Figure 10. Top 20 Most Utilised Aircrafts for Falcon Airlines

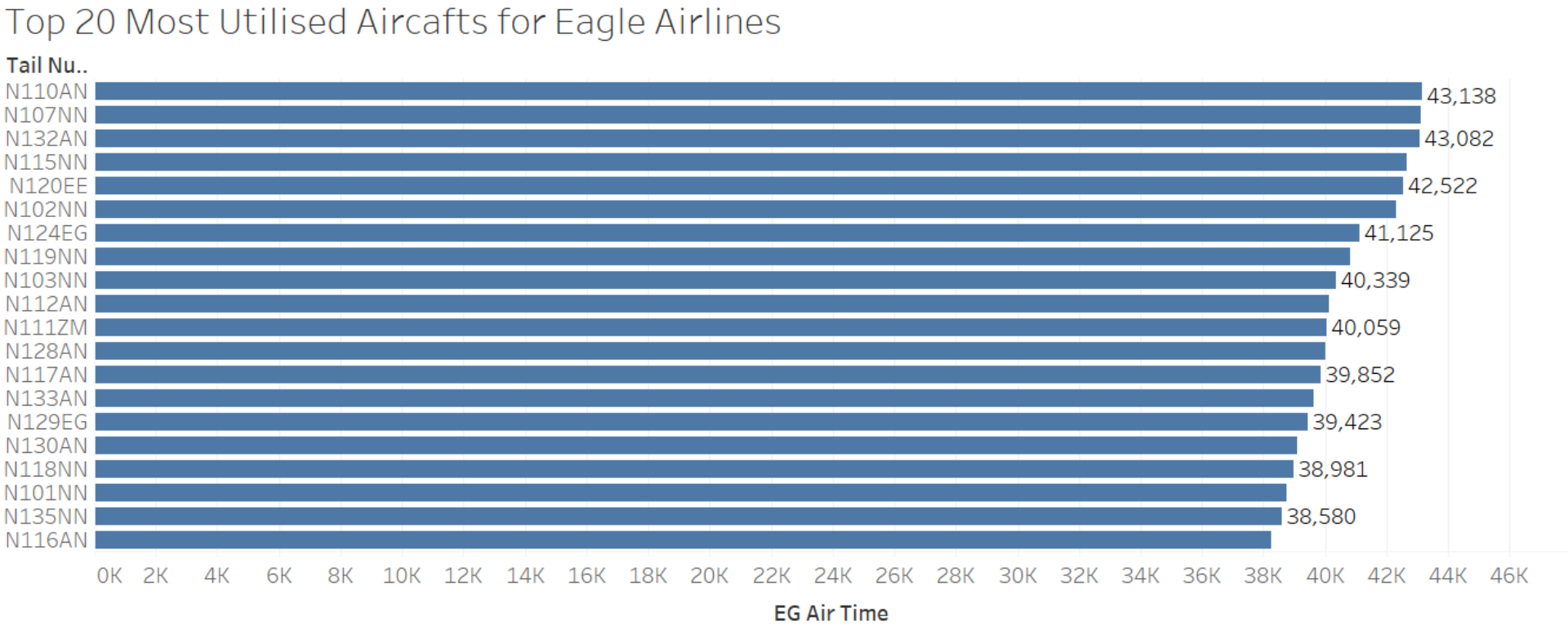
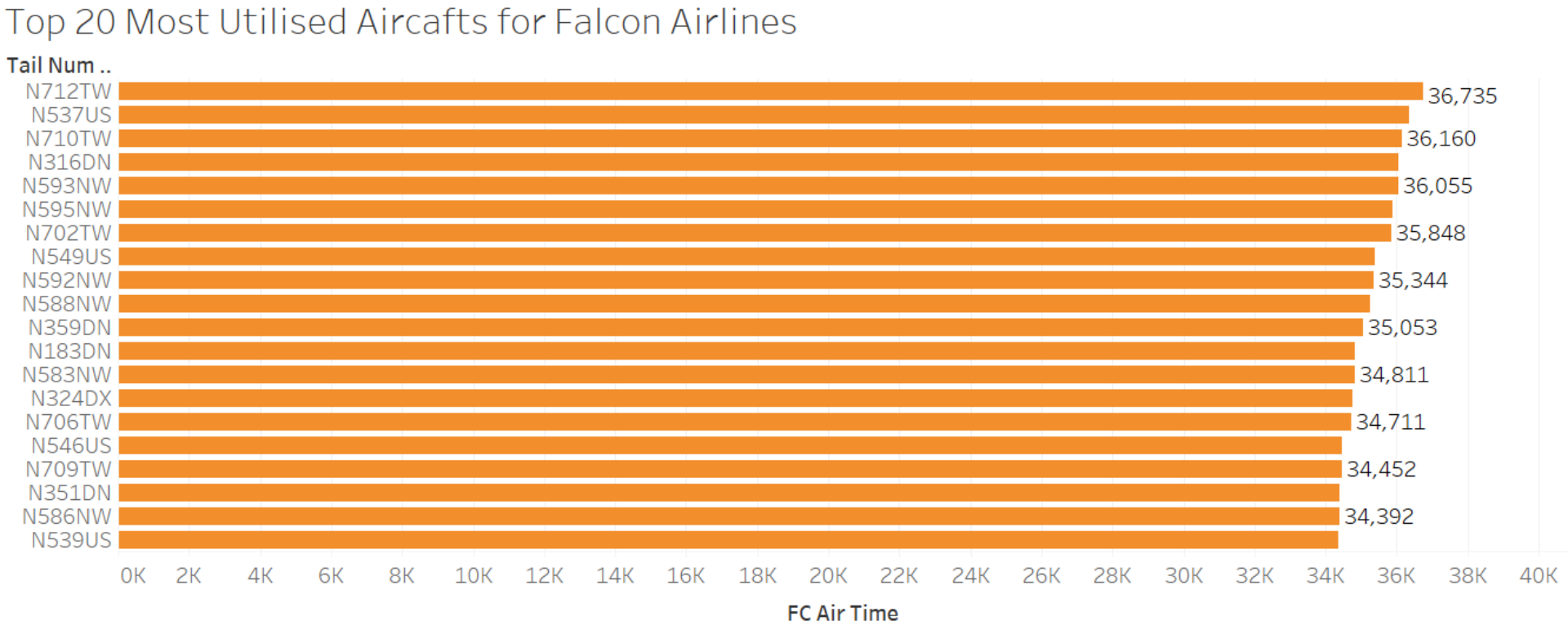


