



EPA Next Generation Air Monitoring

Briefing for National Wildfire Coordinating Group (NWCG) Smoke Committee

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Earth Systems



Air
Ambient Air Quality
Pollutant Deposition

Climate
Changes in:
Temperature · Extremes
Precipitation · Sea Level

Exposures to and Effects on:

Ecosystems · Watersheds
Human Health and Communities

Responses
Mitigation
Prevention
Adaptation

AIR MONITORING

Social Factors
Population · Public Health · Economy
Technology · Transportation · Behavior
Water/Food Supply · Land Use Change

Responses
Mitigation
Prevention
Adaptation

Energy
Emissions of Air
Pollutants
and Other Environmental
Stressors

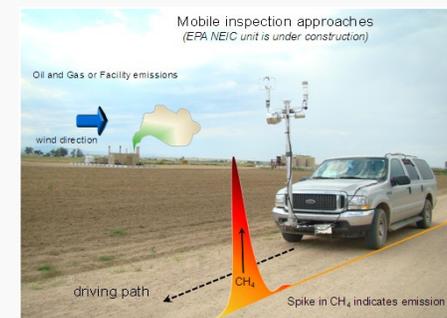
Human Systems

Changing the Paradigm for Air Pollution Monitoring



From Sensors to Satellites

- Sensors
 - Present both Opportunities and Challenges
 - Evaluating a range of technologies
- Satellites
 - Evaluating and enhancing air quality applications
 - Leveraging investments from NASA and NOAA
- Data Fusion
 - Integrating modeling data with monitoring data to fill spatial and temporal gaps.

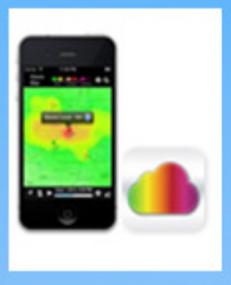


A cultural and technology shift is underway



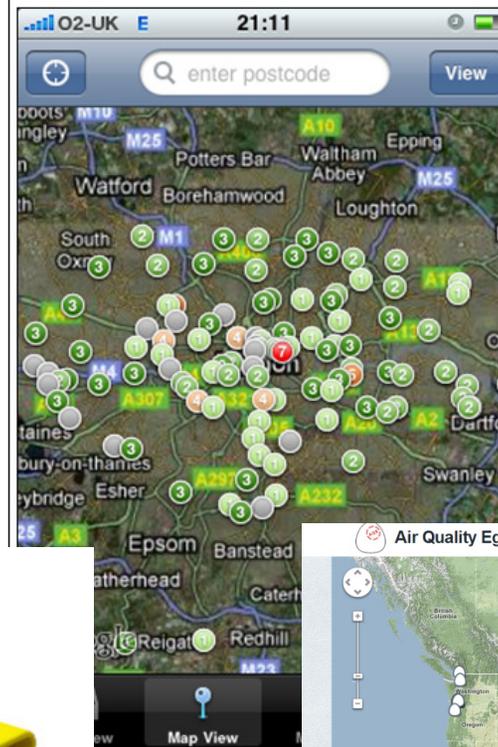
Emerging data-viewing/communication apps

 **OzoneMap App!**
Mobile App



OzoneMap - Air Alliance Houston, in collaboration with University of Houston and the American Lung Association have developed a new mobile phone app with real-time ozone data for the Houston area. Check it out here!

