
A white commercial airplane is shown in flight against a clear blue sky. The aircraft is angled upwards and to the right. The tail fin is dark blue with a red maple leaf logo and the number '515' above it. The fuselage has 'AIR' visible on the front section.

Airtrack Aviation Modelling

Delay Impacts and Propagation



Introduction

01



February 17, 2025

**Snow storm and
Plane crash**

**Extensive
Delays**



**1,290 flights
over six days
cancelled**

About Us

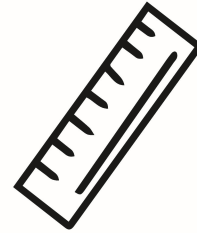
AirTrack Inc.

Airport Operations
Contractor to NAVCAN



Metric:

Cumulative Passenger-delay
minutes across major
airports



Parties

NAVCAN



Oversees air traffic control operations, including takeoffs and landings, and making critical decisions that impact regulation and policy

Canadian Airlines



These airlines operate and manage aircraft, employ pilots and crew, and are responsible for transporting passengers

Canadian Airports



Airport air traffic controllers focus on maximizing traffic flow at a national level while adhering to NAV Canada's guidelines

A scenic landscape photograph showing a winding asphalt road that curves through a lush green valley. The road is flanked by steep, grassy hillsides. In the distance, rolling hills and a small town are visible under a sky filled with soft, white clouds. The overall atmosphere is peaceful and scenic.

Model Description

02

Agents

Airport Agent



Attributes:

congestion, delay, buffer, capacity

Behaviours:

Catalogue, delay arriving and departing airplanes

Airline Agent



Attributes:

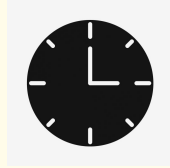
status, origin, destination, airline, maintenance

Behaviours:

Identify and perform maintenance, circle and land at destination

Pseudo Agents

Delay Pseudo Agent



4 Methods of Delay

- Weather
- Maintenance
- Ground procedures
- Congestion

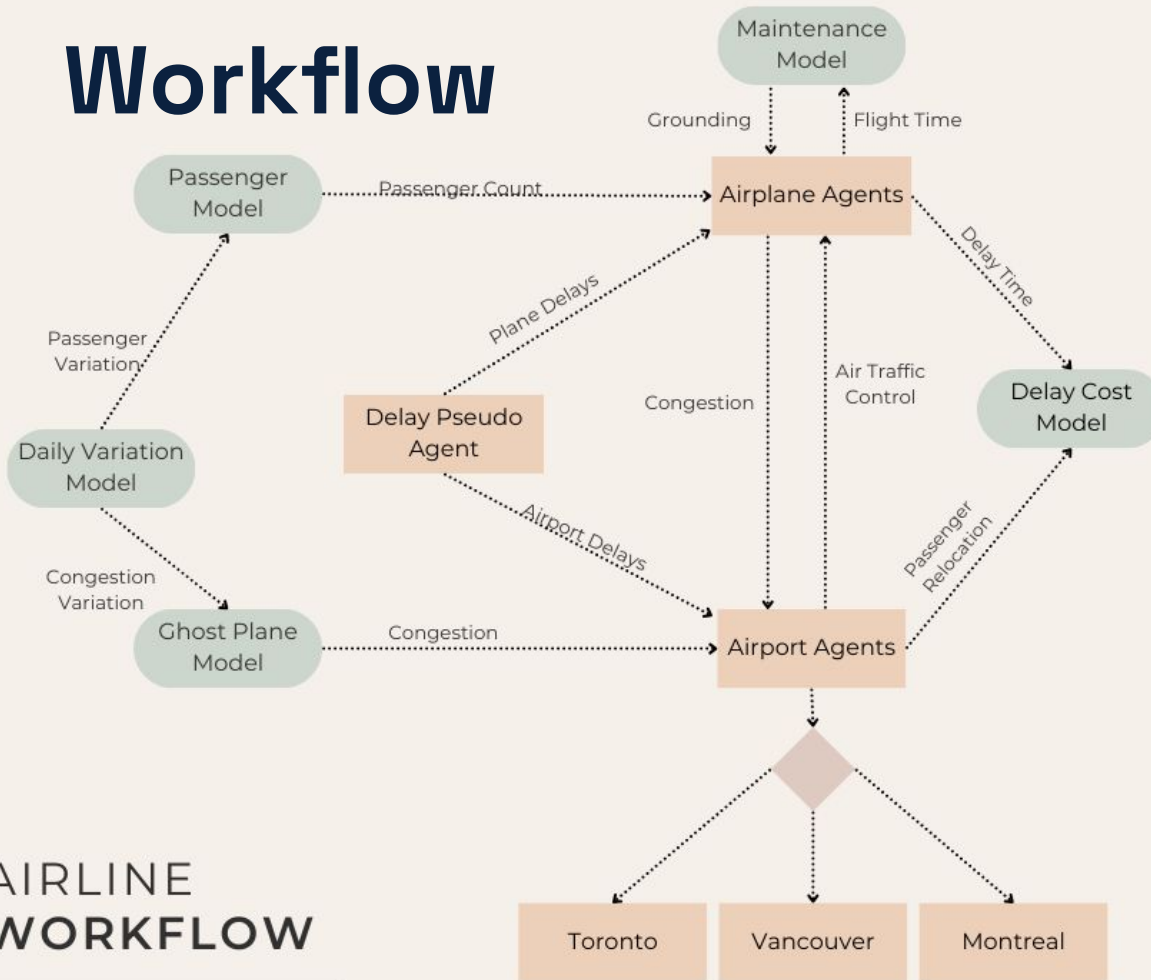
Ghost Plane Pseudo Agent



Representing all external planes for local congestion

- Daily Variation Model
- Timed departures and Arrivals
- Simplified behaviors for efficient simulation

Workflow




AIRLINE
WORKFLOW

Data

- Extreme Weather Data
- Airline and Airport Procedure
- NAVCAN Documentation
- Flight data aggregators
- Google Maps API
- Seminal Literature world wide

Limitations

- Airport Control Procedure is protected
- Customers Perception of Delay is Fluid
- Proper Procedure is often overlooked
- Extreme Impacts of Delay Can be Multinational



