AQMesh

Small sensor air quality monitoring system

TOGETHER WE CREATE SOLUTIONS THAT SHAPE THE FUTURE

ambilabs®

> ***New 'hyperlocal' [AQMesh] sensor network will monitor London's air quality.***

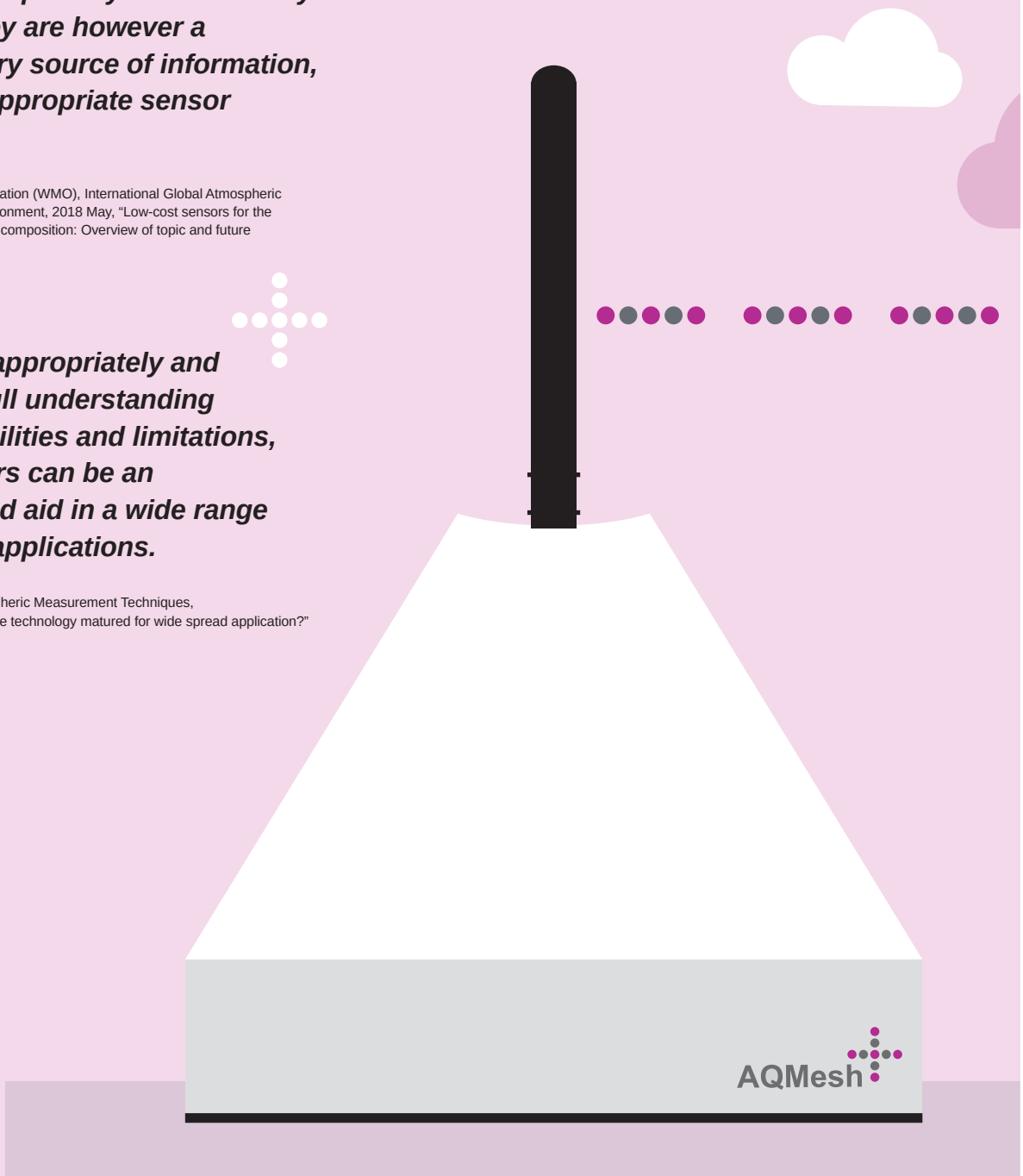
Intelligent Transport 2018, 22 Jun

> ***[Small] sensors are not currently a direct substitute for reference instruments, especially for mandatory purposes; they are however a complementary source of information, provided an appropriate sensor is used.***

World Meteorological Organization (WMO), International Global Atmospheric Chemistry (IGAC) & UN Environment, 2018 May, "Low-cost sensors for the measurement of atmospheric composition: Overview of topic and future applications"

> ***When tested appropriately and used with a full understanding of their capabilities and limitations, [small] sensors can be an unprecedented aid in a wide range of air quality applications.***

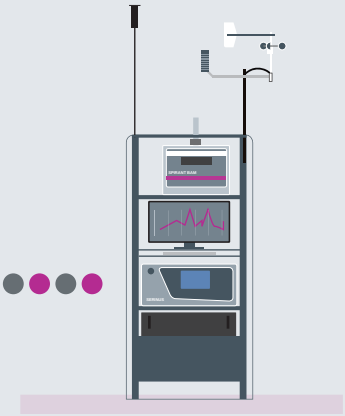
Jayaratne et al. 2018, Atmospheric Measurement Techniques,
"Low-cost $PM_{2.5}$ sensors: Is the technology matured for wide spread application?"



AQMesh + **Am**bilabs®

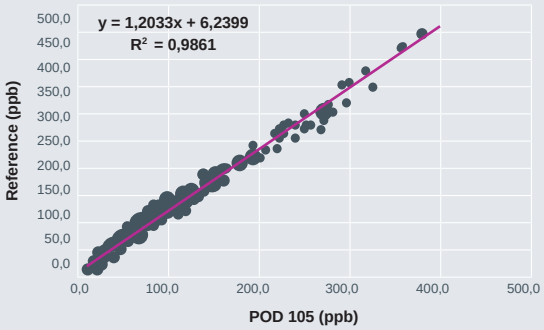
The world's finest reference quality gas analyzers has teamed up with the best of breed small sensor Air Quality monitoring system.

Combining AQMesh with Ambilabs®'s superior range of gas analyzers will transform the way smart cities and progressive thinking organizations use the power of collective environmental monitoring to measure, report and adhere to air quality standards and regulations.



> ***Co-location comparison trials against certified reference equipment continue to prove AQMesh performance and reliability for localised air quality monitoring.***

Environmental Technology 2018, "Latest AQMesh co-location studies show capability of small sensor systems", 14 Nov.



AQMESH

The tried and tested name in small sensor technology for commercial use:

- Hundreds of published scientific papers and research papers
- Thousands of hours of real-world trials and commercial placements in more than 30 countries
- No other commercially available small sensor system demonstrates better accuracy.*

AMBILABS®

Tier one trusted supplier of reference quality Air Quality Monitoring Systems (AQMS):

- Superior design, manufacture, installation and maintenance
- Air quality monitoring pioneer with 20 years' experience
- Serinus® gas analyzers for reference quality monitoring of O_3 , CO, NO, NO_2, NO_x,NH_3, SO_2, H_2S, TS and TRS
- Hundreds of AQMS sites around the world consisting of thousands of individual pieces of reference quality monitoring equipment.

AQMESH + AMBILABS® GAS ANALYZERS

Designed to work alone, together with Serinus® gas analyzers or in harmony with new or existing reference quality AQMS:

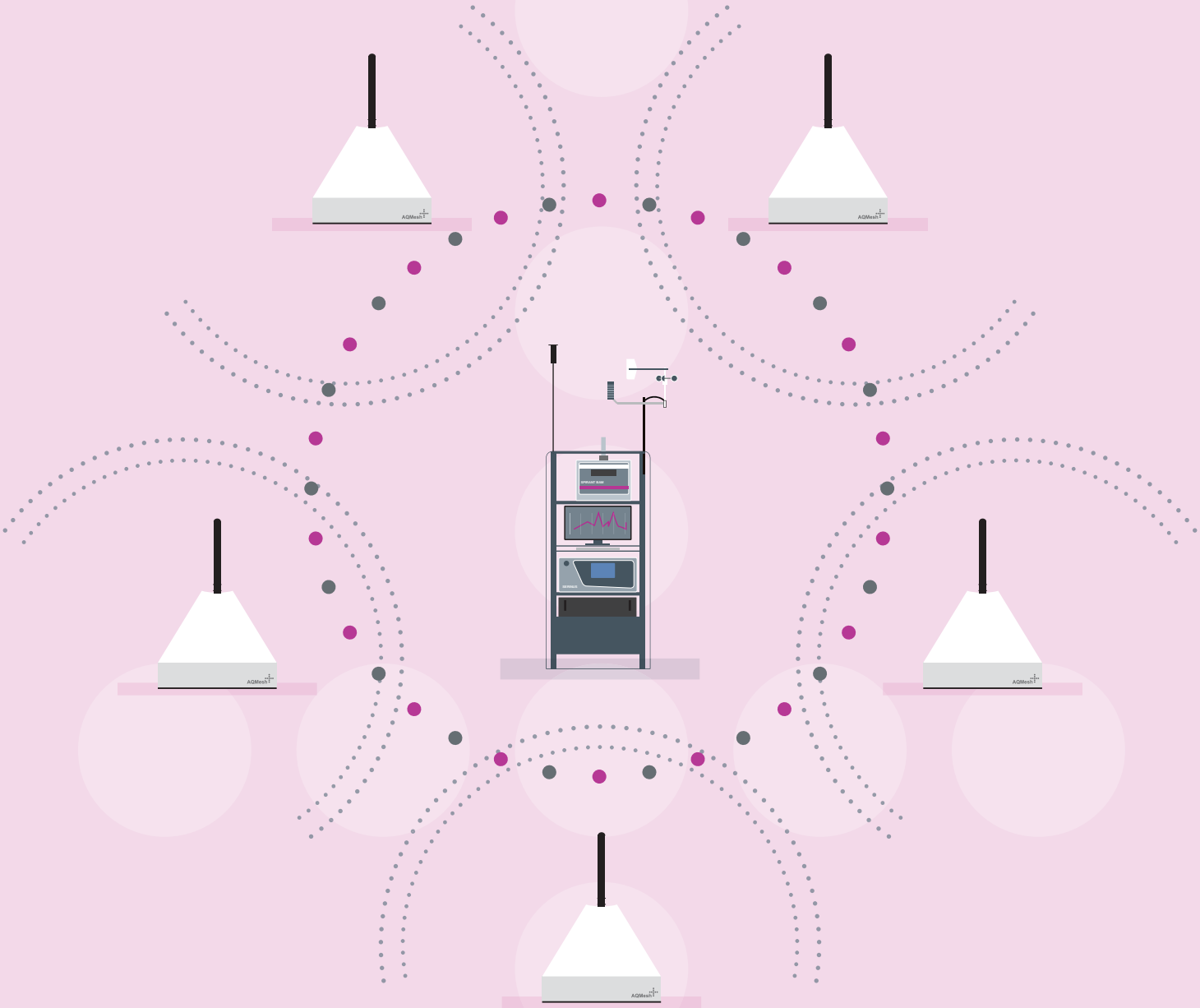
- Practical, cost-effective, commercial indoor and outdoor use
- Greatly increase the spatial resolution of air quality monitoring networks
- Provides hyperlocal measurement and trend analysis over time of human exposure to air pollution.

* Environmental Instruments Ltd 2016, "Looking for a 'low cost' air quality monitoring solution?" "10 reasons why you should choose AQMesh", 25 Jul

Scalability

When multiple AQMesh pods are added together they deliver localized real-time air quality data that supports initiatives to reduce air pollution and its risk to human health.

It's this ability to easily add, subtract, or relocate individual AQMesh pods where and when required that provides environmental professionals with a level of monitoring flexibility and scalability not possible with fixed-site reference quality AQMS alone.



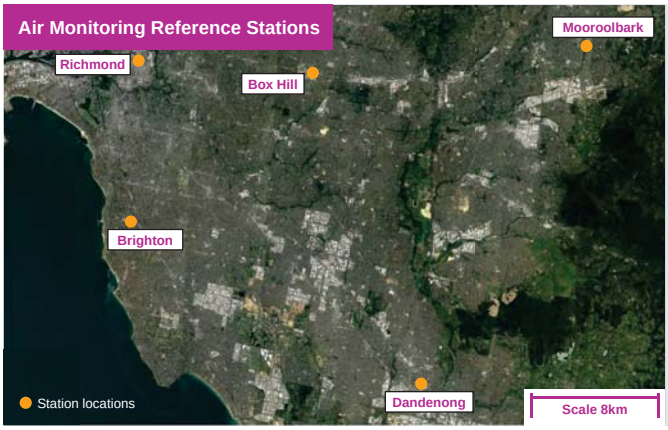
One to Many

Strategically placing a high number of AQMesh pods around and between a low number of reference quality AQMS stations delivers hyperlocal monitoring results.

