Fulcrum3D Sodar | simply better
state of the art remote sensing
Fulcrum3D Sodar | simply better

reliable, flexible & cost-effective

The Fulcrum3D Sodar is a portable wind monitoring unit designed to measure wind speed, direction and inflow angle from 40m up to 200m above ground level. Optimised for the operating range of modern wind turbines, it is purpose designed for performance in complex terrain and to meet the stringent requirements of the wind energy industry.

The Fulcrum3D Sodar is delivered complete with its own trailer, solar power supply and communications system.

Applications include:
- site prospecting & infill for ