



ANALYZE UNITED STATE FLIGHT DELAY FROM JANUARY 2017–JULY 2022 AND CREATE DASHBOARD USING TABLEAU

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BACKGROUND

The aviation industry in the United States is one of the largest and busiest in the world, connecting cities and states with a dense aviation network. However, high flight volumes often cause delays, which impact airline operational efficiency, customer satisfaction and operational costs. Based on data on flight delays from January 2017 to July 2022, there are several main factors causing delays, such as airline operational problems (carrier delays), limited navigation systems and airport infrastructure (NAS delays), bad weather, and chain effects due to planes being behind schedule. earlier (late aircraft delay). States like Illinois (IL), with Chicago O'Hare International Airport (ORD), often record the highest number of delays due to its role as a major hub for national and international flights. It is hoped that a deep understanding of this data will help airport authorities and airlines identify the sources of problems and optimize the management of their schedules and services.

Tools



Tableau

Helps to create and visualize interactive dashboards to generate useful insights.



Microsoft excel

to transform data, whether adding columns, changing data types, performing Excel operations such as trim, etc., as well as carrying out data analysis

About the data used

kaggle [VIEW DATASET IN KAGGLE](#)

Year: Year of data collection.

Month: Month of data collection (in numerical form).

Date: A combination of "Month" and "Year", format for example "Jul-22".

Carrier: Airline code.

Carrier_name: Airline name.

Airport: Airport code.

City: The city where the airport is located.

State: The state where the airport is located (in the US).

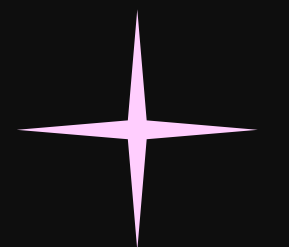
Airport_name: Airport name.

Arr_delay: The total accumulated delay of all flights arriving at the airport, calculated in minutes.

Carrier_delay: Total time of delay caused by airline issues, such as flight crew shortages or technical problems, in minutes.

NAS_delay: Delay time caused by the National Aviation System, for example air traffic congestion or airspace management, in minutes.

Late_aircraft_delay: Time of delay due to the aircraft arriving late from a previous flight, in minutes.



General description

This dashboard illustrates flight delay data in the United States from January 2017 to July 2022. Total flight delays include various categories with the following accumulated amounts:

- Arr Delay (Total Arrival Delay):

The cumulative delay time reached 386,124,672 minutes, reflecting the large scale of the impact on the entire US aviation system.

