

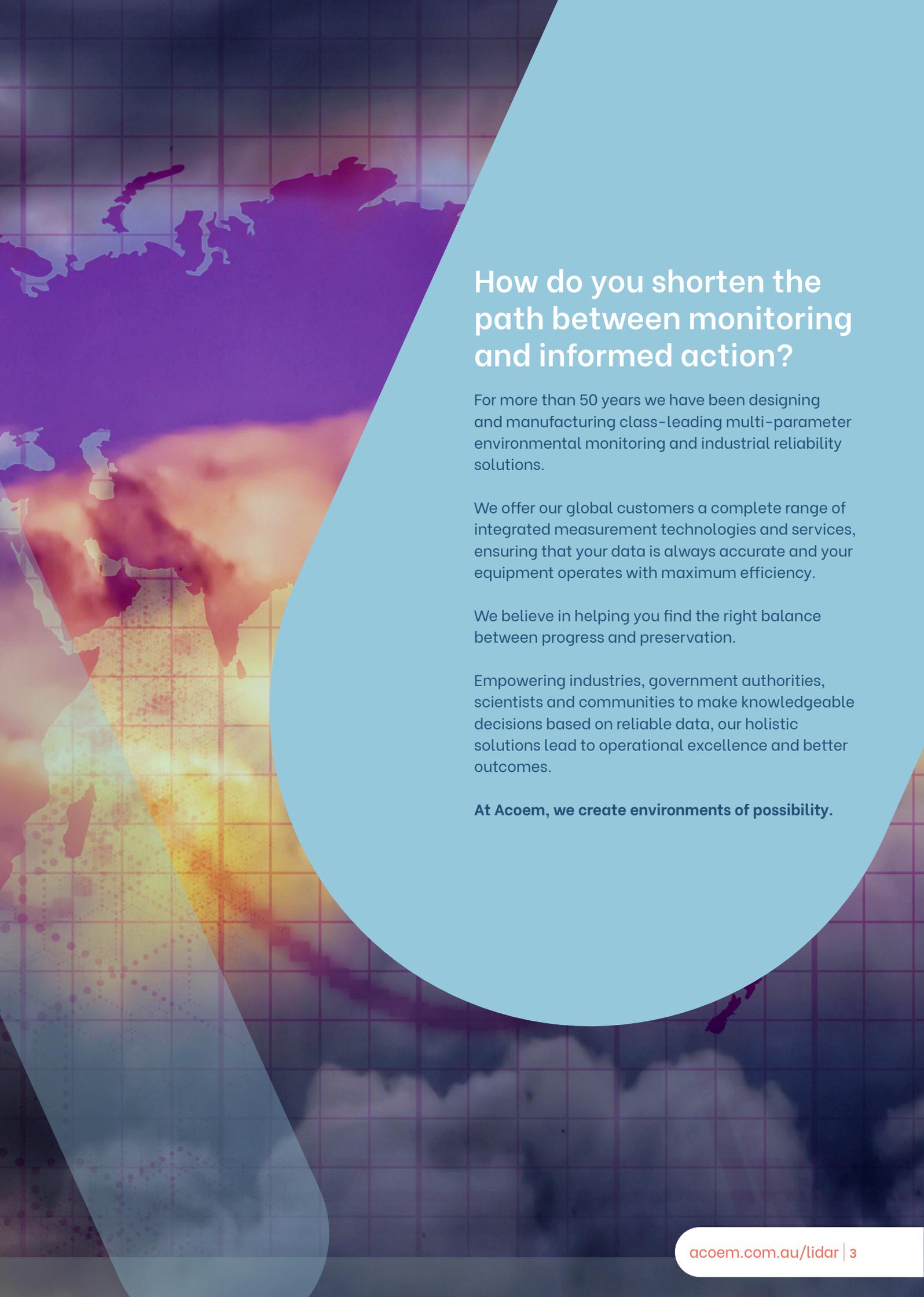
IntegroTM LIDAR Network

HOLISTIC 3D
DUST MONITORING SYSTEM



acoem
CREATING ENVIRONMENTS OF POSSIBILITY





How do you shorten the path between monitoring and informed action?

For more than 50 years we have been designing and manufacturing class-leading multi-parameter environmental monitoring and industrial reliability solutions.

We offer our global customers a complete range of integrated measurement technologies and services, ensuring that your data is always accurate and your equipment operates with maximum efficiency.

We believe in helping you find the right balance between progress and preservation.

Empowering industries, government authorities, scientists and communities to make knowledgeable decisions based on reliable data, our holistic solutions lead to operational excellence and better outcomes.