However, small sensor technology is not a direct substitute for reference quality instruments, especially for mandatory or regulatory purposes.

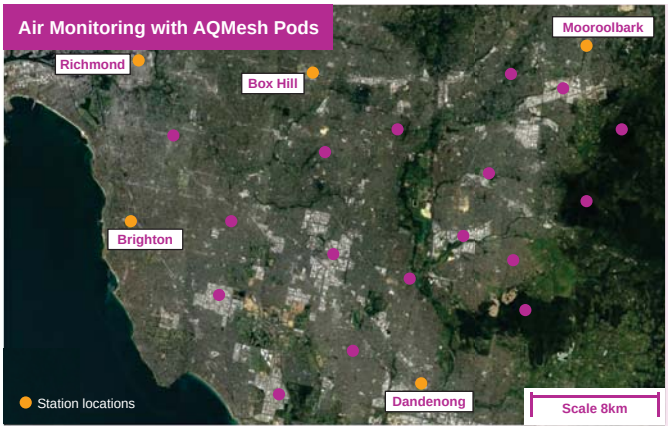
That is why when AQMesh is used as a complementary source of information to augment and enhance existing reference quality AQMS networks, environmental professionals are rewarded with increased spatial resolution of air quality data.

Increased spatial resolution of air quality data dramatically multiplies the opportunity for better understanding, insight and action.



MELBOURNE SOUTH EASTERN SUBURBS

- A city of 5 million
- 5 ECOTECH reference quality AQMS stations
- 10-20 km apart
- Mixed land use over changing topography: Suburban, residential, commercial, industrial, roads, parks



WHAT AN AUGMENTED AIR MONITORING NETWORK COULD LOOK LIKE

- Add 25 AQMesh pods
- Each pod 3-7 km apart
- 5 AQMS + 25 AQMesh = Significantly increase understanding of air quality at the neighbourhood level

AQMesh

The proven small sensor air quality monitoring system

AQMesh has been designed to offer a robust and easy-to-use air quality monitoring system that can deliver localised real-time readings, improving the accuracy and scope of gathering air quality data to support initiatives to reduce air pollution and its risk to human health.

Power

Sensor type	Expected life span	Notes
External DC	> 5 years	9 – 24V DC
Lithium metal battery pack [#9]	> 24 months	Dependent on measurement strategy & pod spec
External high capacity battery pack [#9]	> 60 months	Dependent on measurement strategy & pod spec
NiMH rechargeable battery pack [#9]	> 4 months	Dependent on measurement strategy & pod spec
Solar power pack	> 5 years	Change internal lead-acid battery every 24 months

Sensor life

Sensor type	Expected life span
Electrochemical	2 years [#7]
NDIR	5 years
Solid state	5 years
Omnidirectional microphone	5 years
Optical particle counter	1 year (minimum) [#7] [#8]

Physical

ENCLOSURE
ABS, protection IP65

ENVIRONMENTAL

Temperature range: -20°C to +40 °C

Humidity range: 15 to 95 % RH

MOUNTING

Pod supplied with mounting bracket for walls / posts

APPROX. SIZE & WEIGHT

Length: 170 mm

Width: 220 mm

Height (excl antenna): 250 mm

Height (incl antenna): 430 mm

Weight: 2 – 2.7 kg

Data & Communications

COMMUNICATIONS
Data sent to remote server via 2G or 3G SIM (data access contract is required)

MEASUREMENT PERIOD

Variable, from 1 min to 1 hr

TRANSMISSION FREQUENCY

Variable, from 5 mins to 12 hr intervals

SERVER SOFTWARE

Web browser based, processing of sensor output to give reading, database storage on secure server

DATA ACCESS

Tables, graphs, data download, multi-user access, password controlled, optional API data access