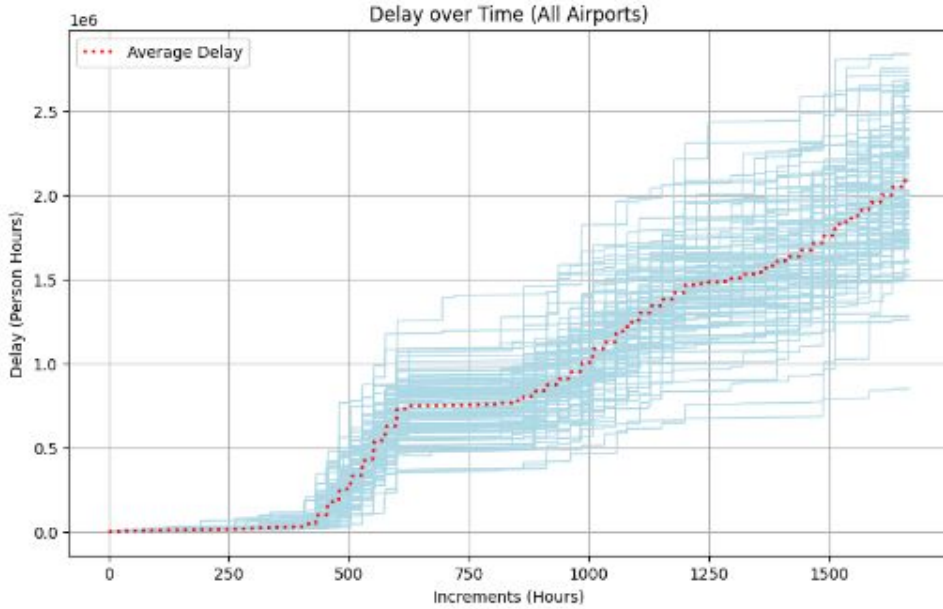
Model Results

03

Usage of Person Hours in Delay

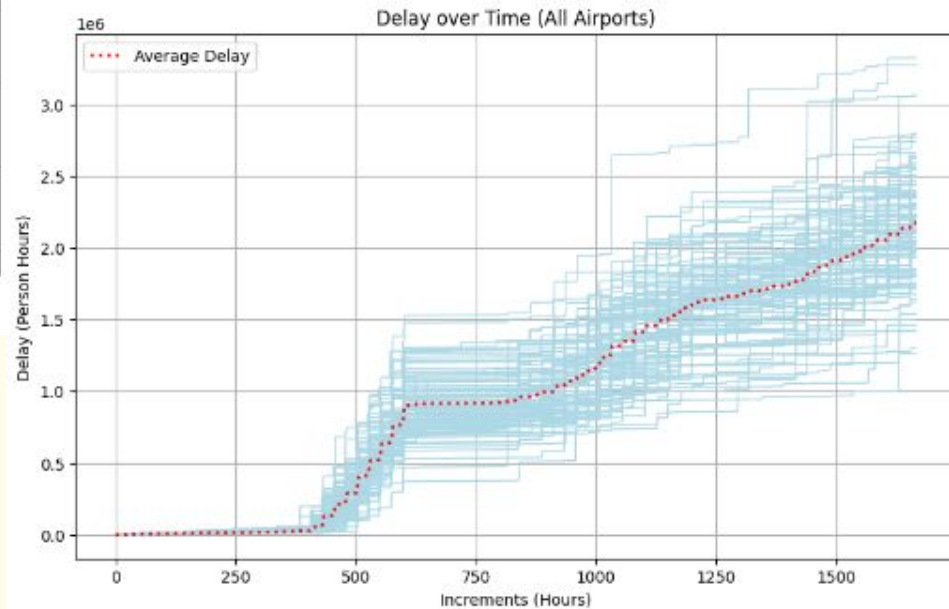
- Compare the impacts of delay with respect for the number of people impacted
- Overall using 70 days of simulation and 92 flights per day carrying an average of 80 passengers
- Results in a delay of 12 minutes of delay on average per flight for each 100,000 person delay hours