Figure 11. Top 20 Most Utilised Aircrafts for Falcon Airlines



Analysis

- As shown in Figures 10 and 11, the **utilisation rate** (derived from air time) **for Eagle Airlines' aircrafts** is **higher than** that of **Falcon Airlines**. An indication is that EG usually has on average longer flight routes compared to FC (Figure 12).
- Differences in sum of airtime over two months for both Eagle Airlines and Falcon Airlines are not significant enough to gain insights about average arrival delay.
- Hence, we will examine the airports where these two airlines operate.

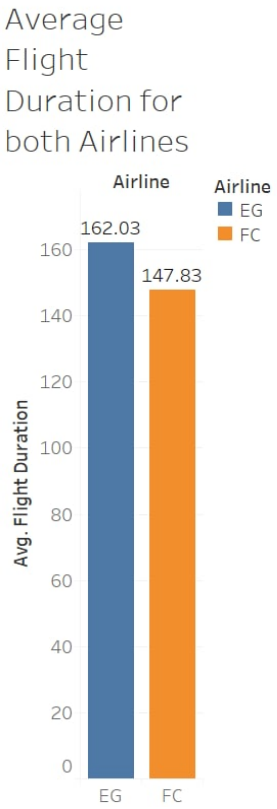
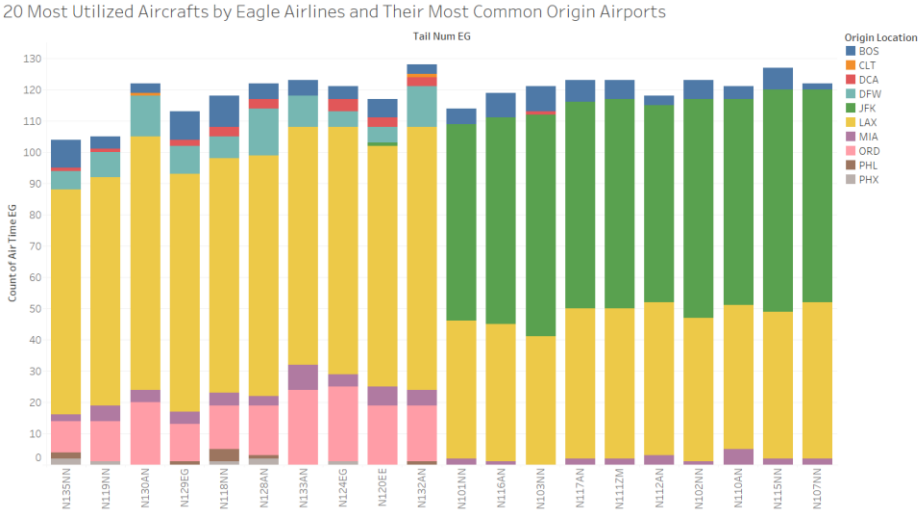
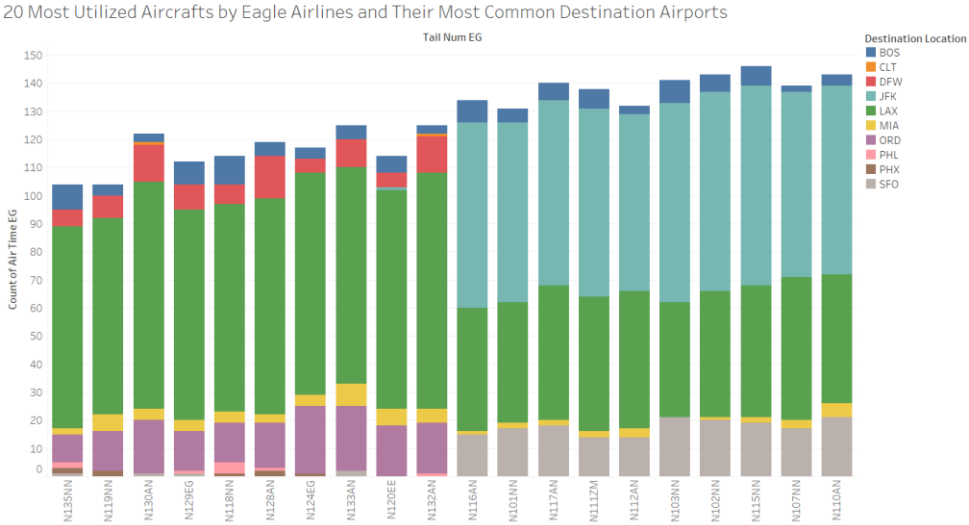


