Low-Cost Sensing – Current Status and Opportunities

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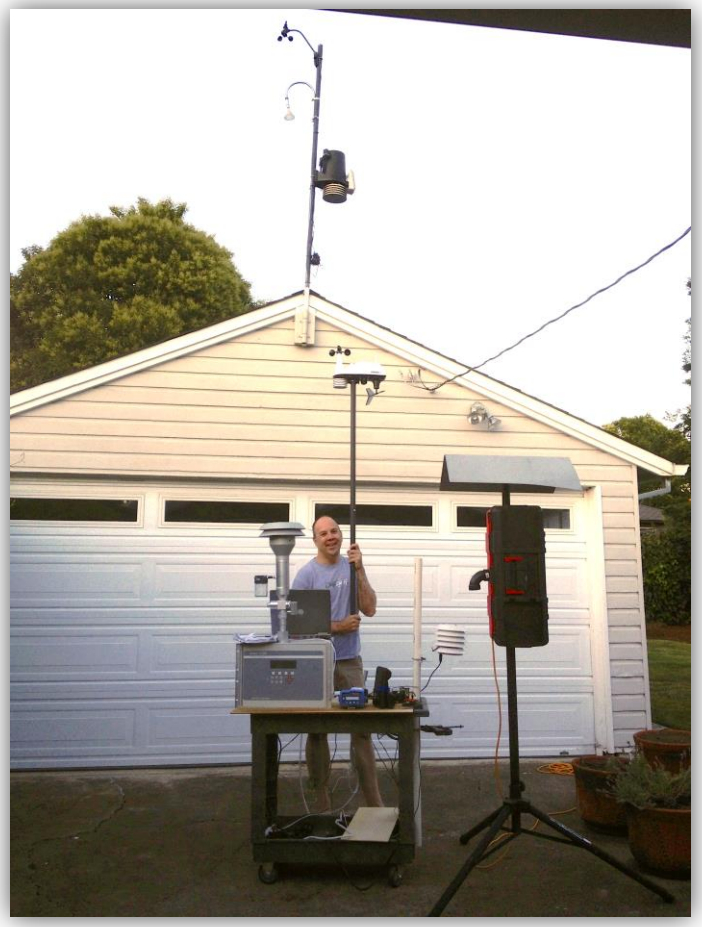


STi
Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

Outline

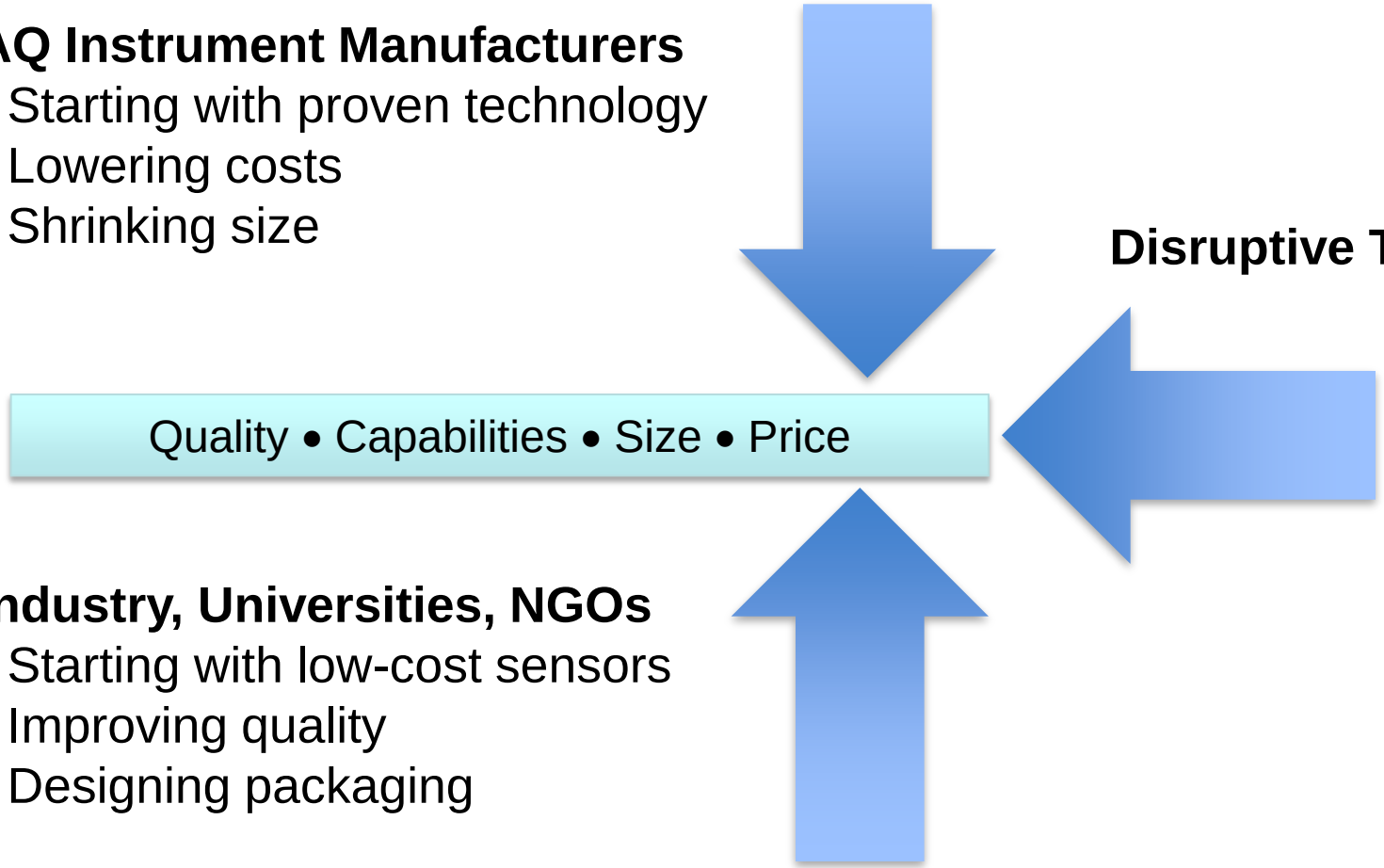
- Current status
  - Who
  - What
  - Why
- Specific project examples
- Concerns & opportunities
- Future

Background – Many Efforts

- Who
  - University – cutting edge research
  - Private sector/start-ups
  - Government
  - NGOs
  - DIYers
  - Schools

Background – What's Happening

AQ Instrument Manufacturers
- Starting with proven technology
- Lowering costs
- Shrinking size



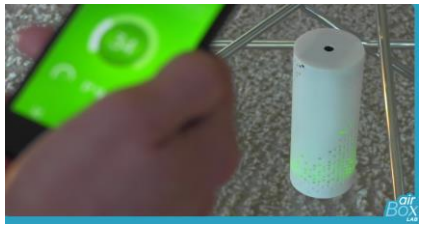
Industry, Universities, NGOs
- Starting with low-cost sensors
- Improving quality
- Designing packaging

Background – What's Happening in the Private Sector

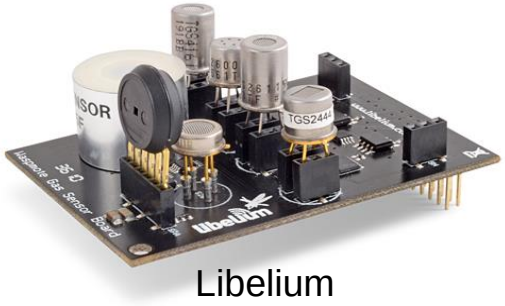
AirBase

Sensaris

Cairpol



Airboxlab



Libelium

Esensors

CubeSensor

Canary

Lapka

Sensordrone

Background – Why This Is Happening

- “Because they can” (low cost, easy to create)
- STEM education
- Personal health info and protection
- Advocacy for changing policy
- Decision making
- Research

Example – Maker Faire

Sponsor: STI, HabitatMap, Manhattan College, NY Hall of Science

Type: Educational

Approach:

- Developed AirCasting pods
- Let people measure particles
- Crowd sourced the data
- Interviewed participants