At Acoem, we create environments of possibility.

The Integro™ LIDAR Network

A complete dust measurement and monitoring system

The Integro™ LIDAR Network is a turnkey solution that effectively and efficiently monitors on-site dust levels and displays data in near-real time, providing accurate feedback to enable dust mitigation strategies including suppression systems.

DUST AND METEOROLOGICAL MONITORING STATIONS

The Integro™ LIDAR network utilises ground-based dust measurements along with wind speed and direction from fixed stations to correlate the scanned data to real world measurement units such as $\mu\text{g}/\text{m}^3$.

LIDAR TECHNOLOGY

The LIDAR instrument, developed by Leosphere, is used to continuously scan the observed area and measure dust concentration and radial wind speed/wind direction to identify dust emission sources and dust dispersion trajectories.

AIRODIS™ SOFTWARE

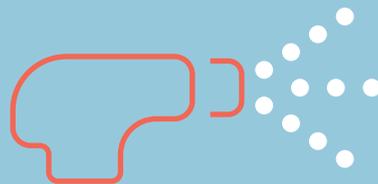
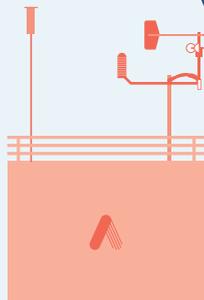
Data from the LIDAR instrument and the monitoring stations is correlated to determine the extent and load of atmospheric dust every 5-10 minutes.

ACOEM CLOUD 3D INTERFACE

The web browser-based interface gives users a high-resolution Google Earth-like 3D viewing experience for live and historical site data.

DUST MANAGEMENT MEASURES

Operation managers use the data to immediately implement targeted dust management measures.



Around the world, governments, corporations and communities are increasingly concerned about the health and environmental impact of dust migration from mining and industrial activities.

Their concerns are well-founded, with an abundance of evidence proving that air pollution has an adverse effect on the health and quality of life of people living and working in exposed areas.

Acoem – over 40 years of dust monitoring expertise

Acoem has been at the forefront of dust monitoring for over 40 years. Driven by industries' and regulatory authorities' need for an advanced compliance solution for real-time dust monitoring over large areas, we were one of the first companies in the world to offer our global customers a working LIDAR-based dust monitoring system.

The Integro LIDAR Network by Acoem is an essential operational tool for businesses looking to increase efficiency and enhance workplace safety while also fulfilling their regulatory compliance responsibilities – making it so much more than an environmental monitoring tool.

Track dust behaviour from the exact emission source

Integro™ LIDAR Network is currently being used in some of the world's harshest and most remote locations. Suitable for a variety of applications, including mining, ports, infrastructure construction and community engagement, the Integro™ LIDAR Network gives you full visibility over concentrations on site.

The Integro™ LIDAR Network consists of:

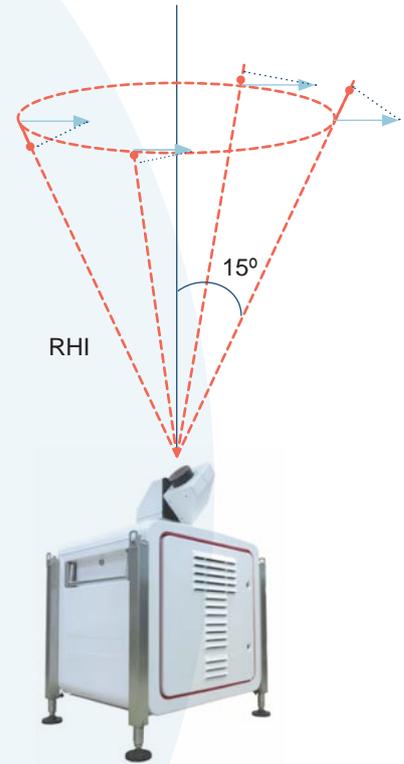
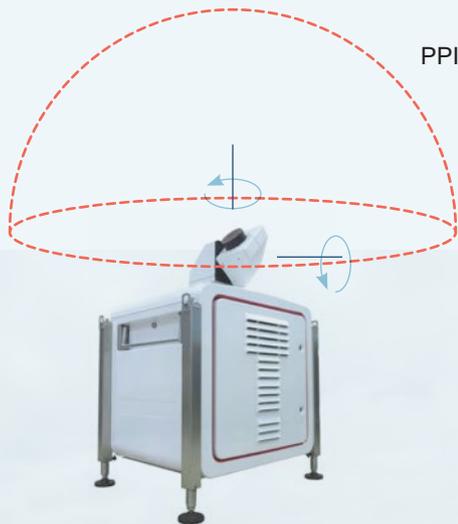
- A Light Detection and Ranging (LIDAR) Windcube® that continuously scans the required area & measures dust concentration & radial wind speed/wind direction
- Reference-quality dust & meteorological stations
- Acoem Airodis™ software to capture, analyse & correlate your data
- Acoem Cloud which stores your data & powers the fully-interactive interface.