Figure 12: Average Flight Duration for both Airlines

Figure 13. Most common origin and destination airports where Eagle Airlines' operate





Analysis

- As shown in the Figure 13, the most common airports for both origin and destinations from top 20 most utilised aircrafts for Eagle Airlines are **LAX, JFK and ORD** (based on the proportion of number of flights).
- Hence, this shows that the top 20 most utilised aircrafts are mainly used for flights that are from and to those airports.
- To understand whether Eagle Airlines' most utilised aircrafts has the impact on the delay, especially significant and severe delays, we will further study the average significant and severe delays of the airports for Eagle Airlines.

Figure 14. Airports where Eagle Airlines' Significant and Severe Delay Mainly Occur

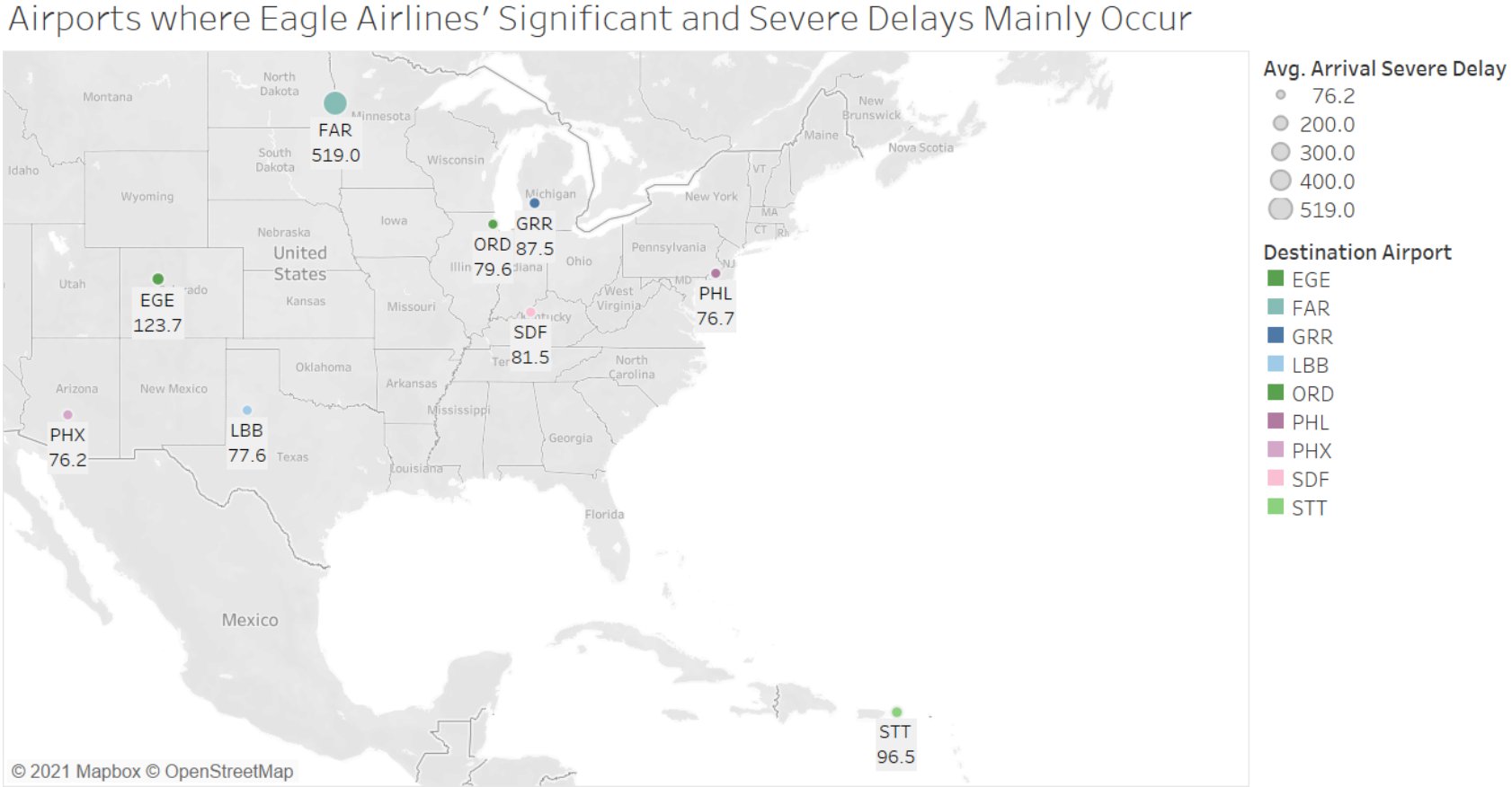
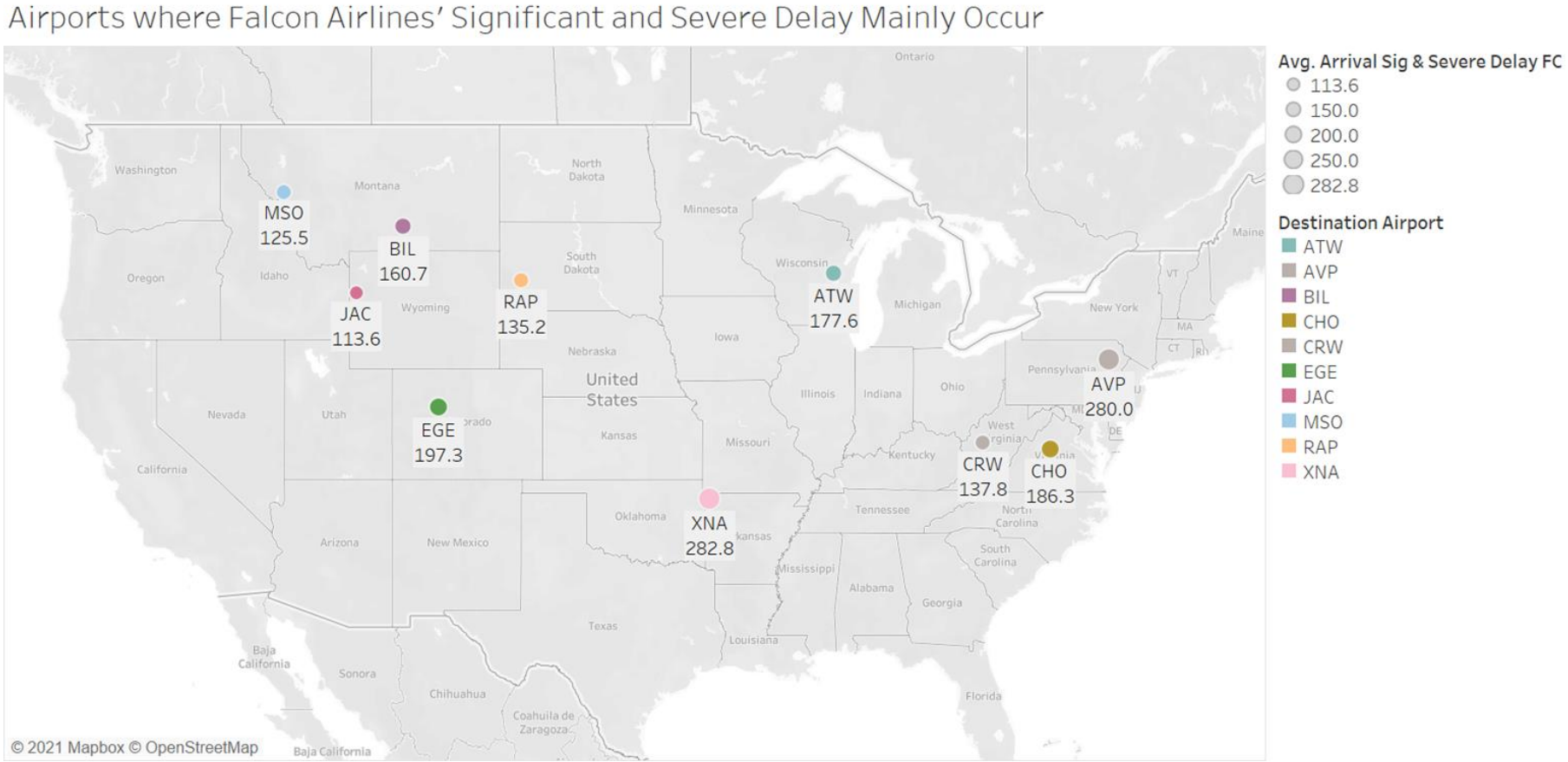


