

Flight Disruptions Analysis Report

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Executive Summary

This report presents an analysis of flight delays and cancellations across major U.S. airports using Power BI, focusing on identifying the underlying causes and uncovering patterns in the data. Using a database of over 5 million commercial flights, key factors such as weather, airline operations, air traffic congestion, and seasonal variations were analyzed. The findings reveal insights into operational inefficiencies and provide a quantitative assessment of delays and cancellations, offering actionable recommendations to the Federal Aviation Administration (FAA) to enhance aviation efficiency and customer satisfaction.

Introduction

This report aims to provide an in-depth analysis of the critical issues surrounding flight delays and cancellations in the U.S. air transportation system. Using Power BI, the data analyst conducted an analysis of over 5 million flight records from major U.S. airports, focusing on identifying patterns in delays and cancellations. The report aims to uncover the root causes of these disruptions, such as weather conditions, operational issues, and air traffic congestion, and offer recommendations for addressing these issues.

Data Sources

The data for this analysis was sourced from a comprehensive database containing over 5 million records of commercial flights from major U.S. airports. The dataset includes key variables such as flight dates, departure and arrival times, flight status (delayed or cancelled), airport codes, airline information, weather conditions, and air traffic data. The dataset was cleaned and pre-processed using Power Query in Power BI to handle missing values, filter out irrelevant data, and ensure consistency for analysis.

DataSet:

1. Flight

- Year
- Month
- Dayofweek
- Airline
- Orgin Airport
- Departure Delay
- Cancelled
- Cancelation reason

2. Airports

- IATA_code
- Airport

- City
- State
- Country
- Latitude
- Longitude

3. Airlines

- IATA_code
- Airlines

4. Cancellation_code

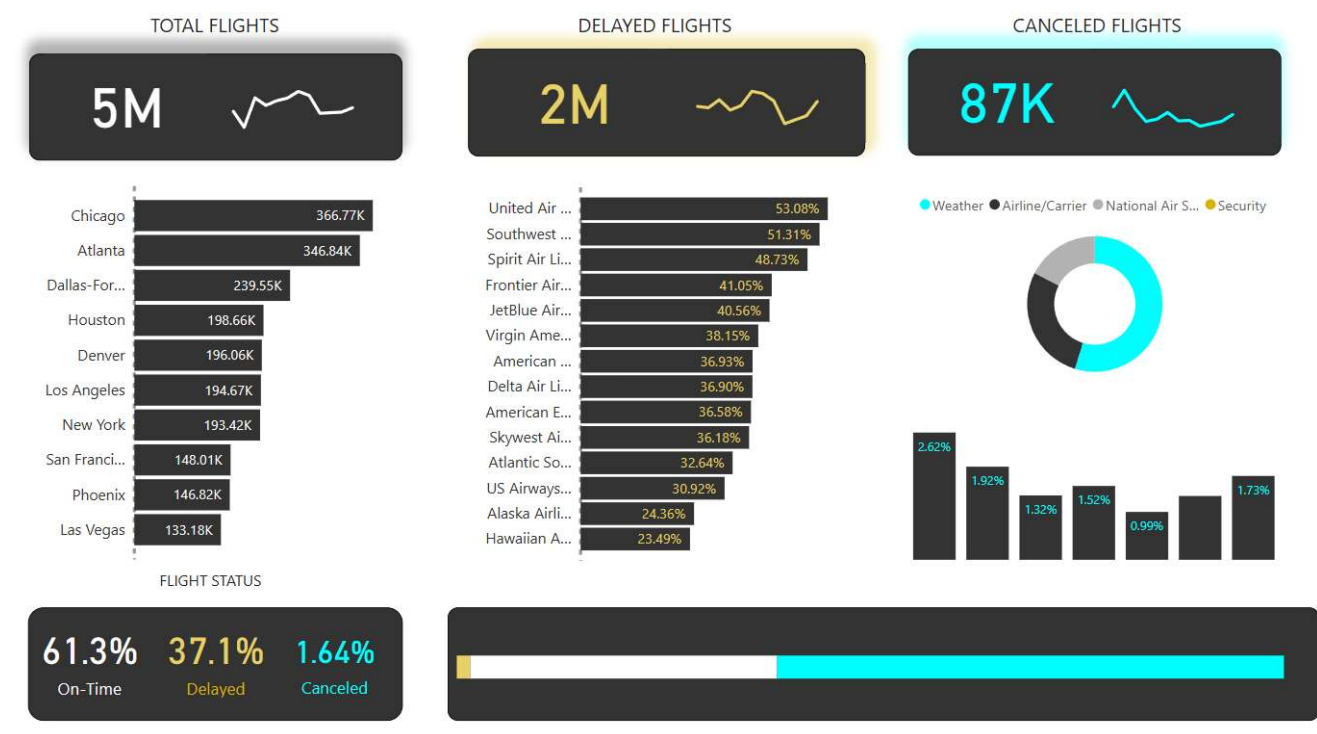
- Cancellation_reason
- Cancellation_Description