airalliancehouston.org



londonair.org.uk/
iphone



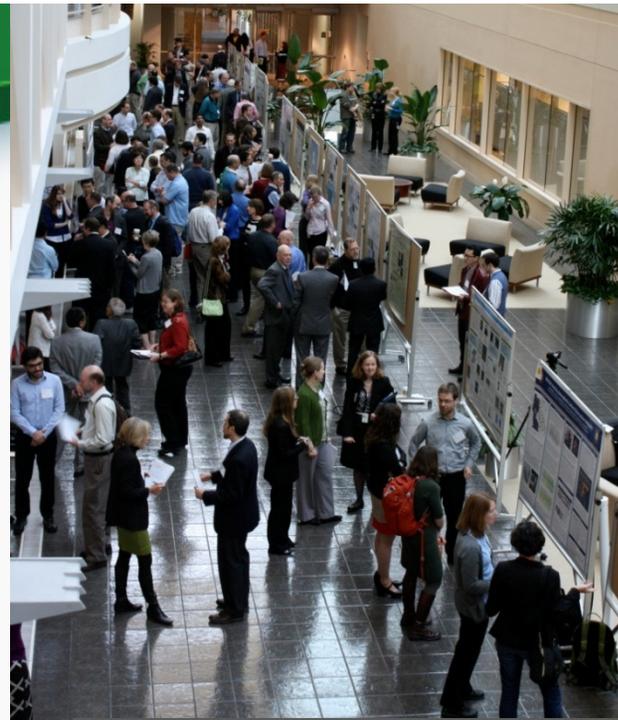
AirCasting App

aircasting.org



What is EPA doing?

- Assessing emerging technology
 - Literature review of sensor technology
 - Sensor evaluation through laboratory and field analyses
- Thinking big picture about these developments and implications
- Stimulating collaboration and conversation



DRAFT

EPA Roadmap for Next Generation Air Monitoring



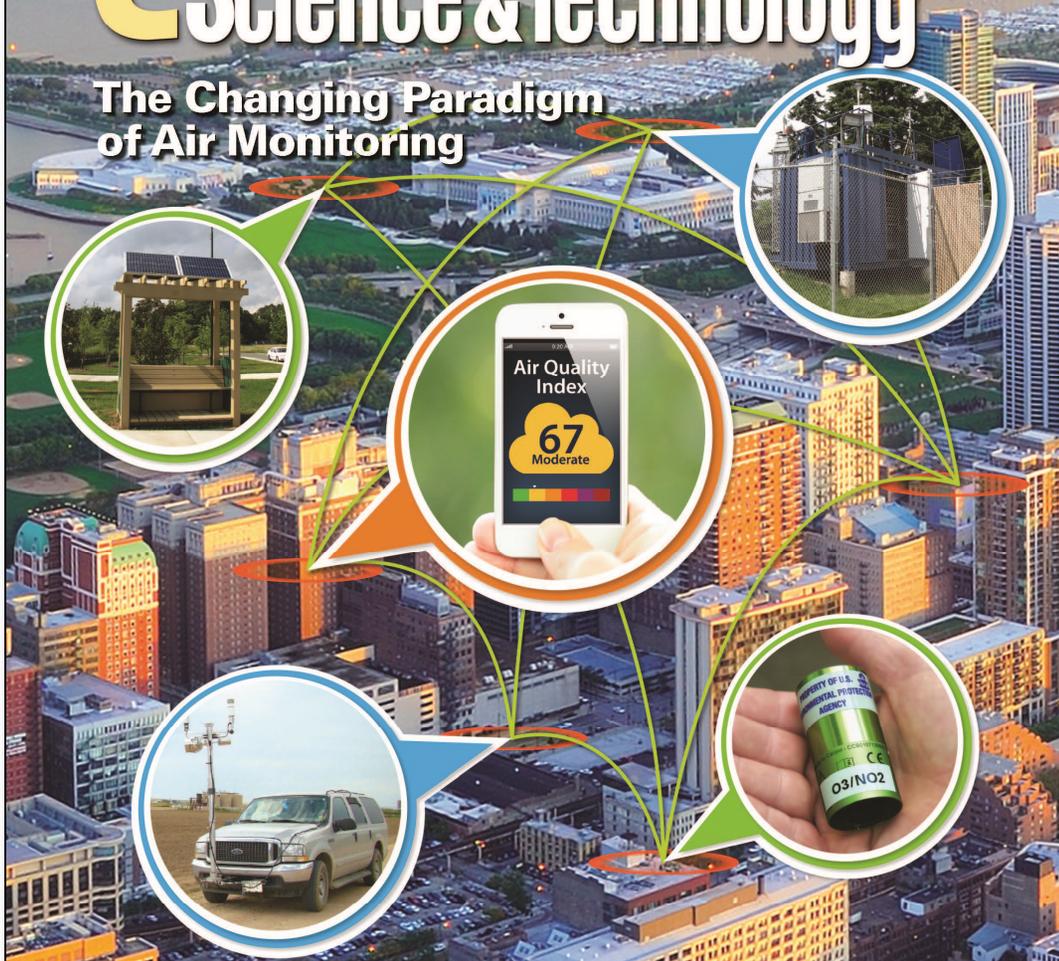
Environmental Protection Agency
Office of Research and Development