Figure 15. Airports where Falcon Airlines' Significant and Severe Delay Mainly Occur



Analysis

- Although LAX & JFK are the most common origin and destination airports, their average significant and severe delay is not high compared to other airports. One possible reason might be due to **a high number of aircrafts are being focused on those busy airports**, which mitigate the delay time. In return, those airports that are not as busy have fewer aircrafts.
- Moreover, Eagle Airlines seems to **not perform well in managing the delay** comparing to Falcon Airlines' average delay time which are more consistent across the airports. Thus, we can see that airport like **FAR** has much higher average delay time compared to the other airports where Eagle Airlines' flights operate.

Suggested Overall Improvements:

- Eagle Airlines should redesign their aircrafts assignment system to make sure that there are **enough aircrafts per airport** so that the average time delay across different airport could be more spread out or be improved.

3.3 Types of Arrival Delays

Types of Arrival Delays

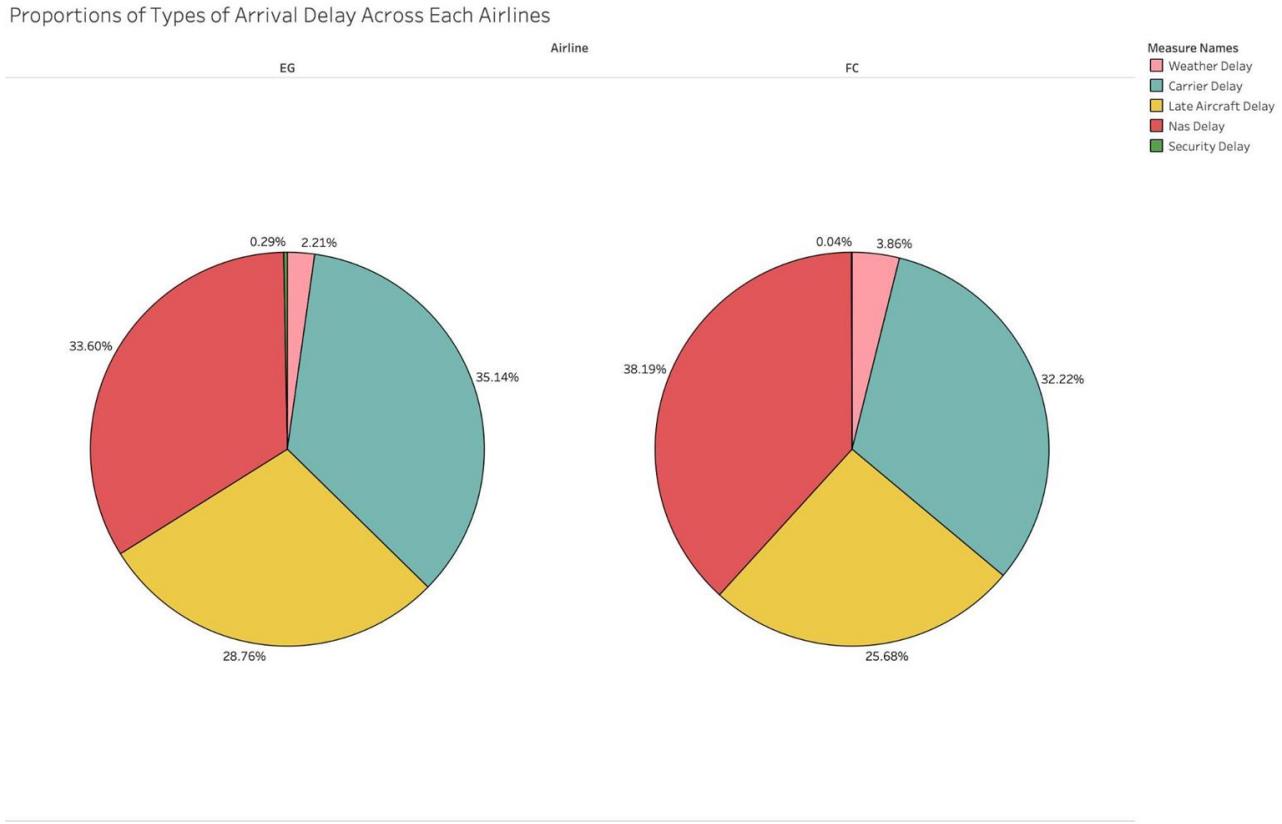
- Arrival Delays are categorised into 3 types:

Minor Delay	Significant Delay	Severe Delay
Delayed less than 15 minutes	Delayed between 15 and 45 mins	Delayed for more than 45 mins

- For Significant or Severe Delay, there is a need for explanations by the flight crew, and these delays are categories into 5 different categories: **Carrier Delay, Weather Delay, National Air System Delay, Security Delay and Late Aircraft Delay.**

- Therefore, we can look into the proportion of these 5 different categories across each airline, to **identify which types of delay are significantly or severely affecting Eagle Airlines** the most and how the airline can tackle the problem to effectively improve its performance.