The LIDAR technology difference

The Leosphere Windcube®, a LIDAR (Light Detection and Ranging) instrument, measures dust emission sources and dust movement over a scanned area.

Unlike fixed dust monitoring stations – where detection is delayed and the spatial extent is poorly constrained – LIDAR accurately captures dust emission sources, movement and trajectories over the entire scanned area.

Real-time information allows facility managers and environmental officers to track dust behaviour from the exact emission source and immediately respond by implementing a corrective action plan.



The Windcube® can be configured to complete several different scan types, including:

- **Radial** or Planned position Indication (PPI) which covers a full 360° rotation or a targeted partial segment scan, plus wind speed & direction
- **Vertical** or Range Height Indication (RHI) which determines the lift off & ceiling height of the dust plume dispersion & lets you choose the desired resolution of the dispersion images.

Coverage area ranges from a few hundred metres up to 12 km (24 km scan diameter).

The advanced LIDAR technology in the Integro™ LIDAR Network captures 10,000 to 50,000 individual data points per scan every 5-10 minutes.

This, together with data from the fixed monitoring stations, provides information on dust mass concentration measurements in $\mu\text{g}/\text{m}^3$. That is the equivalent of running up to 50,000 individual dust monitoring stations using one integrated system.

LIDAR technology works in harmony with the fixed stations, using their regulatory dust concentration measurements to correlate its scanned data.