ENVIRONMENTAL Science & Technology

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pubs.acs.org/est

The Changing Paradigm of Air Monitoring



The Changing Paradigm of Air Monitoring

Snyder et al., ES&T, August 2013
<http://pubs.acs.org/doi/abs/10.1021/es4022602>

Assessing and supporting new technology



Emerging air monitoring systems (informal classification)

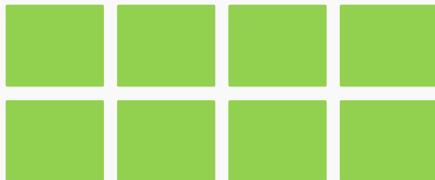


Group 1: Regulatory or regulatory-equivalent air monitoring stations
Cost: 100Ks (in thousands), Data reliability = A+

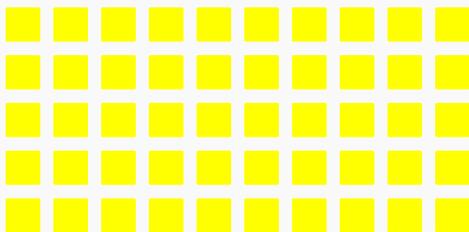
existing



emerging



Group 2: Smaller-footprint monitoring systems for community screening and research studies
Cost: 1-10Ks, Data reliability = B+ (target)



Group 3: Very small, very low cost systems enabling dense sensor networks, citizen science
Cost: 0.1-1Ks, Data reliability = ?