Figure 16 : Proportions of the different delays



Analysis

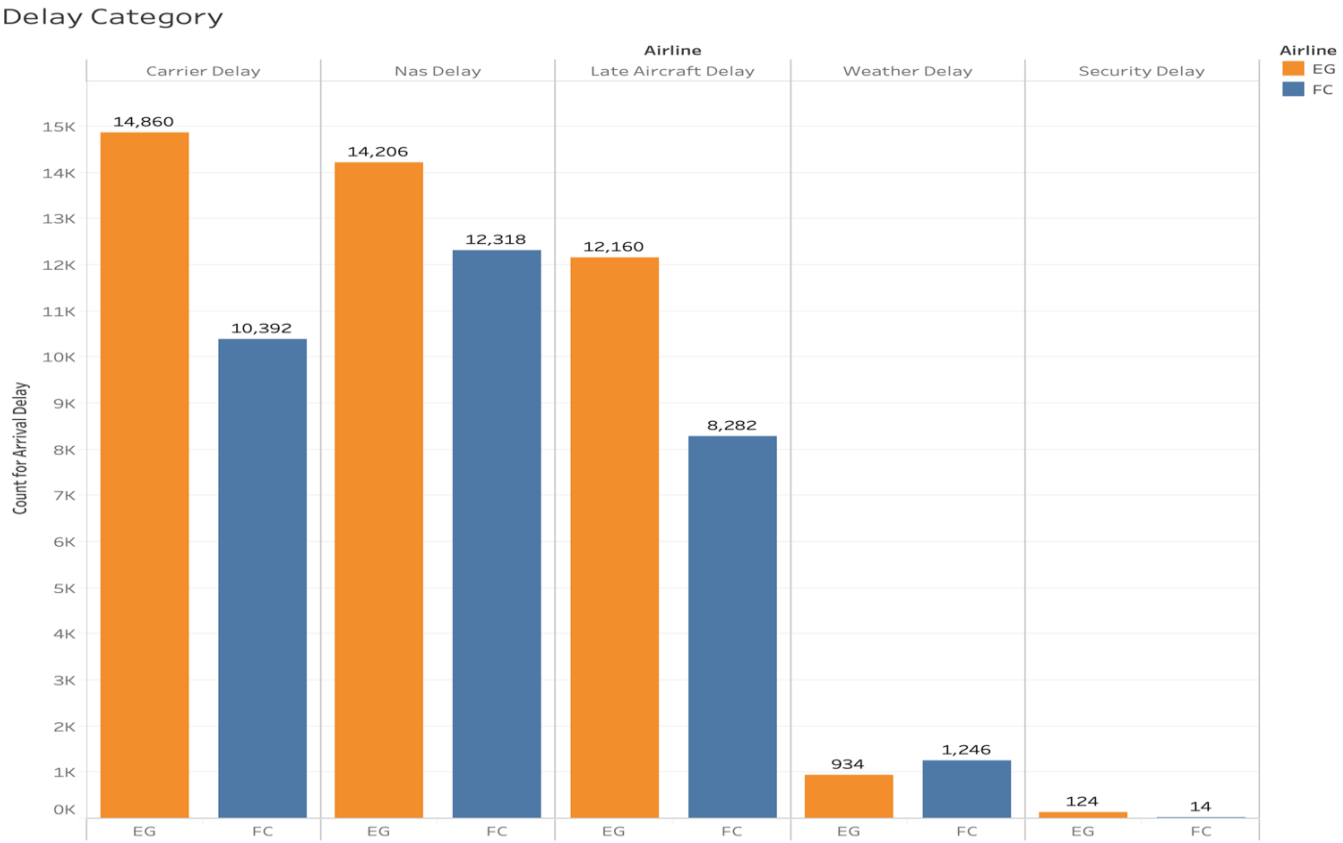
- From the pie charts, we can conclude that **Carrier Delay, NAS Delay and Late Aircraft Delay** make up the **top 3 proportions** of the types of arrival delays across both Eagle Airlines and Falcon Airlines.

- While, Weather Delay and Security Delay are almost **insignificant** in the pie chart, totalling up to less than 5% of types of arrival delay for both airlines.

- However, looking at just the proportions for each airline, there is **insufficient information** for us to conclude that Eagle Airlines are performing worse than Falcon Airlines as both airlines have similar results.

- Therefore, we will further investigate and look into the **count of the different delay categories** across both airlines so that we are able to **compare the performance** between Eagle Airlines and Falcon Airlines.

Figure 17: Count of each delay category



Analysis

- Figure 17 shows that **Eagle Airlines suffer significantly higher arrival delays** across majority of the delay categories, except for the weather delay where its difference is relatively insignificant.
- As mentioned previously (from figure 16), figure 17 also shows **carrier**, **NAS**, and **late aircraft** delays as the **most significant contributors** of delay amongst the 5 categories.
- As NAS delay could be due to conditions that are out of the control of the airline, which includes heavy traffic volume, airport operations, and air traffic control, the airlines should focus on minimising other delays.
- Thus, we will be further zooming into the other 2 key delays (Carrier & Late Aircraft Delay).

Analysis

- There could be several reasons that may cause the **occurrences of carrier delay**, which includes **aircraft cleaning**, **cargo loading** and **awaiting arrival of connecting passengers/crew**.
- **Late aircraft delays** may also be a result of **late arrival of previous flights**, causing the next flight to be delayed.
- The two contributing delays mentioned above are in the airline's control and Eagle Airlines should look into reducing these delays to improve its performance.
- Also, Something worth noting is that although Falcon Airlines has more flights in operation, it has a lower count of delays compared to Eagle Airlines, thus Eagle Airlines need to look into operating more efficiently.

