# Community Measurements of Aviation Emissions Contribution to Ambient Air Quality

## Project 18

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ASCENT
AVIATION SUSTAINABILITY CENTER

# ASCENT Project 18 2017-Aims

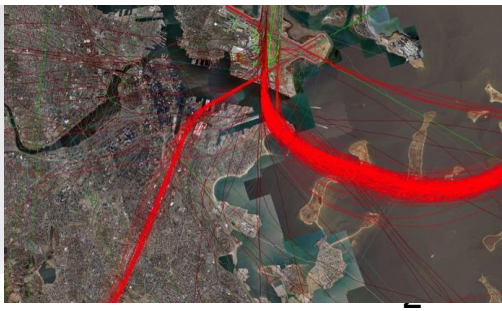
- The primary goal was to conduct new air pollution monitoring underneath flight paths to and from Boston Logan International Airport, using a protocol specifically designed to answer the question of the magnitude and spatial distribution of ultrafine particulate matter (UFP) in the vicinity of arrival flight paths.
- Data was collected from April – September 2017 at six monitor site locations that would address the question of whether aircraft emissions, and in particular arrival emissions, can contribute significantly to UFP concentrations at appreciable distances from the airport.

UFP Conc

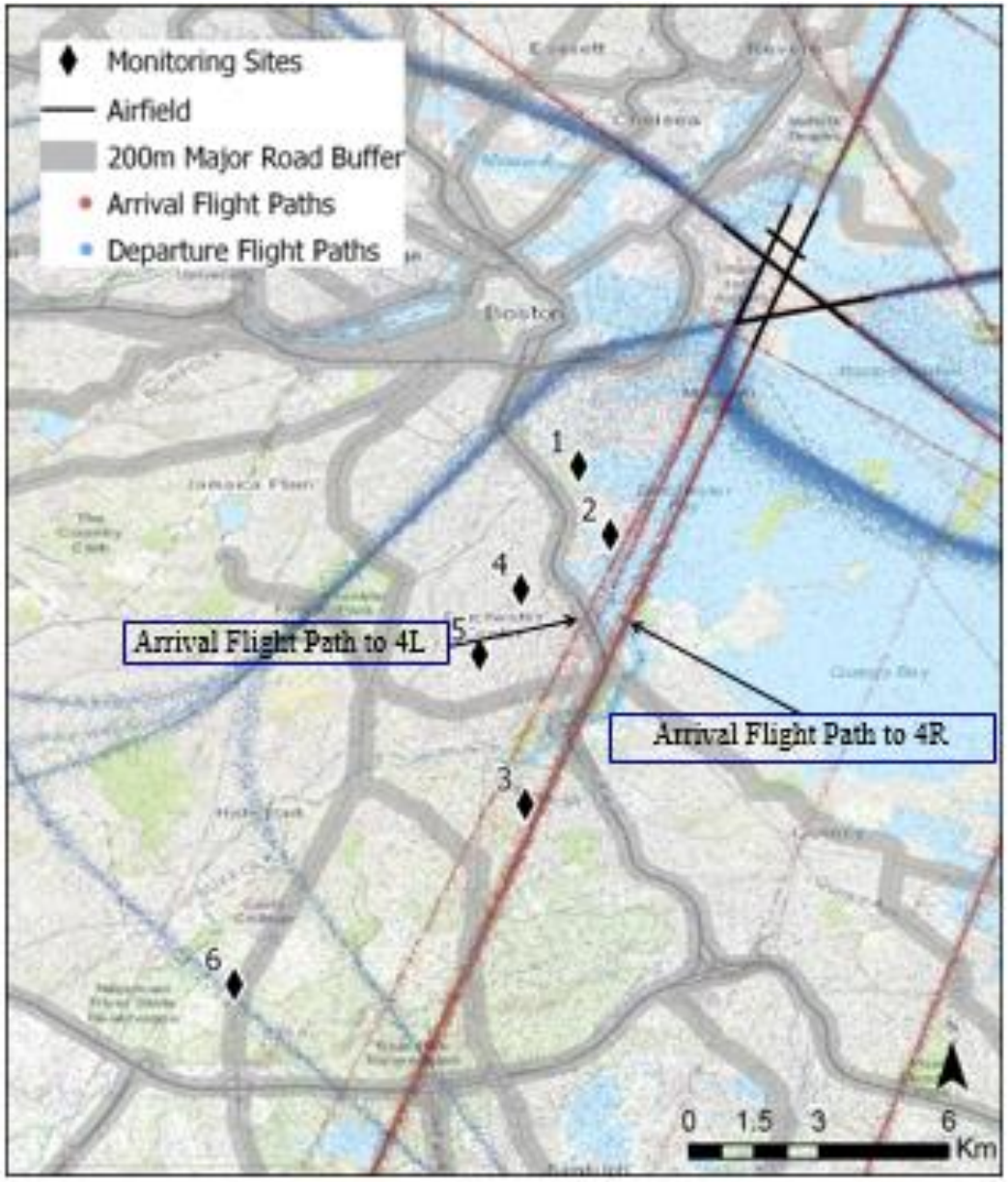
Met

BC

Flight Activity



# Field Campaign 2017




- **Site Selection**
- Focus on arrivals to Boston Logan International Airport on Runway 4R/4L