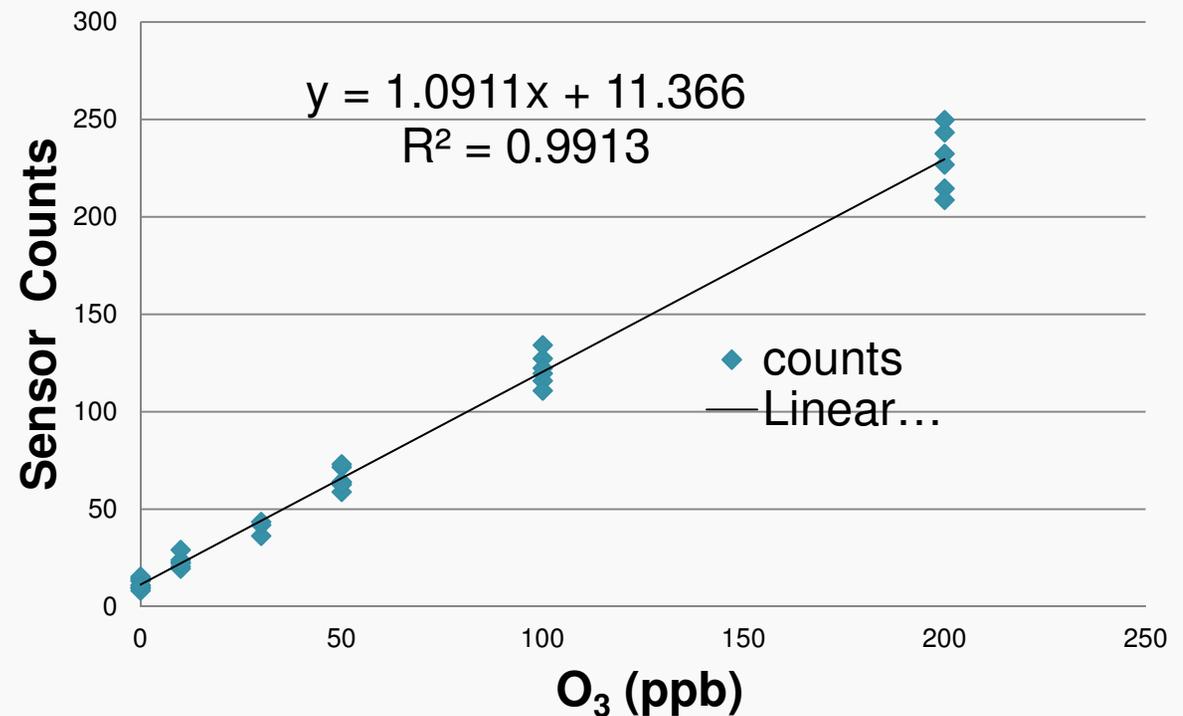
Sensor Evaluation



- Laboratory and field evaluations of existing sensors available on the market
- Pollutants examined – O₃, NO₂, CO, CO₂, PM, VOCs