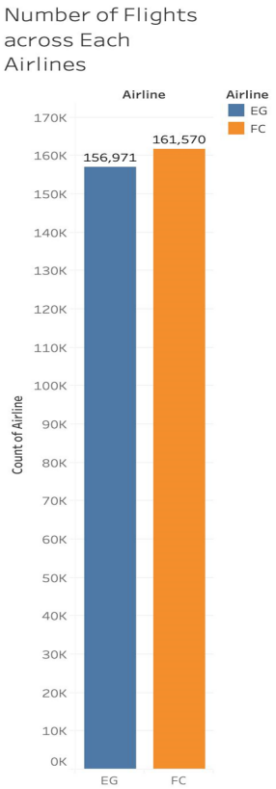


Figure 18: Total Number of Flights across Airlines

Analysis

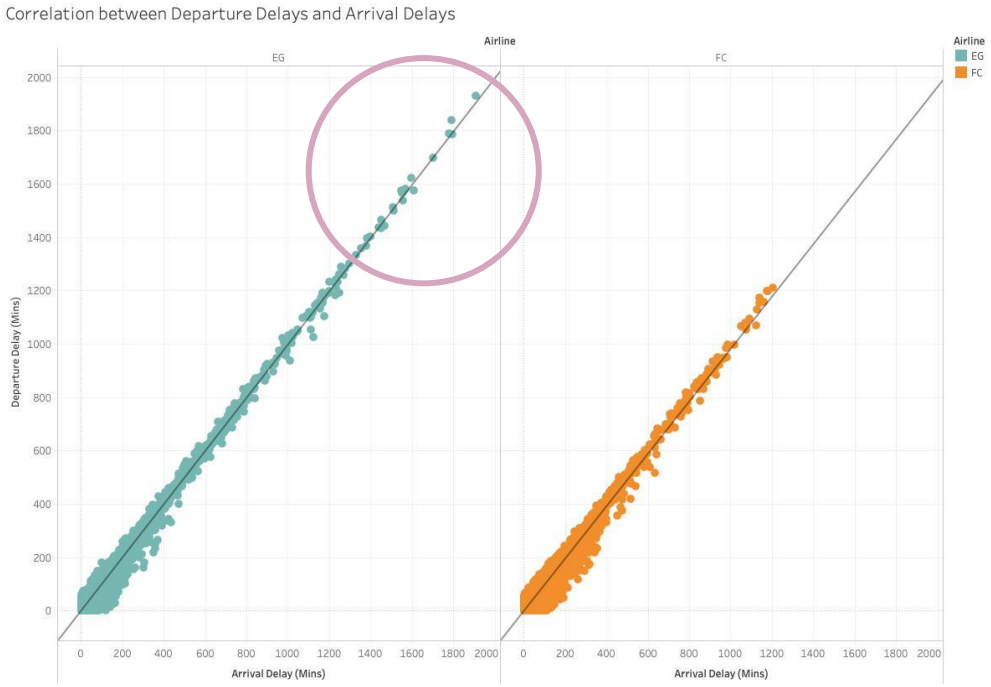


Figure 19: Correlation between Departure and Arrival Delay

- We also took a look at the correlation between Departure and Arrival Delays and it is shown that Departure delay and Arrival delay have a **very strong correlation**. (Figure 19).

- Departure Delays can be **due to both Carrier Delay and Late Aircraft Delay**, as these delays **happen before departure** and will prevent the aircraft from taking off on time.

- Notice that Eagle Airlines have much longer delays (shown by the red circle). Thus it is very important to for them to **minimise Departure Delay** as much as possible so that it will directly minimise the number of Arrival Delay.

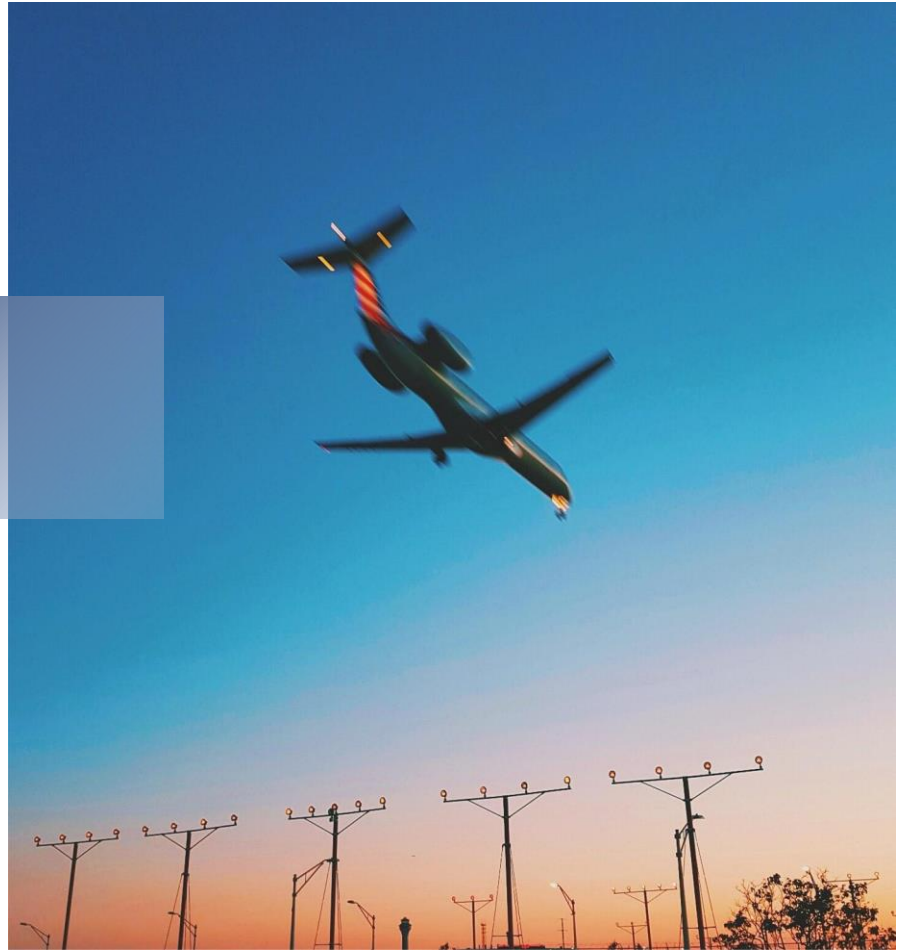
Suggested Improvements

It is important for Eagle Airlines to be **targeting Carrier Delay** more. Carrier Delay has a direct relationship with Late Aircraft Delay. When the flight is delayed before departure, it will directly result in delayed arrival of the flight to its destination, thus causing the subsequent flights to be delayed.