Example – Maker Faire

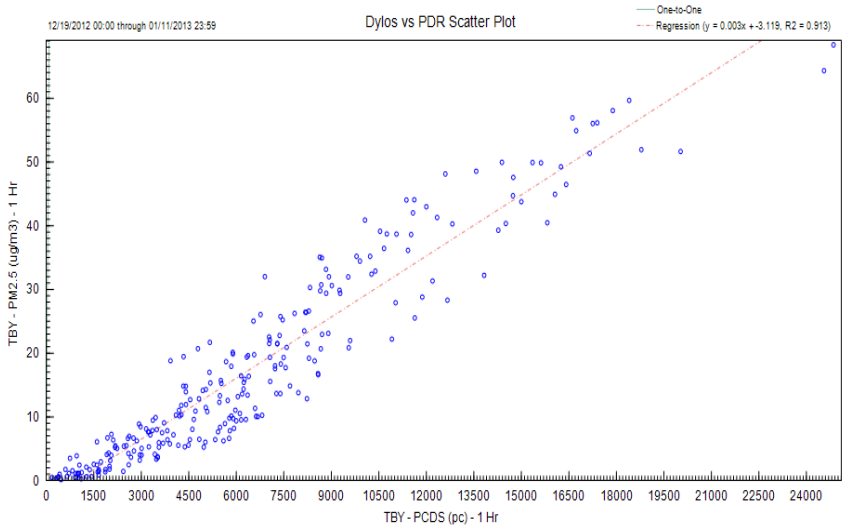
Example – Particle Evaluations

Sponsor: Tim and his garage

Type: Educational

Approach:

- Compare low-cost particle sensors to reference instruments
- Determine the quality of the sensors



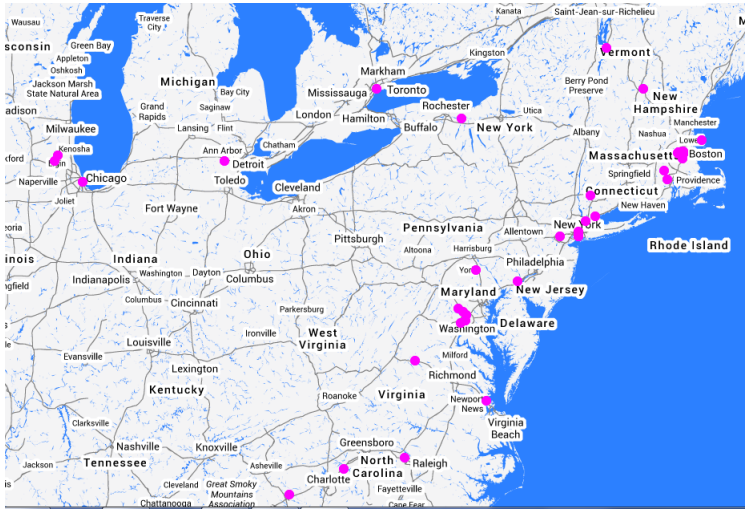
Example – Air Quality Egg

Sponsor: Public via KickStarter

Type: DIY

Approach:

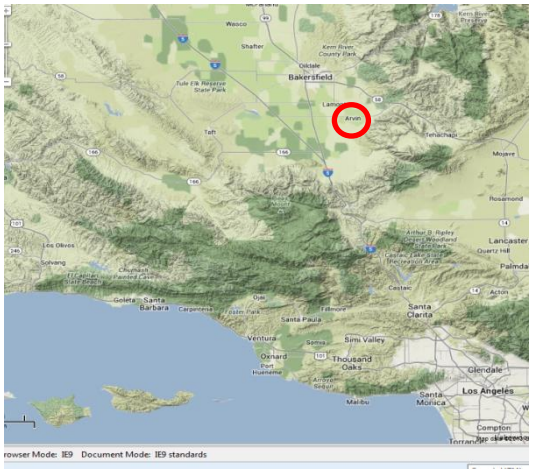
- Sought crowdsourced funding ($140k)
- Developed 1200+ eggs to measure CO and NO_2
- Costs about $150
- Results discouraging; didn't focus on quality



Example – Air Quality Agency

Sponsor: San Joaquin Valley Unified Air Pollution Control District

Type: Research



Objective:

- Determine ozone gradients in and around Arvin, California
- Develop an algorithm to predict peak ozone concentrations in the greater Arvin area

Approach:

- Deployed 23 low-cost ozone sensors in the Arvin area
- Collecting 6 weeks of data
- Conducting quality control and data analysis

Example – Air Quality Agency

Collocation Study

Field Site

Potential Concerns with Low-Cost Monitoring

- Inaccurate data used by organizations
- Confused citizens
- Distrust of government
- Time drain on AQ agency staff
- Unknown process for how data will be used

Potential Opportunities from Low-Cost Monitoring

- Engage new people/advocates for clean air
- Supplement monitoring networks
- Lower cost of monitoring
- Outreach and education
- Peer regulation (local understanding → local solutions)

Future – How Government Can Help

- Quality studies
  - EPA/ORD – sensor evaluations
  - EPA Air Sensor Guidebook
  - AirNow Sensor Evaluation Service
- Pilot studies
  - Demonstrating claims
  - Establishing value
  - Community group monitoring
  - Engaging stakeholders
- Aggregation for ingesting and quality-controlling data
- Health messaging determination

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