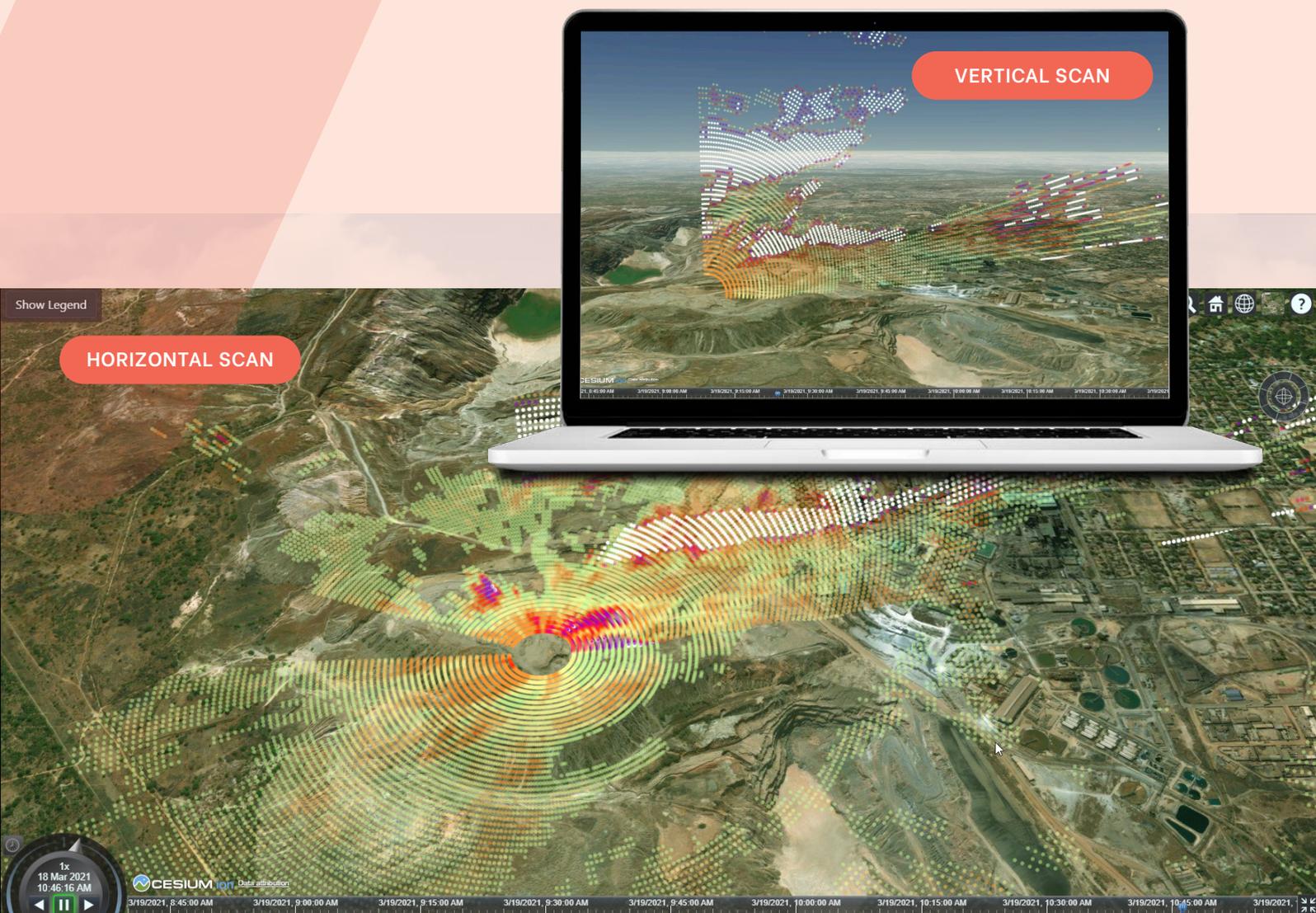
3D mapping brings your data to life

The 3D mapping platform of the Integro™ LIDAR Network offers a whole new level of interactivity with an enhanced user experience that empowers you to make informed operational decisions.

Fully integrated and built into the Acoem Cloud web browser, access the interface from any enabled device – smartphone, tablet or computer.

Offering a high-resolution Google Earth-like 3D viewing experience, the intuitive mapping platform helps you transform your monitoring data into immediate action.

- Visualise in 3D actual particulate concentrations & aerosol plumes on your site in near-real time
- Zoom in or zoom out with the touch of a button
- Scan up & down to view the colour-coded data from above, from the side or any angle
- Quickly & easily identify hotspots or fluctuations
- Access historical data using the horizontal time scale
- Pinpoint changes over specific time periods & compare results
- Evaluate the effectiveness of mitigation measures.

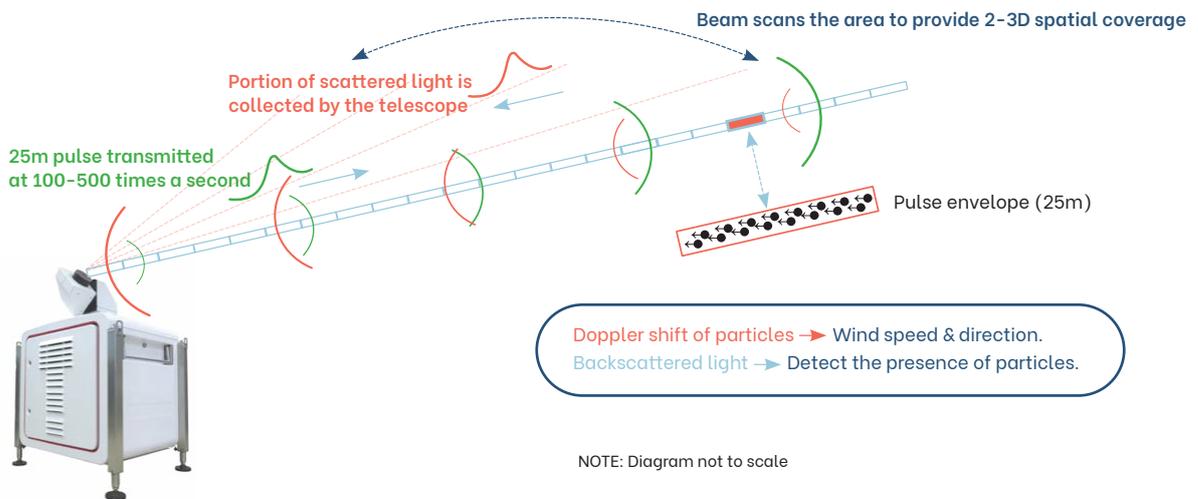


How LIDAR works

The Leosphere Windcube® takes a snapshot measurement of dust back-scatter at preconfigured 'gates' along its line of sight.

The spacing between the gates is programmable, structured to best measure and record dust activity across the total distance.

Most often, gate spacing is set at 25 metres, but in many applications, may have smaller intervals. The scanning speed can be varied with lower scan speeds producing higher resolution images of a dust plume. The LIDAR configuration is easily modified allowing scanning scenarios to be selected to target specific areas.