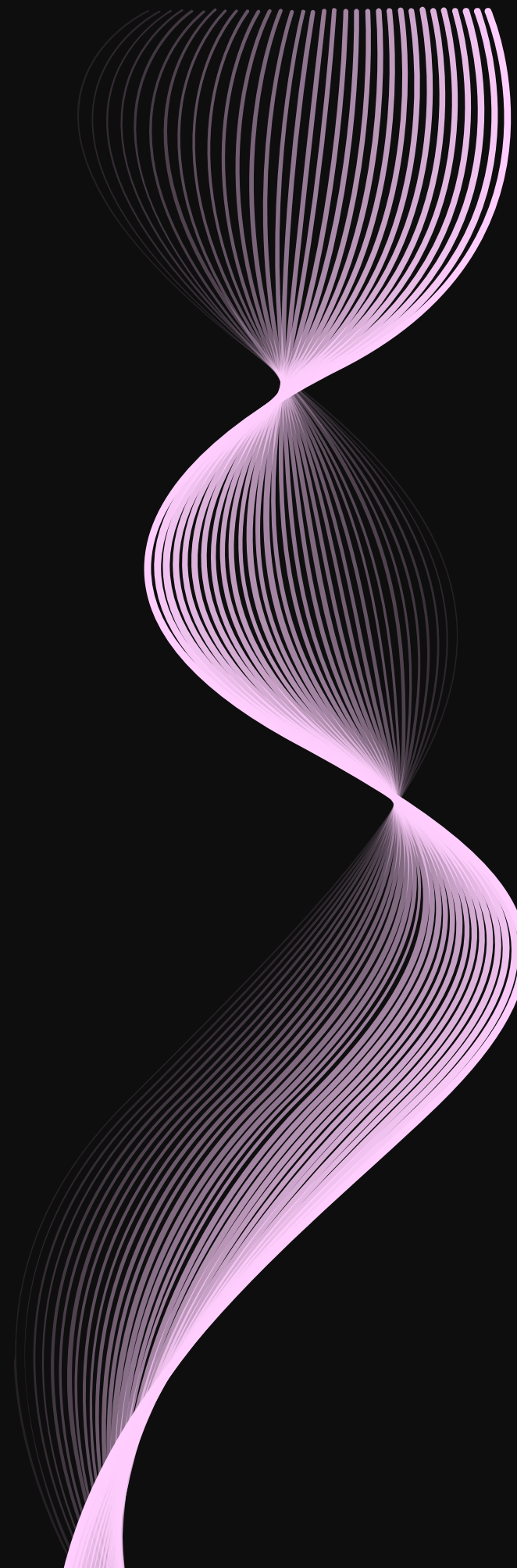
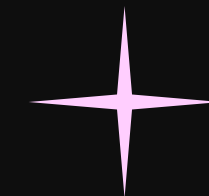
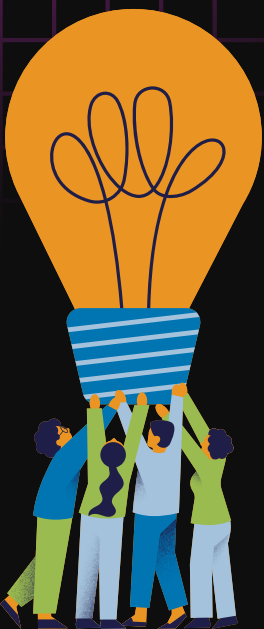
- The main delay time components are:

Late Aircraft Delay: 145,618,944 minutes (37.7%)

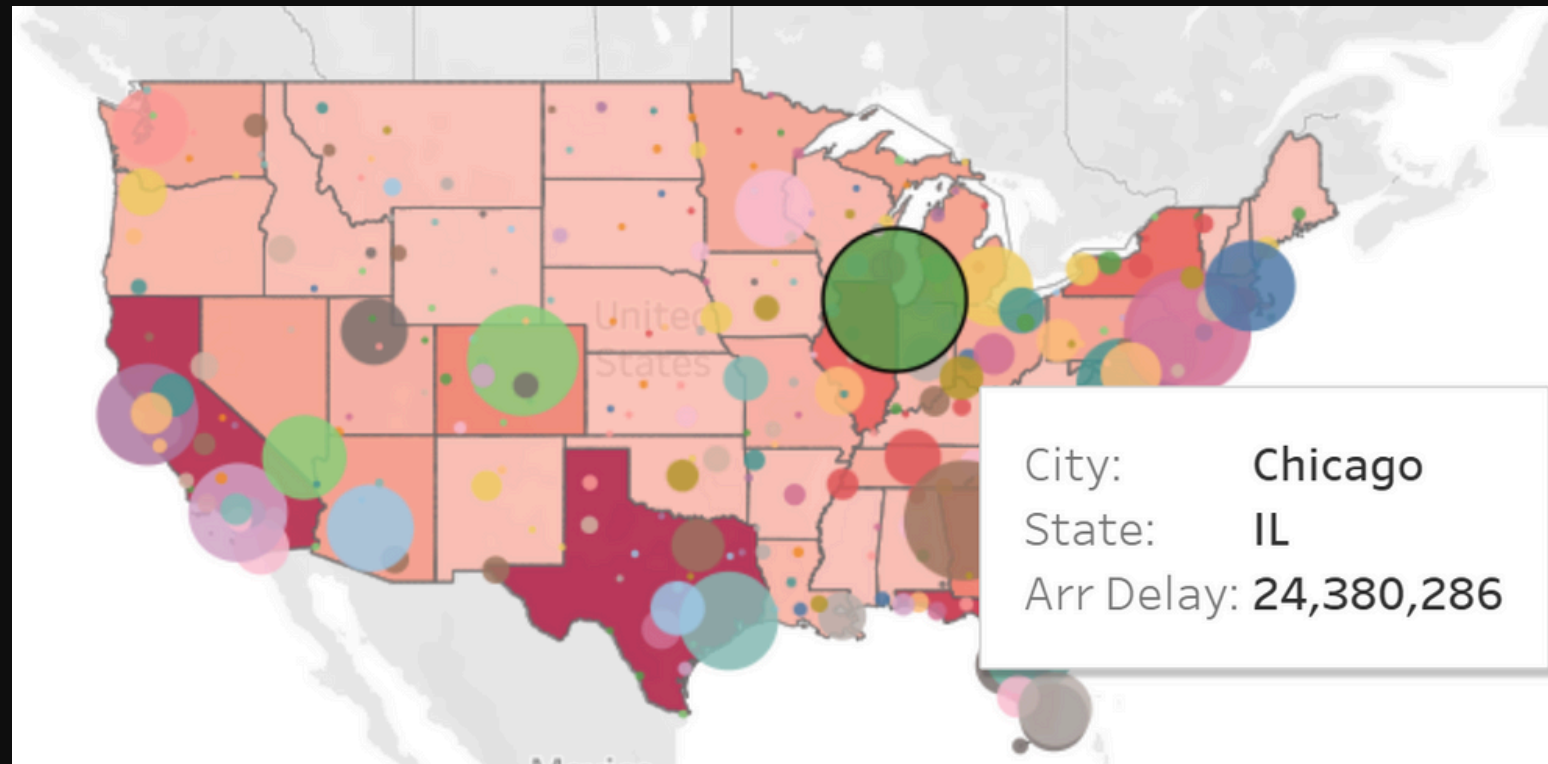
Carrier Delay: 133,453,066 minutes (34.6%)

NAS Delay: 84,799,404 minutes (21.9%)

These figures show that the two main categories that contributed were delays due to previous aircraft and airline operational problems.



Analysis Based on Geography (Distribution Map)



The map shows the distribution of delay times in various states.

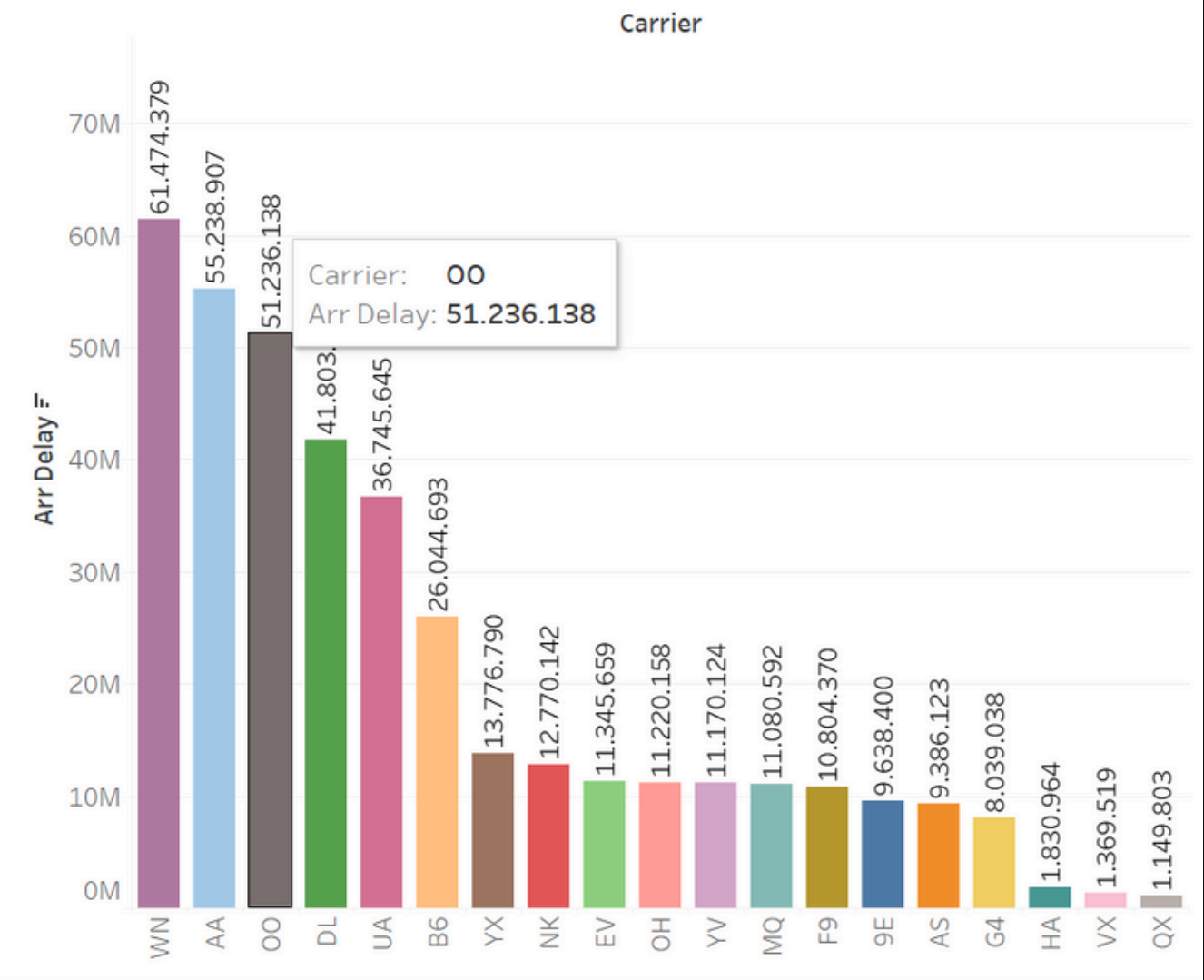
Some states with high late times, such as Illinois (IL), which had 24,380,286 late minutes, may be affected by:

- There are large airports such as Chicago O'Hare International Airport (ORD), which is one of the busiest airports in the world.
- Potential problems include high flight volumes, crowded airport capacity, and frequently changing weather conditions.

States with larger circles on the map indicate major delays, including many affected flights.



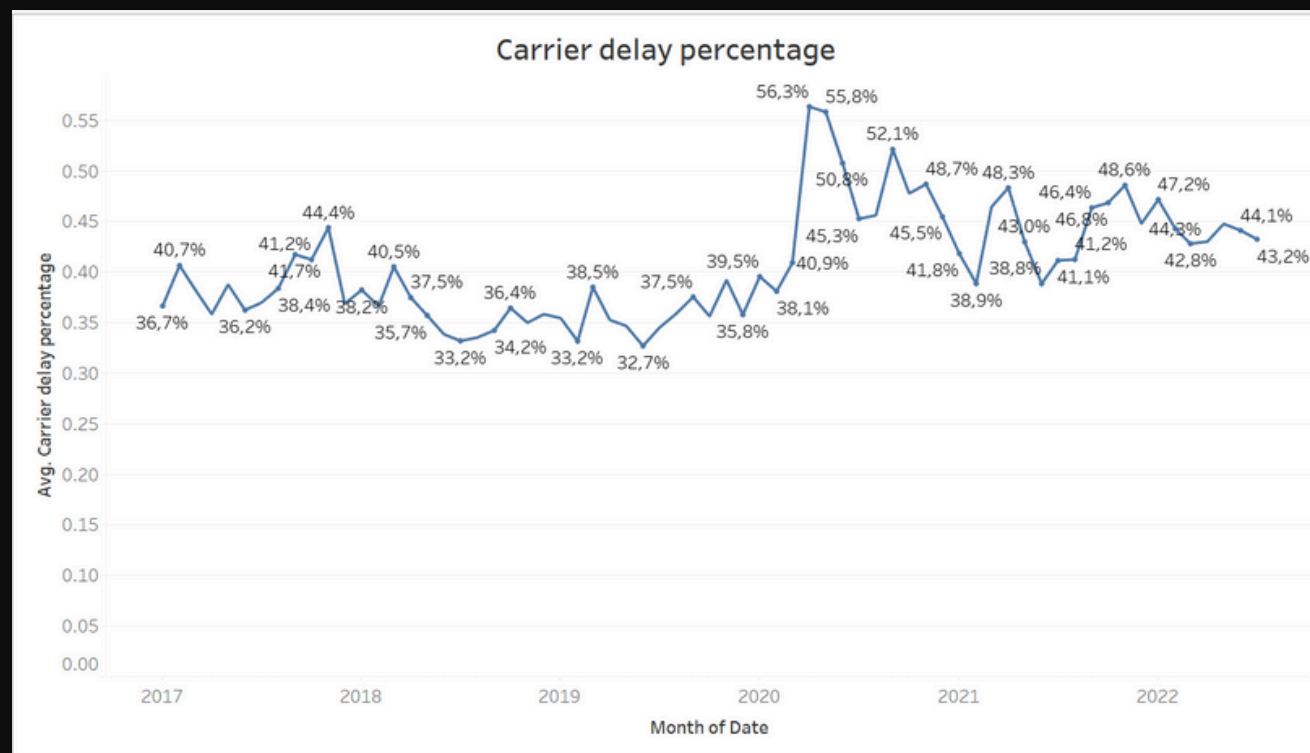
Airline Analysis (Carrier)



The airlines with the largest contribution to arrival delays (Arr Delay) are:

- WN (Southwest Airlines): Occupies the highest position, with a total delay time exceeding 60 million minutes.
- AA (American Airlines): It is in second place with a delay time that is almost close to the first airline.
- OO (SkyWest Airlines): Contributes to significant delays, but below the other two major airlines. These large airlines have a greater contribution because their flight volume is much higher than other airlines. This shows that large airlines are more vulnerable to the impact of problems such as aircraft operations, crew rotation and air traffic conditions.

Airline Delay Percentage Analysis (Carrier Delay Percentage)



This graph highlights changes in the percentage of airline delays from 2017 to 2022:

- At the beginning of 2017, the Carrier Delay percentage ranged from 38%-41%.
- 2020 showed a drastic increase of up to 56.3% amidst the COVID-19 pandemic. This can be associated with:
 1. Airline staff shortages.
 2. Travel restrictions and sudden changes in schedules.
 3. Imbalance of demand and operating capacity.
- After 2020, the percentage decreased steadily again to an average of 40%-43%.
- This indicates that the pandemic has had a huge impact on the aviation industry, especially airlines.

Analysis of Major Delay Categories

1. Late aircraft delay

- This category accounted for 37.7% (145,618,944 minutes) of total delays.
- Late Aircraft Delay is caused by an aircraft arriving late from a previous flight, affecting the schedule of the next flight.
- This problem reflects a domino effect, indicating the need to optimize turnaround time and operational flexibility in aircraft rotation.

2. Carrier Delay

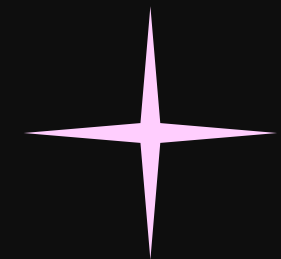
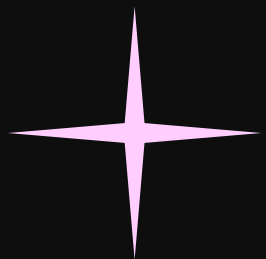
- These causes of delays accounted for 34.6% (133,453,066 minutes) of total delays, which are usually attributed to:
- Shortage of flight crew.
- Technical or logistical problems at the airline.
- Airlines with the highest delay times (WN, AA) should evaluate operational efficiency, crew planning and aircraft readiness.

3. NAS Delay

- The National Navigation System (NAS) accounted for 21.9% (84,799,404 minutes) of total delays, which were affected by:
- Air traffic density.
- Air space management.
- Flight path changes or restrictions.
- Improvements in navigation technology and air traffic management can help reduce this figure.

4. Weather Delay & Security Delay

- Weather Delay is not yet displayed explicitly on the dashboard but is usually a seasonal factor, for example storms or snow.
- Security Delay may not be too big, but it still needs to be anticipated because it is incidental.



Strategic Recommendations

For Airlines:

WN and AA: As airlines with the largest delays, they need to improve schedule management, crew rotation and aircraft turnaround time.

Improved operational logistics to reduce the domino effect of previous aircraft delays (Late Aircraft Delay).

For Navigation and Airport Managers:

Invest in airspace management technology to reduce NAS Delay, especially at large airports with high flight volumes such as Chicago

Collaboration with airlines to optimize the use of air space and time slots.

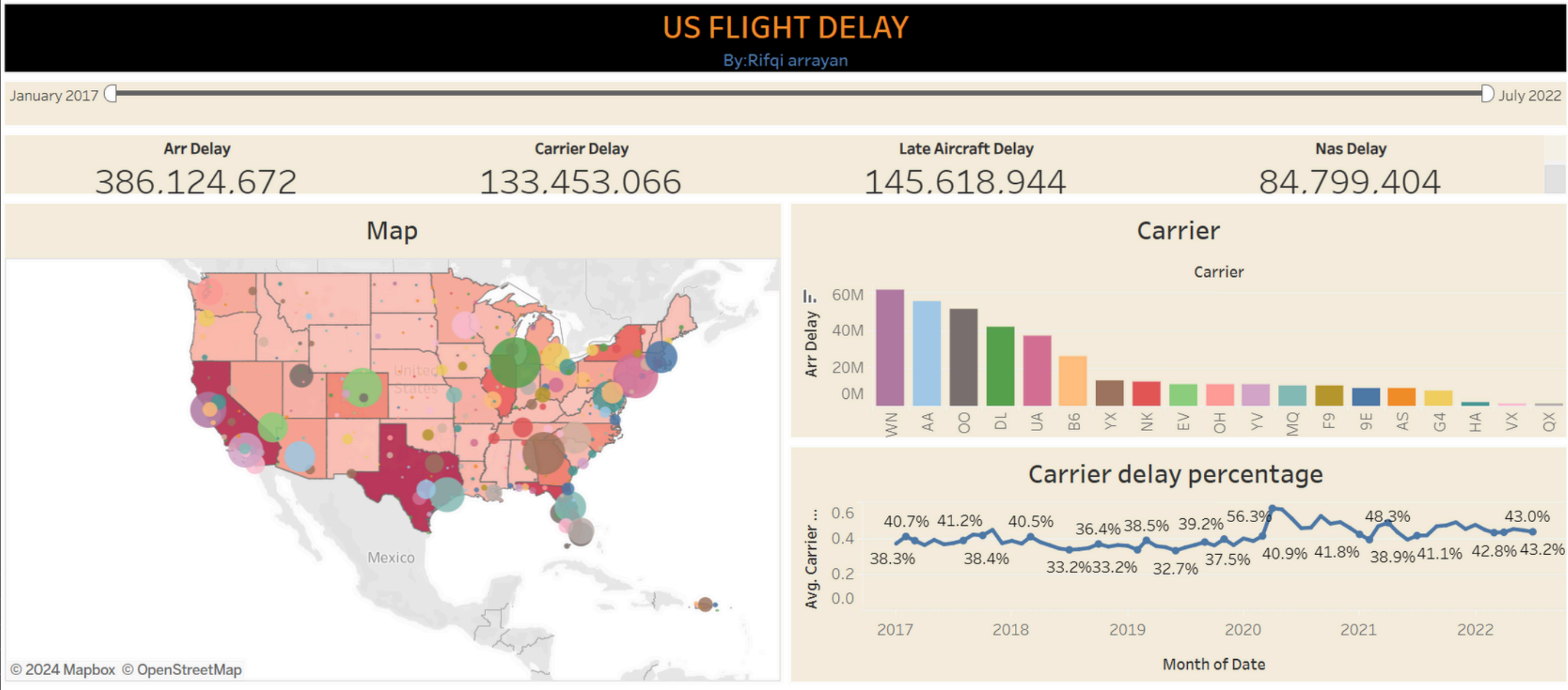
For Weather and Crisis Management:

There are special protocols to manage delays caused by bad weather (for example alternative flight path plans).

For Extraordinary Crisis:

2020 demonstrated the vulnerability of the aviation system to extraordinary conditions such as a pandemic. A mitigation plan needs to be prepared to minimize similar impacts in the future.

Dashboard





VIEW IN GITHUB

VIEW IN TABLEAU



Thank you