Solutions targeted at Carrier Delay

- Increasing manpower to minimise the turnover time needed for maintenance and checking of aircrafts before flights
- Improve efficiency of stakeholders (aircraft ground crew, cabin crew) through quarterly upskilling courses etc.

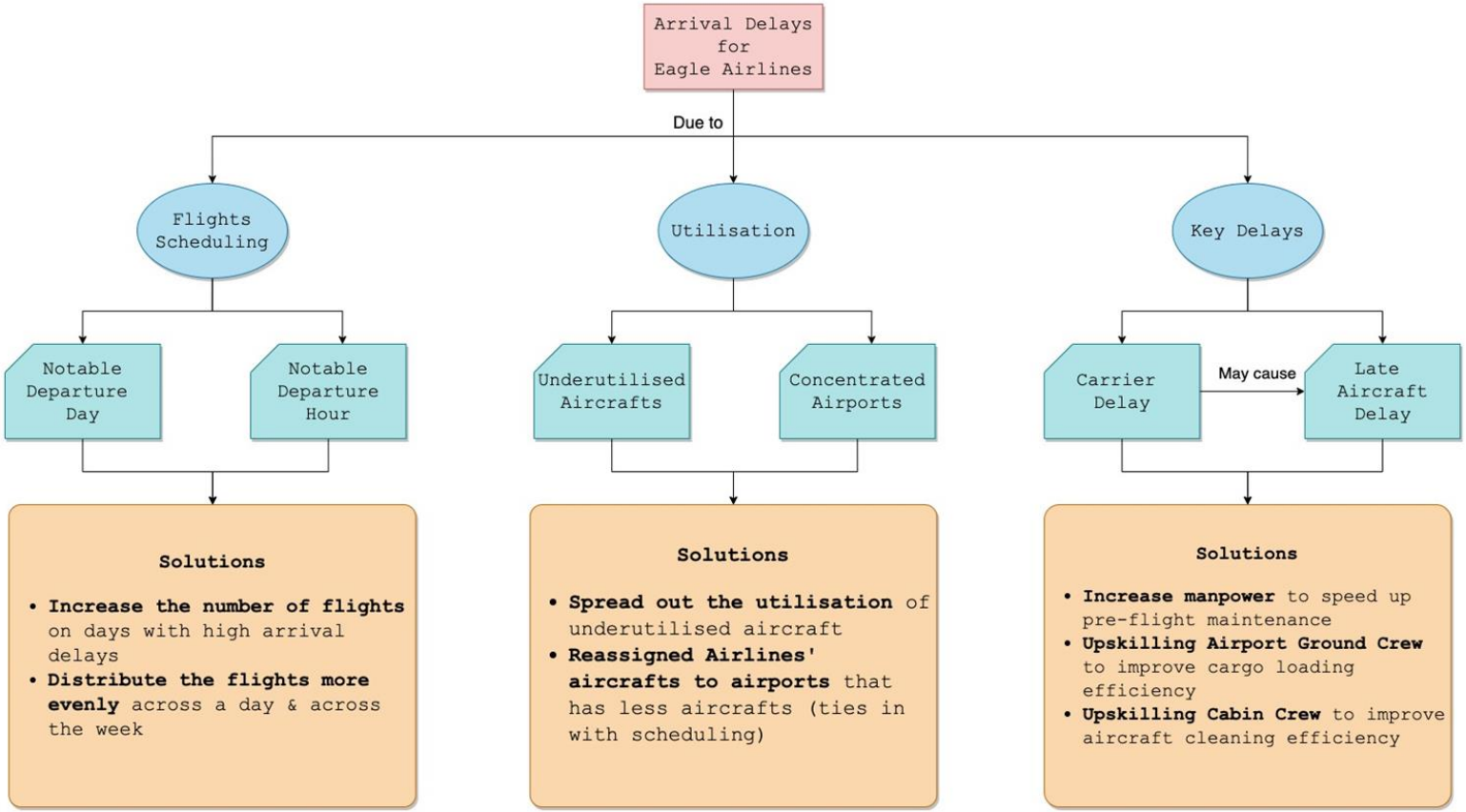
Through the above suggested improvements, these will help to reduce departure delays as the time taken for pre-flights maintenance, aircraft cleaning and cargo loading will be significantly reduced, resulting in the **flights to be departed on time and arrival on time.**



04

CONCLUSION

Conclusion


Arrival Delays for Eagle Airlines
Due to
Flights Scheduling
Utilisation
Key Delays
Notable Departure Day
Notable Departure Hour
Underutilised Aircrafts
Concentrated Airports
Carrier Delay
May cause
Late Aircraft Delay
Solutions
• Increase the number of flights on days with high arrival delays
• Distribute the flights more evenly across a day & across the week
Solutions
• Spread out the utilisation of underutilised aircraft
• Reassigned Airlines' aircrafts to airports that has less aircrafts (ties in with scheduling)
Solutions
• Increase manpower to speed up pre-flight maintenance
• Upskilling Airport Ground Crew to improve cargo loading efficiency
• Upskilling Cabin Crew to improve aircraft cleaning efficiency

Thank you!