The impacts of Runway Expansions

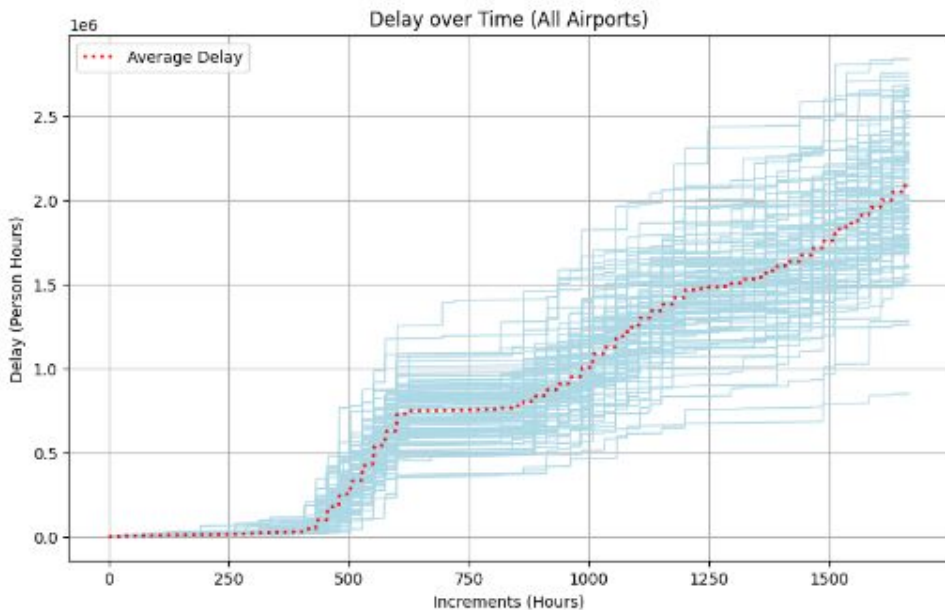


Delay under regular conditions

Delay with expanded runway structure

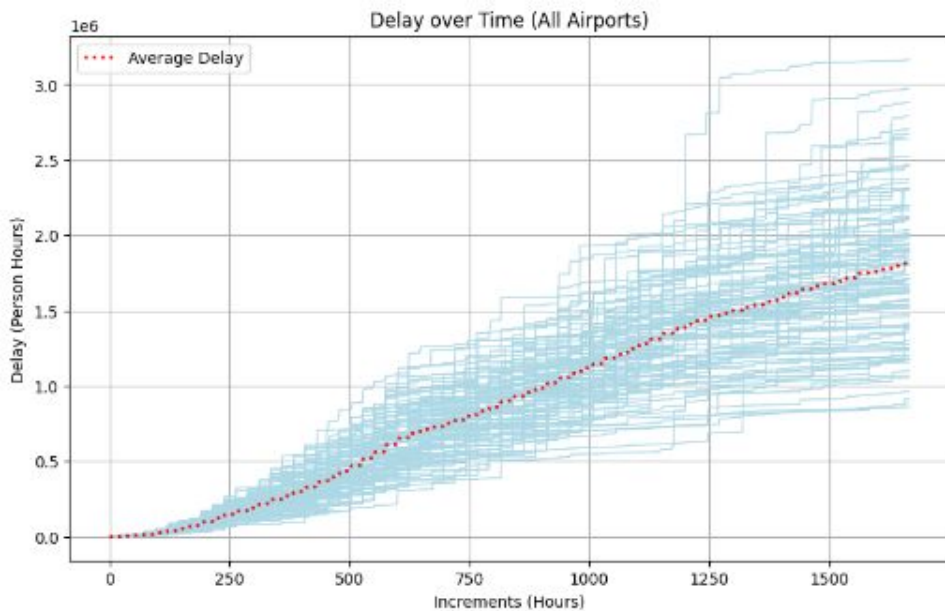


Implementing Ground Delay Programs

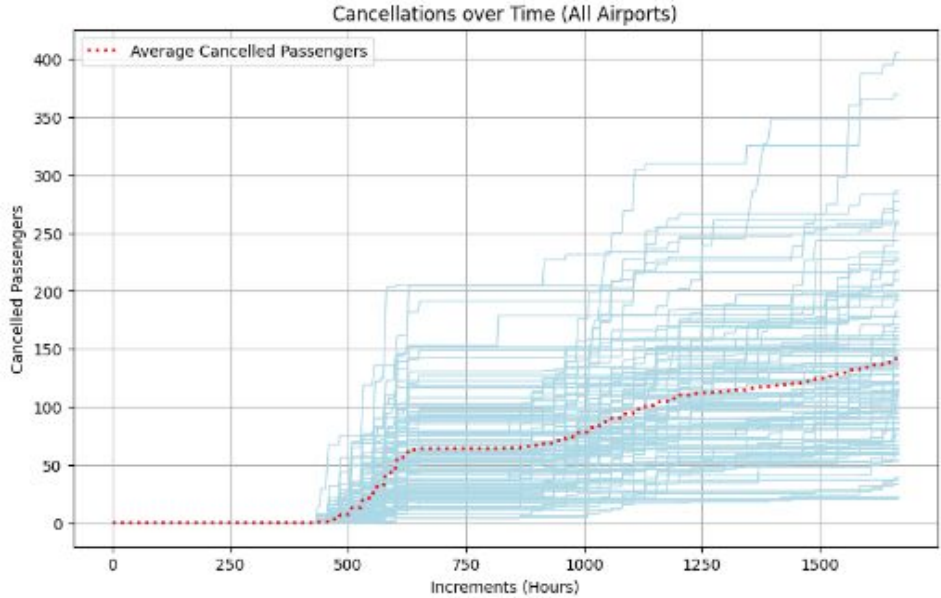


Delay under regular conditions

Delay with Ground Delay Programs

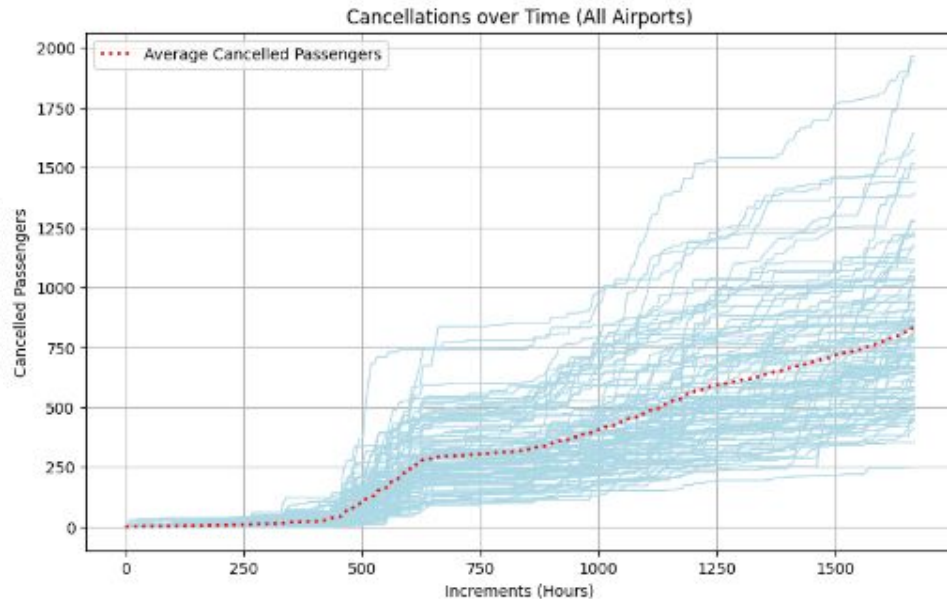


Costs of Ground Delay Programs

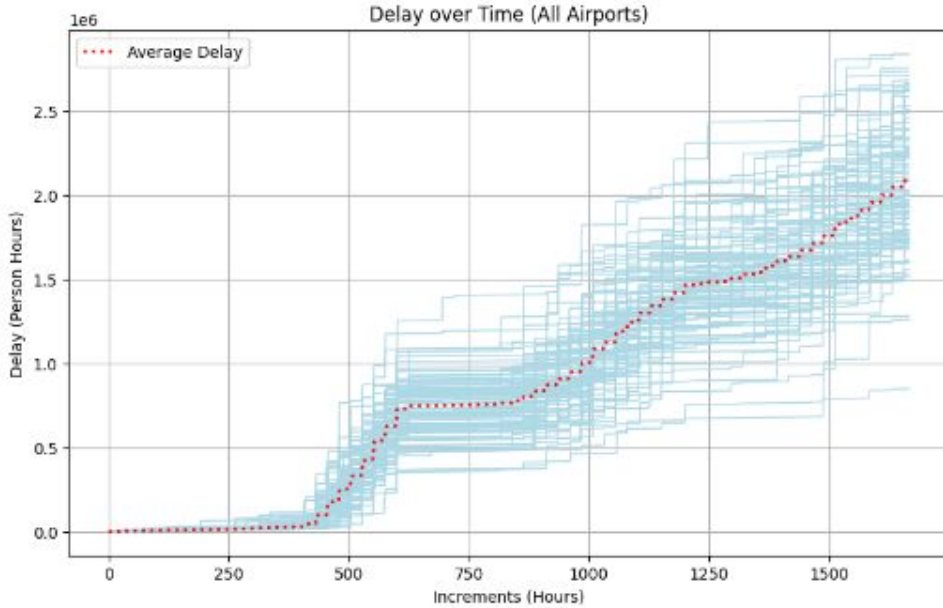


**Cancellations under
regular conditions**

**Cancellations With
Ground Delay Programs**

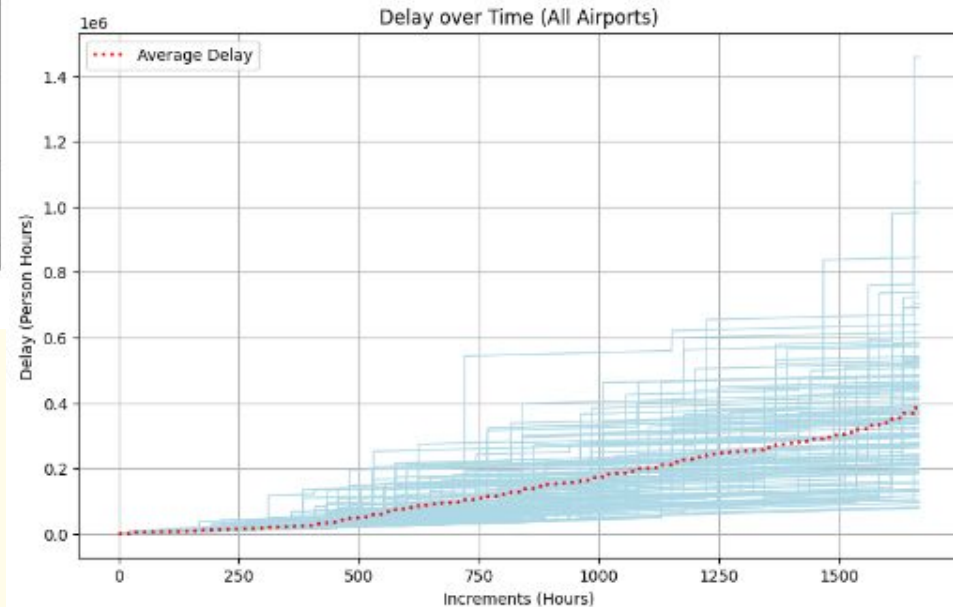


Upgrading Airline Fleets



Delay under regular conditions

Delay with updated airplanes and equipment



Conclusion

05



Recommendations

- **Ground delay programs**
 - Cheap to implement
 - Lower delay effectively
 - Increase cancellations
- **Promote improved maintenance procedure**
 - Expensive for airlines
 - Large delay reductive impacts
 - Consider partnerships with airports for facilities

Future potential for simulation

- Expanding the network of airports simulated to get higher fidelity data on local delay propagation
- Increasing detail in landing disputes through internal airline policy and operations
- Considering the impacts of perception on delay and how customers can feel better about similar delay



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