- 51,858 arrivals in 2016 (most used runway)

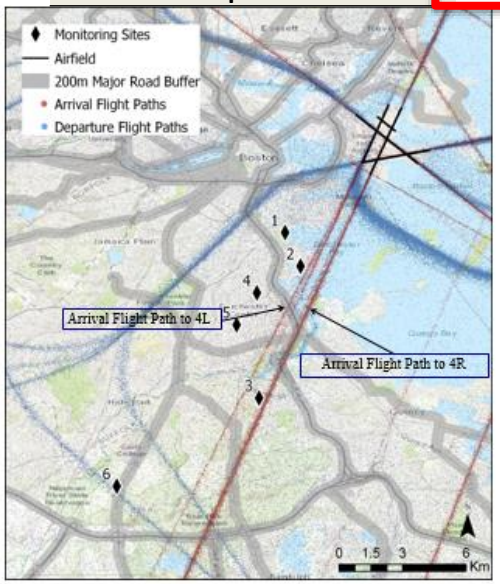
- Flight path largely over populated areas

- Sites chosen to be > 200 m from major roadways, at varying distances from airport and from flight path based in part on projected wind direction and runway usage

# Preliminary Results – UFP Distributions

**Table 1. UFP Measurements (Particles/cm³) at Six Study Sites near Boston Logan International Airport**

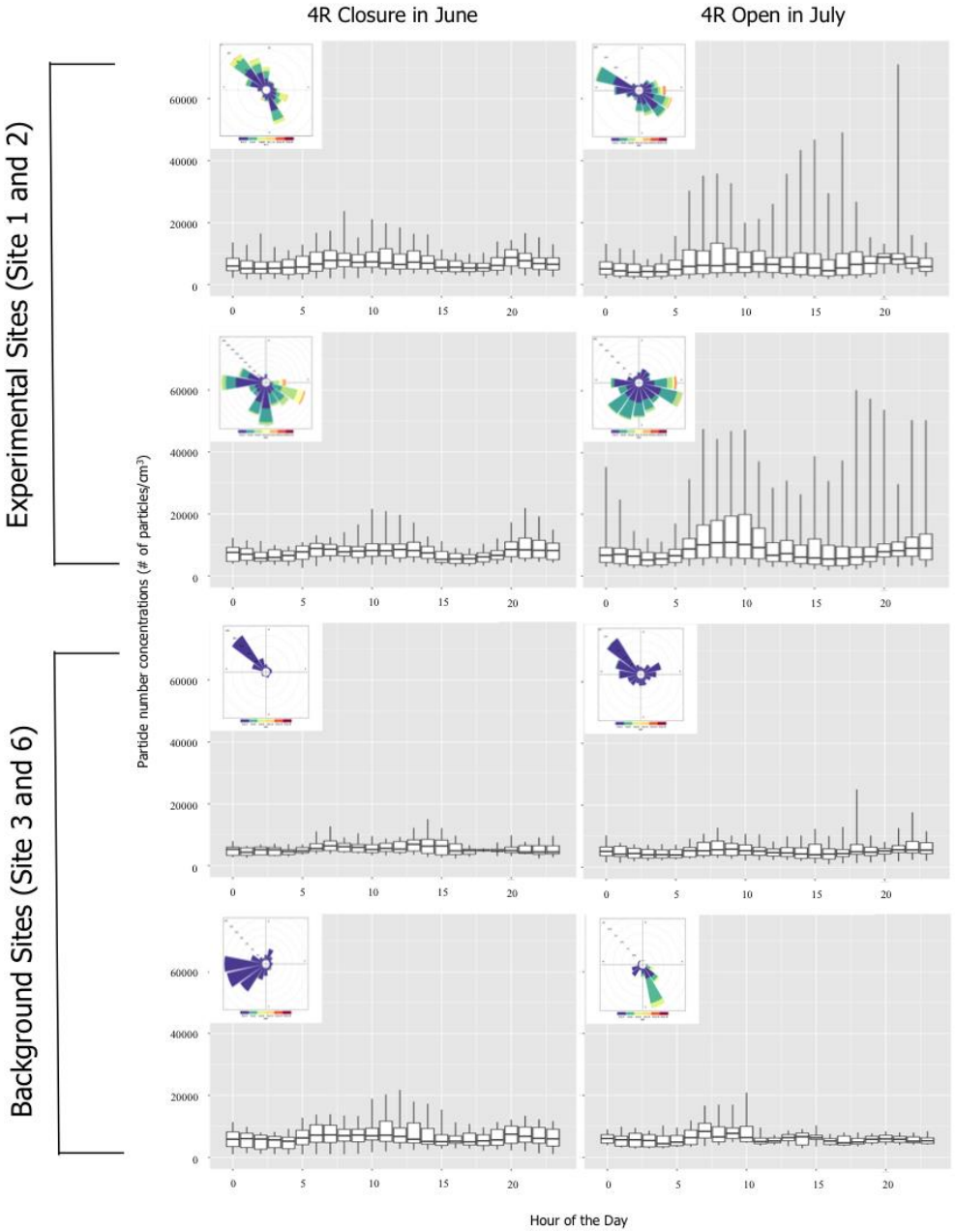
| | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|---|---|---|---|---|---|---|
| Sample Size (days) | 67 | 71 | 57 | 61 | 57 | 62 |
| Sample Size (seconds | 5,262,301 | 5,301,907 | 4,126,007 | 4,363,564 | 4,233,284 | 4,661,517 |
| 0.1st percentile | 800 | 1,100 | 1,600 | 2,500 | 2,000 | 1,800 |
| 1st percentile | 1,000 | 2,900 | 2,500 | 5,100 | 2,900 | 2,500 |
| 5th percentile | 4,300 | 5,800 | 4,300 | 8,200 | 5,700 | 4,300 |
| 50th percentile | 14,100 | 16, 600 | 11,600 | 20,600 | 17,100 | 12,000 |
| 95th percentile | 55,600 | 63,000 | 28,000 | 67,900 | 47,100 | 31,400 |
| 99th percentile | 116,800 | 119,200 | 47,400 | 103,200 | 70,700 | 50,500 |
| 99.9th percentile | 180,200 | 206,600 | 87,500 | 150,800 | 96,500 | 95,800 |