Methodology

The analysis followed a structured approach to identify trends, patterns, and root causes of flight delays and cancellations:

- **Data Cleaning and Transformation:** Data was imported into Power BI and cleaned using Power Query to remove errors, handle missing values, and standardize formats.
 - **Exploratory Data Analysis (EDA):** Initial visualizations, including bar charts and histograms, were used to understand overall trends in delays and cancellations.
 - **Advanced Data Analysis:** Key metrics, such as delay times, cancellation rates, and the relationship with factors like weather and air traffic, were analyzed using DAX (Data Analysis Expressions) in Power BI.
 - **Visualization:** Interactive Power BI dashboards were created, including maps, time series, and heat maps, to present the findings visually. The insights were derived through filtering capabilities, allowing users to explore various scenarios and understand performance trends over time.
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Power BI Dashboard Overview



This Power BI dashboard provides an overview of flight data. Here's what it showcases:

1. Total Flights (5M):

- A line graph indicates the trend of total flights over time.

2. Delayed Flights (2M):

- Another line graph shows trends in delayed flights.
- Top airlines with the highest delay percentages are listed, with United Airlines and Southwest Airlines leading.

3. Canceled Flights (87K):

- A graph displays trends for cancellations.
- A pie chart breaks down the reasons for cancellations, including weather, airline issues, national air systems, and security.

4. Flight Status:

- The summary indicates the percentage of flights that were on-time (51.3%), delayed (37.1%), or canceled (1.54%).

5. Bar Graphs:

- Airports and airlines with high numbers of flights and delays are highlighted.
- Chicago leads in total flights.

The pie chart in this dashboard represents the reasons for flight cancellations, with segments for:

- Weather: A significant portion, likely the largest contributor, indicating weather's impact on cancellations.
 - Airline/Carrier: The second-largest category, representing issues directly related to airline operations.
 - National Air Systems: Covers issues like air traffic control or system malfunctions.
 - Security: The smallest segment, for security-related cancellations.
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Inference:

The analysis of over 5 million flight records has revealed several critical insights into the causes and patterns of flight delays and cancellations in the U.S. aviation system. The findings emphasize the significant impact of operational inefficiencies, weather conditions, and air traffic congestion on the performance of airlines and airports.

Key takeaways from the report include:

1. Weather-Related Cancellations: Weather emerged as the largest contributor to flight cancellations, underscoring the need for improved forecasting and contingency planning to mitigate disruptions.
2. Operational Challenges: Airlines such as United Airlines and Southwest Airlines experienced the highest delay percentages, pointing to opportunities for operational enhancements to improve on-time performance.
3. Airport Bottlenecks: Chicago led in total flights but also showed a high volume of delays, highlighting a need for infrastructure upgrades and better air traffic management in high-traffic airports.
4. Flight Status Trends: With only 51.3% of flights being on-time, there is substantial room for improvement in overall aviation efficiency, particularly in addressing the 37.1% delayed flights and the 1.54% cancellations.

Recommendations:

- Investment in Weather Preparedness: The FAA and airlines should invest in advanced weather prediction technologies and adaptive scheduling strategies.
- Operational Efficiency: Airlines must review and streamline their internal processes to minimize delays caused by resource constraints or scheduling conflicts.
- Infrastructure Enhancements: High-traffic airports should prioritize improvements to reduce congestion and enhance capacity.
- Collaborative Solutions: Collaboration between airlines, airports, and air traffic controllers is critical to addressing delays caused by national air system inefficiencies.