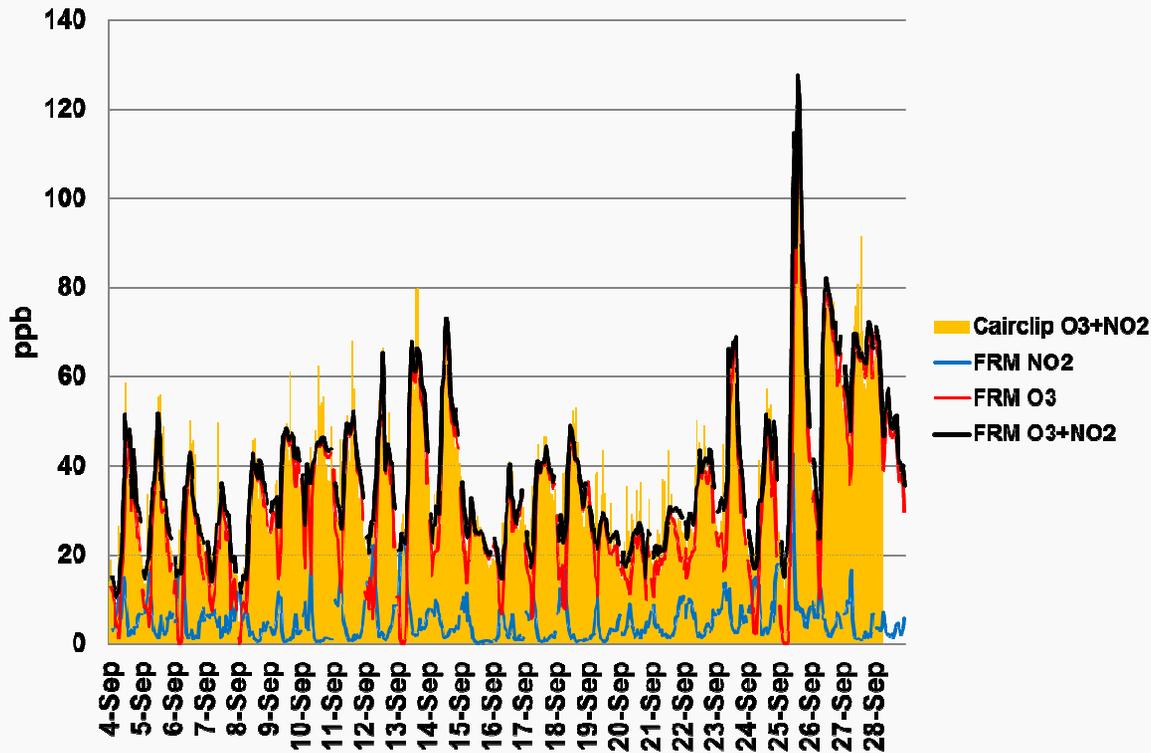
CairClip: Ozone sensor



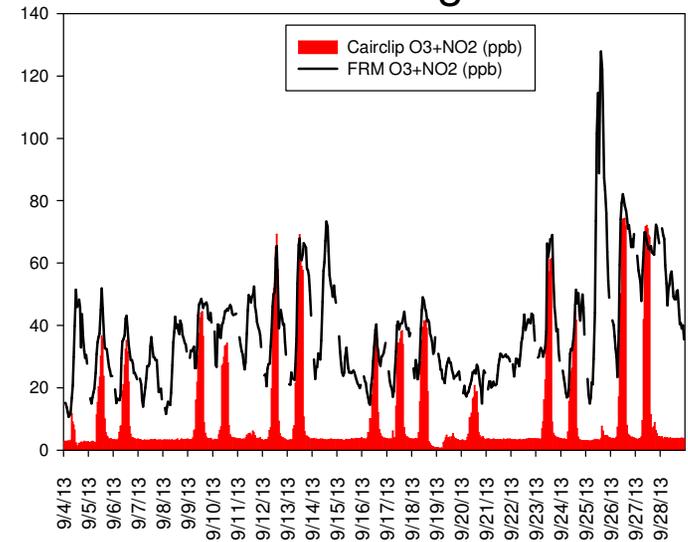
Houston Study with NASA



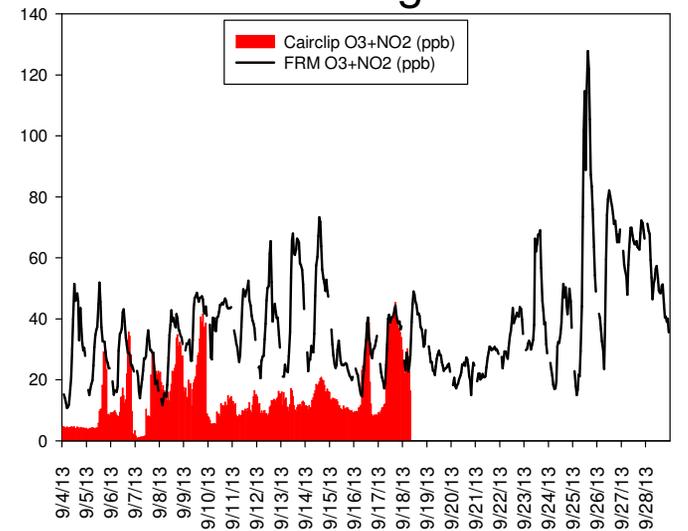
La Porte, TX September 4-28, 2013
1 hour average



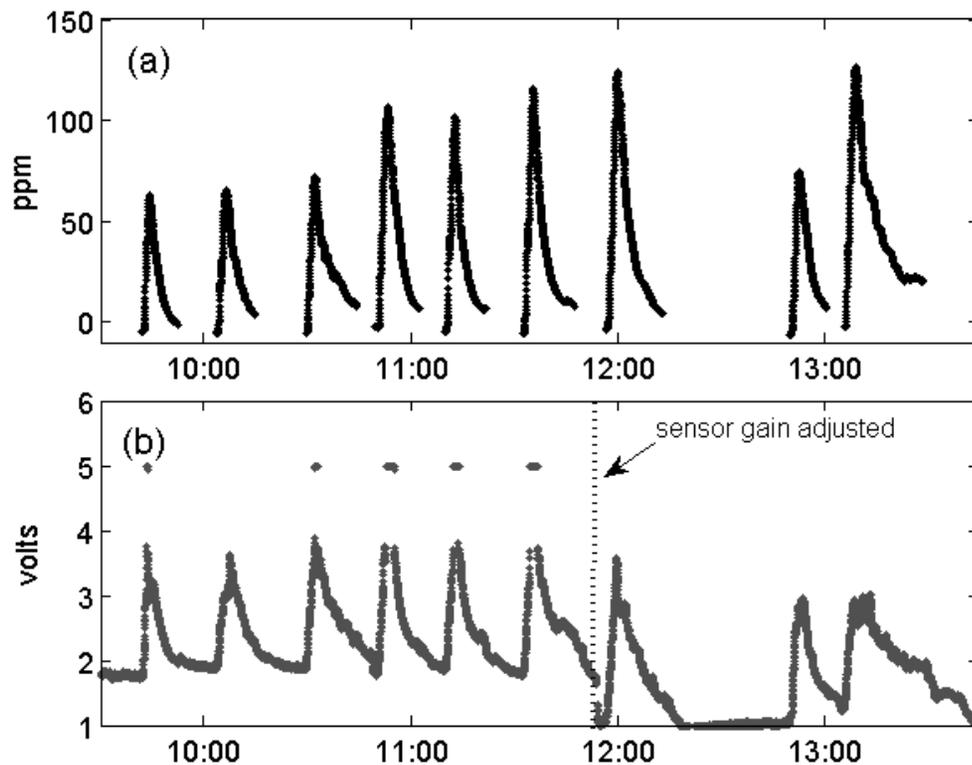
Lomax Junior High School



Deer Park High North

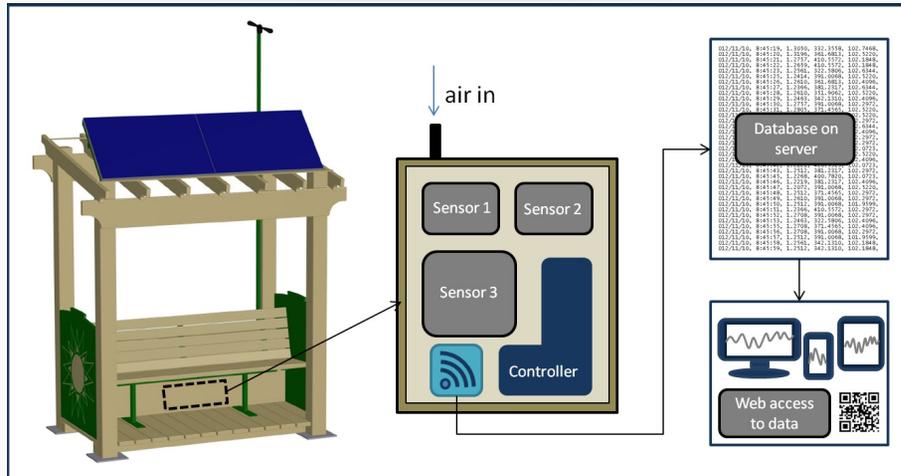


Prescribed Forest and Laboratory Burns



- Currently developing small sensor package for aerial sampling
- Includes CO, CO₂, PM
- Plan to deploy this summer

