

# Thoughts for the Future: Flow Control, Meteorology, PM Sensors, & MAIA

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# Flow Control

## The Current Situation

- GAST pump much larger than needed due to flow control orifice
- Flow control is passive so flow rate decreases as filter loads
- Volume flow rate is measured but PM10 and PM2.5 cut points change with flow rate
- End of day may have lower flow rate so not represented as well

## Why Change?

- BrushLess DC (BLDC) motors (also called electronically commutated motors) have made it cheap and easy to adjust motor power and speed to a given need
- Obtain constant flow rate which provides more reliable PM2.5 and PM10 cuts
- Reduce energy consumption since the pump is much smaller
- Increase pump life since it is operating at lower load

## What's the cost?

- Old: \$400 for the pump, in quantity, plus \$160/yr in power
- New: \$260 for pump and controller, in quantity, plus power savings
- And controller and database programming costs
- And some electronics to interface pump to controller



# Meteorology

## The Current Situation

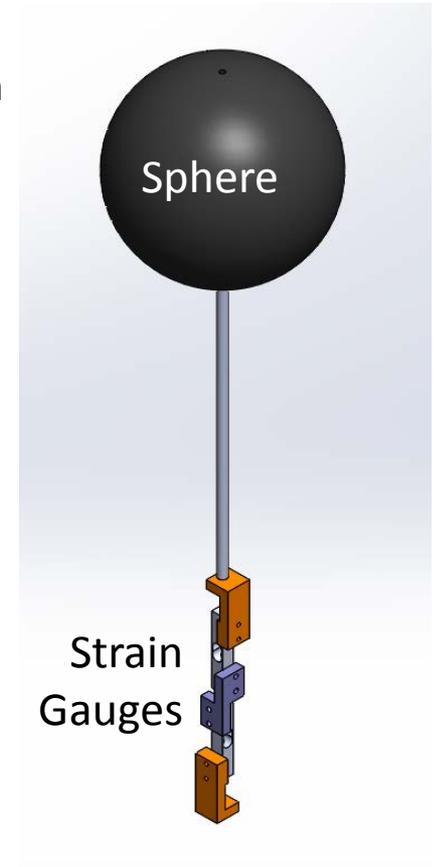
- No meteorology at the sites
- Do not know key factors governing PM concentration, composition and visibility factors

## Why Change?

- RH dependence is key to visibility
- Wind direction and speed can point to the source location
- New controller and internet to collect and transmit data home

## What's the cost?

- NPS supported development of drag sphere anemometer
  - No moving parts to wear out
  - No places for insects or birds to find a home
- Cost is less than \$100 per site
- RH, Temperature, and Barometric Pressure can be obtained with Bosch BME280 chip (see next slide)
- And controller and database programming costs



# Real-Time PM1, PM2.5 and PM10

## The Current Situation

- We collect 24-hour data, 1 in 3 days

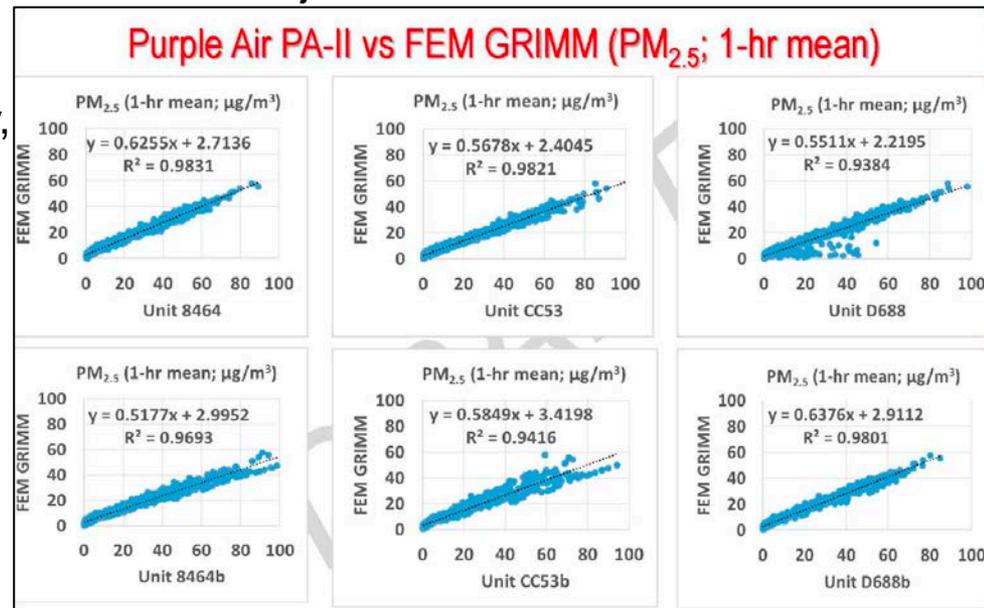
## Why Change?

- Plumes may move through on time scales less than a day
- New, low-cost, real-time sensors coming on the market
- Accuracy is not so hot but we have a gold standard with our 24-hour gravimetric measurements, so can calibrate/adjust



## What's the cost?

- \$189 per site for a PurpleAir, in quantity, includes 2-PM sensors, RH, Temperature, Barometric Pressure
- And will incur programming costs to ingest data and calibrate using PM2.5 and PM10 gravimetric data from filters
- AQ-SPEC data from South Coast Air Quality Management District here



# MAIA (Multi-Angle Imager for Aerosols)

## The Current Situation

- We do not have focused help from satellites
- NASA does not have ground truth synchronized with overflights

## Why Change?

- IMPROVE provides mass and composition data with generally low spatial gradients
- NASA will be launching MAIA whose goal is PM2.5 composition

## What's the cost?

- NASA pays for
  - X Module on a schedule synchronized with overflights
  - 24 hour samples on PTFE
  - PurpleAir or similar to get better time resolution



# Network Reinvestment

**Our priorities – Your thoughts, funding, timing?**

1. Flow control
2. Real-time PM1, PM2.5, PM10, T, RH, BP
3. Wind Direction and Speed
4. OK to use X module for MAIA ground truth if NASA pays?

