U.S. Airline Performance & Delay Analysis

1. Introduction

Flight delays and cancellations significantly affect both airline operations and passenger satisfaction. The primary goal of this analysis is to identify key patterns, reasons, and performance metrics associated with U.S. domestic airline delays and cancellations. By evaluating airline and airport performance, the objective is to derive actionable insights for improving efficiency and service quality.

Objectives: - Understand the overall cancellation and delay patterns - Identify top-performing and underperforming airlines and airports - Provide recommendations to stakeholders for operational improvement

2. Methodology

Data Source: The dataset used was a cleaned and enriched version of U.S. domestic flight data for January, including fields like flight date, delays, cancellation reasons, airline and airport codes, and geographical coordinates.

Tools Used: - SQL (SQLite in VS Code): for data cleaning, transformation, and exploration - Tableau: for visualization and dashboard creation

Key Steps: - Data cleaning and null handling - Enriching with descriptions (e.g., cancellation reason, airport name) - SQL-based EDA for KPIs - Building Tableau dashboards with filters and visual breakdowns

3. Key Findings & Analysis

Total Flights Analyzed: 201
Cancellation Rate: 16%
Avg Arrival Delay: 58.49 mins
OTP Rate (≤15 min delay): 29.85%

Top Delay-Contributing Factors: - Airline/Carrier delays: 8 cases - Weather-related: 7 cases

Airline Performance Insights: - **Skywest Airlines Inc.** had the highest number of flights (112) but a low OTP rate (31.3%) - **American Eagle Airlines Inc.** showed the highest cancellation rate (28.6%) and highest average delay (worst performer) - **Atlantic Southeast Airlines** had zero cancellations and moderate delay (best performer among the set)

Airport Performance Insights: - **Wilmington Airport** had the highest average delay (114.5 mins) - **Roswell International Air Center** and **University Park Airport** also showed higher delays

Day-wise Delay Trends: - Delays were lowest on Thursday (21.29 mins) - Highest delays occurred on Saturday (83.02 mins)

4. Dashboard Overview

Key components included: - **KPIs**: Total Flights, Cancellation Rate, Avg Delay, OTP Rate - **Bar Charts**: Airline & Airport average delays - **Pie Chart**: Cancellation Reason distribution - **Maps**: Airport delay visualization by location - **Filters**: Interactive filtering by airline, day, airport, and cancellation reason

Design best practices applied: - Red used for worse delays, green for better OTP - Color legends added for clarity - Consistent label formatting for clarity

5. Recommendations

1. **Improve Airline Operations:**
    - Focus on reducing delays by American Eagle Airlines and Skywest through better crew/resource management.
2. **Airport Coordination:**
    - Airports like Wilmington and Roswell should assess ground operations and traffic handling to improve punctuality.
3. **Day-Specific Planning:**
    - Allocate more staff and resources on weekends (Saturday, Sunday) to reduce delay peaks.

6. Conclusion

This analysis highlighted clear patterns in flight performance across airlines and airports. With a high overall delay average and low OTP, there's a strong need for operational efficiency. A combination of enhanced airline management and airport coordination can improve passenger experience and reduce economic impact.

Limitations: - Only January data analyzed - Some smaller airports or less frequent carriers may skew averages - More granular temporal data (hourly) could deepen insights