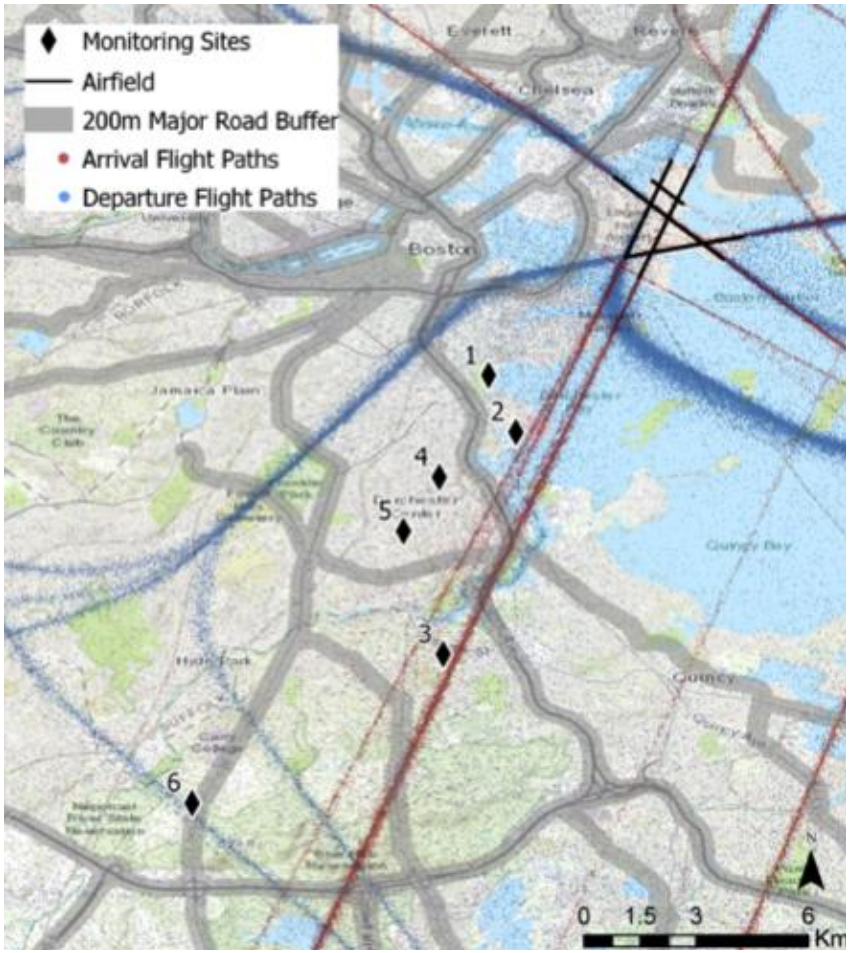



Near-Source Sites

Background Sites

# Preliminary Results – Near-Source vs. Background UFP




More UFP variation at the upper 75th and 95th percentiles than median.

# Future Directions

- Descriptive stats based on the meteorology and time of day have informed regression model development.
- Spatial-temporal regression models used in traffic-based PNC modelling are currently being developed
  - Generalized linear regression
  - Hierarchical modeling
- Completed winter, spring and summer 2018 field sampling campaign to measure UFP at various distances from the airport under multiple landing and take-off trajectories.
- Integrating an electric vehicle for mobile monitoring of PNC to fill in spatial gaps between long term monitors.