Village Green Project



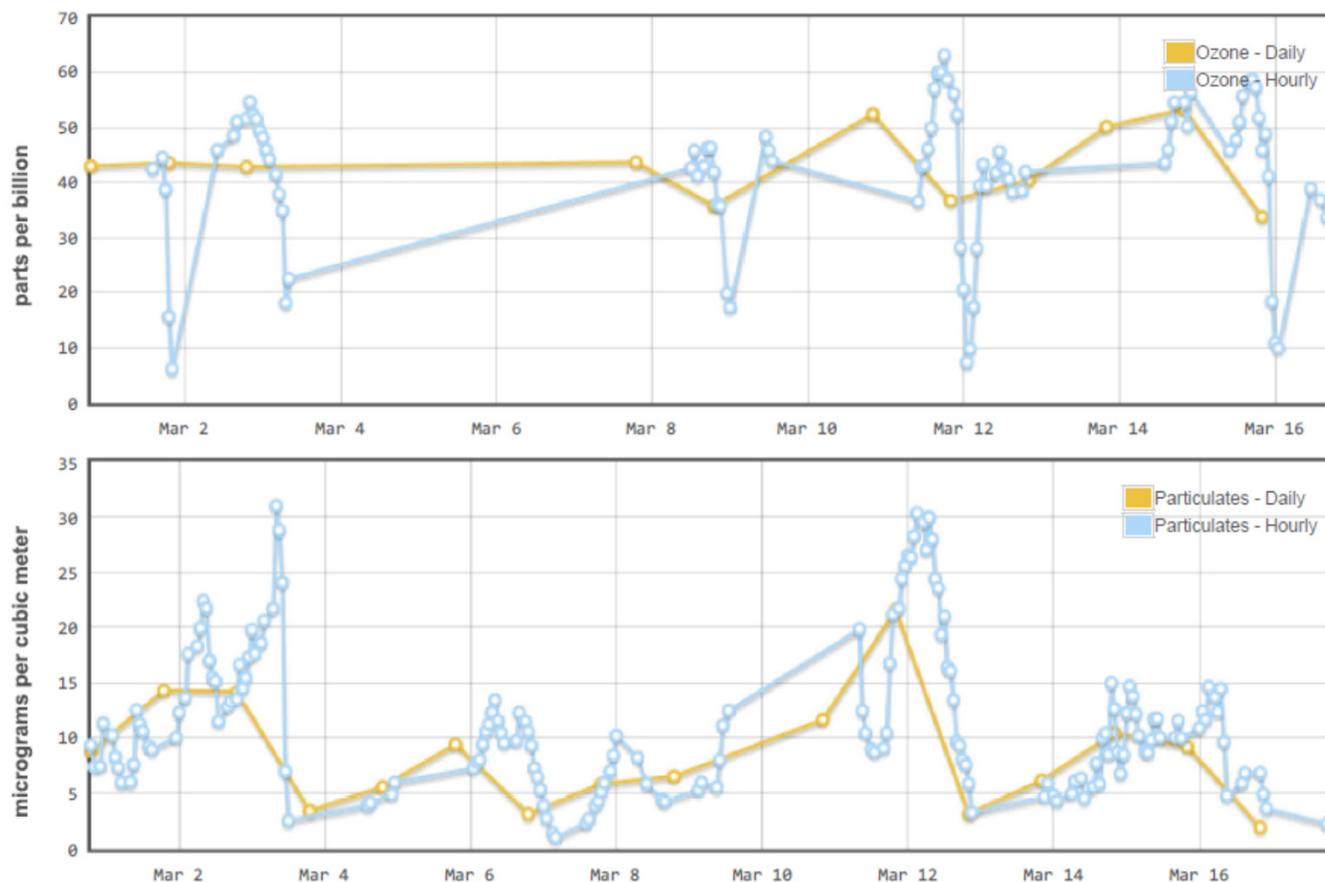
- Self-powered air and meteorological sampler
- Lower cost, real-time instruments - proven capability at ambient levels
- Wireless data communication to publically-accessible website
- Prototype located at Durham Public Library
- In operation since June 20, 2013



Village Green Project Real-time Data



- Minute-by-minute data that can be averaged to hourly and daily
- Includes ozone, PM, wind speed, wind direction, temperature, and relative humidity
- Intended for educational and outreach purposes



<http://villagegreen.epa.gov/>

Coming Soon



- Sensor Evaluations
 - Evaluation of PM and VOC sensors
 - Publish results
 - Publication of literature review (State of the Science)
- Community Applications
 - Participate in next DISCOVER-AQ field study (summer of 2014)
 - Possible expansion of Village Green sites as part of EPA E-Enterprise program
 - Collaborations with EPA Regions on sensor methods development and citizen science applications
 - Request for Applications for grants for community sensor applications (2015)
- Guidance
 - Guidebook for sensor users and developers
 - Public health messages

NGAM: A Challenge and an Opportunity



- Federal/State/Local governments need to prepare for data deluge and responses to concerned citizens
 - What's the quality of the data?
 - How to interpret data from sensors' short term measurements: health implications?
- Federal/State/Local governments will also have new sources of data to better manage air quality and protect public health
- EPA is engaging with the early adopters and developers of these sensors to help ensure this technology is used in a fashion that is appropriate and most useful to us as regulators and to communities and the public.

