🟦 1. Title

Title:
U.S. Airline Performance & Delay Analysis – 2015

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🟦 2. Executive Summary

This project analyzes over one million U.S. domestic flights from 2015 to uncover patterns in airline and airport performance, delay causes, cancellation trends, and route-level efficiency. Using SQL and Power BI, key insights were derived to inform airline operations, passenger planning, and regulatory focus.

🟦 3. Project Objectives

- Analyze flight delays and cancellations across airlines, airports, and routes
- Identify top-performing and underperforming entities (airlines, airports, routes)
- Understand the major causes of delays and their impact
- Build an interactive dashboard for dynamic data exploration
- Deliver actionable recommendations to improve airline performance

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🟦 4. Methodology

🔹 Data Source:

U.S. Department of Transportation – 2015 domestic flights
Tables: flights.csv, airlines.csv, airports.csv

🔹 Tools Used:

- SQLite + DB Browser (SQL queries, view creation)

- Power BI (data modeling, visualization)
- Microsoft Word (report), PowerPoint (presentation), Screen Recorder (video)

🔹 **Process Overview:**

1. Data Ingestion
2. Cleaning & Enrichment
3. Exploratory Analysis (SQL)
4. Dashboard Development (Power BI)
5. Insight Generation & Recommendations

🟦 5. Data Cleaning Summary

- Converted time/date columns to usable formats
- Joined airline & airport info to enrich flight records
- Created final view: v_flight_data_enriched
- Generated calculated columns for metrics like on-time %, delay categories, route names, etc.

🟦 6. Key Metrics Summary

Metric	Value
Total Flights	1.05 million
Average Arrival Delay	7.61 minutes
On-Time Arrival %	78.13%
Delay Rate %	21.87%
Cancellation Rate %	3.86%

🟦 7. Key Findings & Insights

✈️ Airline Performance

- Hawaiian Airlines (86%) and Alaska Airlines (86.56%) had the best on-time rates
- Frontier (63%) and American Eagle (64%) had poor OTP and highest delays
- Delta and Southwest performed well with low delay & cancellation rates

⏰ Delay Causes

- Airline & Late Aircraft delays are the **biggest contributors**
- Frontier and JetBlue had the **highest late aircraft-related delays**

🛬 Destination Airports

- ATL, ORD, and DFW are the **busiest** airports
- LGA and BOS had **low OTP (<71%)** and **high cancellation rates**

📉 Worst Performing Routes

- Cancellation rates >30%:
  - Albany → Newark (40%)
  - Cincinnati → Pittsburgh (33.33%)
- Average arrival delay >100 mins on:
  - Richmond → Columbia (228 mins)
  - JFK → Jackson Hole (149 mins)

🟦 8. Power BI Dashboard Highlights

✅ Visuals Created:

- Line Charts: Monthly Trends (Flights, Delays, Cancellations)
- KPI Cards: OTP %, Avg Delay, Total Flights
- Bar Charts: Airline Delay Causes, Airport Performance, Route Cancellation
- Donut: Cancellation Reasons Breakdown

- Map: Flights by State
- Slicers: Airline, Month, Route

✅ **Features:**

- Conditional formatting for KPIs
- Dynamic filtering via slicers
- Insight boxes and color-coded summaries
- Tooltip enhancements and dual-axis charts

🟦 9. Recommendations

- Focus on reducing **Late Aircraft** and **Carrier-related delays**
- Airlines with low OTP (Frontier, Spirit) need operational improvements
- Airports with high cancellations should investigate bottlenecks (e.g., LGA, BOS)
- Improve customer communication and rebooking support on high-risk routes

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🟦 10. Limitations

- Dataset only covers 2015
- Limited info on international flights or passenger-level impact
- Weather & security delays may lack granularity
- No direct info on turnaround time or ground crew efficiency

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🟦 11. Conclusion

This project provided a deep dive into U.S. airline operations, revealing both strengths and weaknesses in flight punctuality and reliability. Using SQL and Power BI, we identified top-performing airlines and concerning bottlenecks at specific airports and routes. These insights support strategic decisions for improving the passenger experience and airline efficiency.