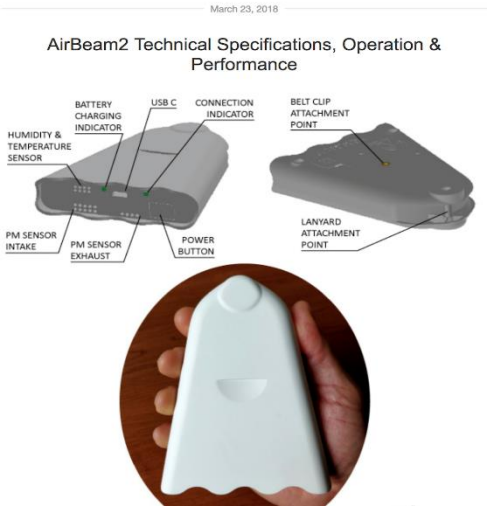
TEACHER GUIDE

AirBeams & AirCasting: How does it work?

The AirBeam is a palm-sized air quality monitor used to measure the amount of particulate matter in the air. Paired with an android device, and the AirCasting mobile app, citizen scientists, educators, students, and community leaders can take air quality measurements and contribute to a crowdsourced air quality map on the AirCasting website. Using the website, individuals can display and share air quality data.

The AirBeam uses a light scattering method to measure particulate matter (PM 1.0, 2.5 and 10). by drawing in air and measuring the concentration and size of particles using a light scattering method.



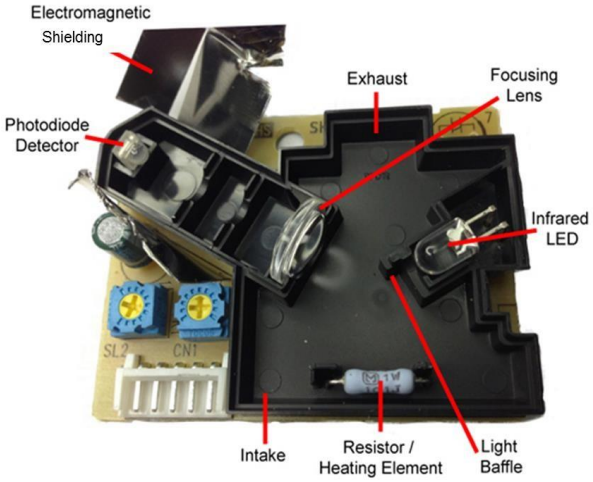


Image by Chris Nafas, modified by HabitatMap.

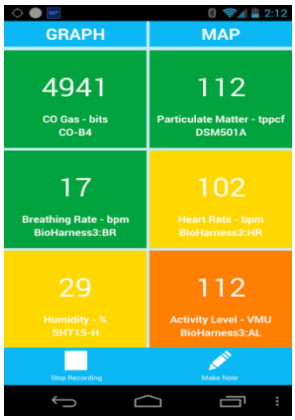
Once powered on, the AirBeam uses a small internal fan to create a partial vacuum which causes more air to flow into the AirBeams' "PM sensor intake". As the air is drawn through a sensing chamber, the infrared light from an LED bulb shines on the particles in the airstream. Some of this light is absorbed by the particles, and some is scattered. Two sensors inside the AirBeam: a particle-counting sensor and a light-scattering sensor, detect the number of particles and the amount of scattering. The information from the sensors is converted into a measurement that estimates the number of particles in the air (see below for more information on how estimates are calculated).

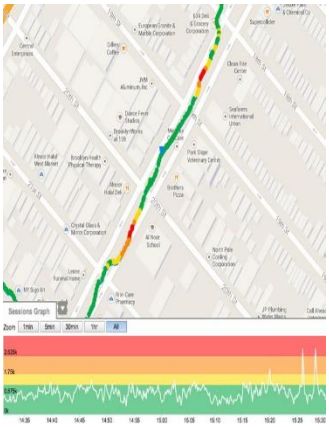
While the light scattering is related to the amount of PM in the air, the intensity of the light depends on a number of different factors.

- Amount of particles
- Size of particles
- Wavelength of light
- Angle of light scattering
- Number of particles
- Color of particles

The AirBeam takes measurements of PM 1.0, 2.5 and 10 in $\mu g/m^3$, as well as temperature and relative humidity. These measurements are taken once per second, and then communicated via Bluetooth to the AirCasting mobile app. The app maps and graphs the data in real time on your android smartphone or tablet. At the end of each AirCasting session, the collected data is sent to the AirCasting website, where the data is crowdsourced with data from other AirCasters to generate maps indicating where PM concentrations are highest and lowest.

An AirCasting session lets users capture real-world measurements, annotate the data and share it via the crowdmap on the AirCasting website. Using the AirCasting mobile app, AirCasters can record, map, and share 3 levels of PM concentration (1.0, 2.5, and 10), temperature, sound levels, and humidity.





* **Particulate Matter 1.0, 2.5 and 10 µg/m3:** Particles scatter light at an angle and intensity that is dependent on their size. When light strikes a particle, it is either diffracted, refracted, reflected, or absorbed. Smaller particles scatter light more intensely and at smaller angles than larger particles. Each particle size produces a unique scattering pattern. The intensity of light scattered is a function of its wavelength λ, scattering angle θ, particle size d_p, and relative index of refraction n between the medium and particle.

Photodetectors detect the intensity of scattered light. The energy of incident photons (elementary particle of light) on these devices cause electrons to be liberated. This produces an electrical signal (current) which is proportional to the intensity of detected light. This signal is converted into a measurement that estimates the number of **Particulate Matter 1.0, 2.5 and 10 µg/m3.**

Using the AirBeam & AirCasting App

Each AirBeam has a unique number that gets connected to the AirCasting App on the tablet to transmit the data. Once the AirBeam is connected to the tablet the data is transmitted every second and recording can take place. If the tablet is connected to WiFi the data will be visible on a map. If WiFi is not available, the data will be associated with a GPS location and will be placed on the map when uploaded to the AirCasting platform.

Connecting the AirBeam to the Android Tablet or Phone

Connecting the AirBeam Sensor to the AirCasting App:

1. Turn on the AirBeam1. You'll know it's on when the red LED indicator begins blinking.
2. Turn on the android tablet or phone. Open the AirCasting app.
3. Press the menu button, then press Settings.
    - Press External devices, then select the AirBeam1 unique ID# (# will be on the AirBeam itself) from the list of paired devices. When prompted to connect, press Yes. You will then be redirected to the Sensors Dashboard.
4. In 5-20 seconds, measurements from the AirBeam will appear on the screen and the blinking red light on the AirBeam will switch to solid red. You're connected!