EPA Air Sensors Workshop



Next Generation Air Monitoring Workshop (NGAM) Series

Air Sensors 2014: A New Frontier

Monitoring technology for today's world

June 9 & 10, 2014

EPA Campus in Research Triangle Park, North Carolina

- Showcase your work
- Mingle with sensor developers and users
- Discover new and exciting technologies

[Register now](#) and see the call for poster and presentation abstracts!

Topics covered include:

- New technologies
- Research opportunities
- Sensor performance
- Data collection, storage and sharing
- Citizen science and community-based monitoring

Webinar available!

<https://sites.google.com/site/airsensors2014/home>

For More Information



- EPA Next Generation Air Measurement Website
 - <http://www.epa.gov/research/airscience/air-sensor-research.htm>
- Village Green Project
 - <http://villagegreen.epa.gov/>
- EPA Air and Climate Research Websites
 - <http://www.epa.gov/research/airscience/>
 - <http://www.epa.gov/research/climatescience/>
- Lindsay Stanek
 - Stanek.Lindsay@epa.gov
 - 919-541-7792



Supplemental

Features of Cairclip



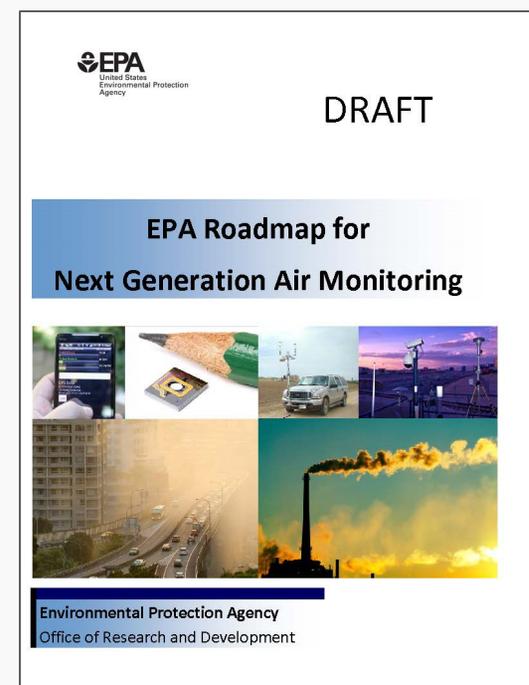
- Detection range for O₃ and NO₂: 0 to 250 ppb
- Weight: 55 grams (about 0.12 pounds)
- Dimensions: 32 mm (1.26 inches) wide, 62 mm (2.44 inches) long
- Battery life: ≥24 hours
- Recharging battery: 4-6 hours to completely charge
- Battery charged with either a USB cable or AC adapter
- Can store 28,800 data points
 - 20 days of 1 minute average data
- Cairsoft user software to retrieve measurement data
- Average cost - \$900



EPA Roadmap for Next Generation Air Monitoring



- Goals
 - Affordable near source, fenceline monitoring technologies and sensor network-based leak detection systems
 - Supplement air quality monitoring networks through development of low cost, reliable air quality sensor technology
 - Support environmental justice (EJ) communities and citizen science efforts to measure air pollution in local areas
- Cross Cutting Areas of Focus
 - Technology Development, Testing, and Integration
 - Technology Demonstration, Outreach and Communication
 - IT infrastructure and New Data Streams
- For Each Area of Focus
 - Major Findings/Conclusions
 - Recommendations/Gaps
 - Short and Long Term Priorities
 - Implementation Strategy



Draft version available at <http://www.epa.gov/research/airscience/docs/roadmap-20130308.pdf>

STAR RFA Links



- Developing the next generation of air quality measurement technology (closed Feb 2011)
 - http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/research.display/rpt/abs/rfa_id/540
- Monitoring for communities (opens Summer 2014)
 - Will be posted here when open:
<http://www.epa.gov/ncer/rfa/>