LEOSPHERE WINDCUBE® FEATURES

Dimension	1.5 m ²
Weight	250 kg
Scanning type	Endless, full hemispherical scanning
Scanning mode	Continuous scan mode
Scanning speed	Up to 30°/s
Range of azimuth angle	0 to 360°
Range of elevation angle	-15 to 195°
Angular resolution	0.1°
Pointing accuracy	<0.1°

Model	Scan Range	Scan Diameter
100S	3.5 km	7 km
200S	6 km	12 km
400S	12 km	24 km

POTENTIAL APPLICATIONS FOR INTEGRO™ LIDAR NETWORK

- Stacking & reclaiming activities at stockpiles
- Lift-off from stockpiles under medium to high wind conditions
- Train car dumper areas
- Ship loading activities
- Conveyor transfer stations
- Municipal waste facilities
- Remediation sites
- Dust source studies
- Industrial estates
- Mining areas
- Settling & evaporation ponds.



DUST MONITORING STATIONS

Fixed dust monitoring stations are deployed as part of the Integro™ LIDAR Network. These stations are used to record localised dust concentration levels and wind speed/wind direction data.

Data from the monitors is used to convert the optical data recorded on the Windcube® and display it as a mass concentration in $\mu\text{g}/\text{m}^3$. This calculation occurs every hour within the Airodis™ software, utilising a correlation algorithm developed by Acoem.

METEOROLOGICAL DATA

Measuring wind speed and wind direction is vital to the accurate determination of dust emission sources and lift-off points. The network has several sensors at varying heights to record both local and site-wide wind conditions.

Ambient temperature and relative humidity are monitored at a central location on the site. This data is used to fine tune and check the LIDAR settings and allows the Windcube® to record data that will enable the interface to produce consistent high quality images.

Additional instrumentation can be included within the meteorological network to calculate evapotranspiration. This information can be useful when trying to determine how much water leaves the stockpiles through evaporation.

The Windcube® is mounted at a height that allows a clear line of sight over the scanning area. This ensures that the PPI and RHI scans are uninterrupted by physical structures or stockpiles.



Always connected via Airodis™ software & Acoem Cloud

Acoem Airodis™ software is the primary data handling tool for the Integro™ LIDAR Network, capturing real-time data in 5-10 minute intervals and automatically downloading it to the server.

Airodis™ then processes the LIDAR and reference stations data to determine and report the mass concentration levels of dust dispersion.

Processed data is transferred in real time via the Acoem Cloud to populate the mapping platform interface with constant access to live and historical views of your site.

Benefits of the Integro™ LIDAR Network

- Access real-time, precise information to inform effective & targeted dust suppression measures
- Comply with government regulations for dust emissions
- Identify the exact source of dust emissions exceedances
- Enhance operational efficiency
- Easy-to-use 3D graphic interface
- Protect the safety of your workers
- Safeguard the health & quality of life of surrounding communities
- Conserve resources
- Always connected.





Creating complete end-to-end systems for better outcomes

Acoem's commitment to shortening the path between monitoring and informed action inspires us to push the boundaries of our technology's functionality and capabilities.

Our goal is to continually improve the user experience and create value-added systems for our customers.

Acoem not only creates technology but it partners with like-minded innovators in environmental management to provide holistic data-powered solutions and full end-to-end services.

Our highly skilled Environmental Reporting Services (ERS) team consistently oversees the network to make sure that data captured is validated and accurate.

Because of changes in background and atmospheric conditions, ERS team members review the Network daily and make any required LIDAR parameter changes.

Our technicians also deliver on-the-ground support, managing maintenance issues and calibration so you can concentrate on your core business activities and make timely, accurate and informed operational decisions.

About Acoem

At Acoem, we create environments of possibility – helping organisations find the right balance between progress and preservation – safeguarding businesses and assets, and maximising opportunities while conserving the planet’s resources. We deliver unrivalled, interoperable AI-powered sensors and ecosystems that empower our customers to make enlightened decisions based on accurate information.

Together with 150 distributors, our 800+ employees work across 26 offices, 5 manufacturing facilities and 3 R&D centres in 11 countries, to provide trusted, holistic data solutions for customers worldwide.

Acoem links possibilities with protection.

For more information visit acoem.com



Acoem
1492 Ferntree Gully Road
Knoxfield VIC 3180
Melbourne Australia
+61 3 9730 7800 | email@acoem.com
acoem.com.au/lidar

Specifications subject to change without notice. All images used are for illustrative purposes only. Integro LIDAR Network has no affiliation with Google LLC or its Google Earth program. All trademarks and registered trademarks are the property of their respective owners. ©2021 Acoem and all related entities. All rights reserved. 20210721