AQMESH PLUS SPECIFICATIONS*

Measurement

Sensor	Sensor Type	Units	Range
NO	Electrochemical	ppb or µg/m³	0 to 4,000 ppb
NO_2	Electrochemical	ppb or µg/m³	0 to 4,000 ppb
NO_x	Electrochemical	ppb or µg/m³	0 to 8,000 ppb
O_3	Electrochemical	ppb or µg/m³	0 to 1,800 ppb
CO	Electrochemical	ppb or µg/m³	0 to 6,000 ppb
SO^2	Electrochemical	ppb or µg/m³	0 to 10,000 ppb
H_2S	Electrochemical	ppb or µg/m³	0 to 100,000 ppb
CO_2	NDIR	ppm or mg/m³	0 to 5,000 ppm
Pod temperature	Solid state	°C or °F	-20 °C to 100 °C
Pressure	Solid state	mb	500 to 1500 mb
Humidity	Solid state	%	0 to 100 %
Noise	Omnidirectional mic	dB	35 to 100 dB SPL
Particle count	Optical particle counter	Particles/cm³	0.30 to 30 µm
PM_1 [#1]	Optical particle counter	µg/m³	0 to 200 µg/m³
$PM_{2.5}$ [#1]	Optical particle counter	µg/m³	0 to 500 µg/m³
PM_{10} [#1]	Optical particle counter	µg/m³	0 to 1,000 µg/m³
Lat, long, alt	GPS	decimal	N/A

Performance

Sensor	Limit of confidence [#3]	Typical precision to ref [#4]	Typical mean prescaled accuracy [#5]
NO	< 5 ppb >	0.9 R2	+/- 5 ppb
NO_2	< 10 ppb >	0.85 R2	+/- 10 ppb
NO_x	< 10 ppb >	0.9 R2	+/- 10 ppb
O3	< 5 ppb >	0.9 R2	+/- 10 ppb
CO	< 50 ppb >	0.8 R2	+/- 0.3 ppm
SO_2	< 10 ppb >	0.7 R2	+/- 10 ppb
H_2S	< 5 ppb >	0.7 R2	+/- 5 ppb
CO2	< 1 ppm >	0.9 R2	+/- 30 ppm

Sensor	Limit of detection	Typical precision to ref [#4]	Typical mean prescaled accuracy [#5]
Pod temperature	0.1 °C >	0.9 R2	+/- 2 °C
Pressure	1 mb >	0.9 R2	+/- 5 mb
Humidity	1 % RH >	0.9 R2	+/- 5 % RH
Average noise [#6]	20 Hz to 20 kHz	> 0.8 R2	+/- 1 dB
Peak noise [#6]	20 Hz to 20 kHz	N/A	+/- 3 dB
Particle count	0 particles >	0.9 R2 variable	N/A
PM_1 (v2.0)	0 µg/m³	> 0.9 R2 variable	+/- 15 µg/m³ variable
$PM_{2.5}$ (v2.0)	0 µg/m³	> 0.85 R2 variable	+/- 20 µg/m³ variable
PM_{10} (v2.0)	0 µg/m³	> 0.7 R2	+/- 30 µg/m³ variable
GPS	0.5 m	N/A	+/- 3 m radius

Product designs and specifications are subject to change without prior notice.

The user is responsible for determining the suitability of the product.

#1 Mass estimation based on standardisation of particle shape and density.

#2 From sensor manufacturer's specification. This data was derived from independent lab tests. Standard test conditions are 20 °C and 80 % RH and in the absence of interfering gases. Tested range is -30 °C to +30 °C.

#3 Readings provided below this level, however, due to interferences the level of uncertainty is greater than at higher levels of the target pollutant.

#4 Results based on field testing around the world versus certified reference or equivalence methods at hourly intervals, in extreme and varied conditions.

#5 Average variance to reference equivalence methods at hourly intervals from field testing around the world, in extreme and varied conditions.

#6 Peak noise is the highest recorded value over the gas reporting interval while average noise is calculated using all noise samples over the same period.

#7 Electrochemical sensors and particle sensors carry a 12-month warranty.

#8 Detail of maintenance required is listed in the standard operating procedure.

#9 Subject to carrier restrictions on dangerous goods.

*Gas algorithm V4.2.3, PM algorithm V2.0

ambilabs®
www.ambilabs.com
info@ambilabs.com
877-247-0403
426 Metacom Avenue
Warren, RI 02885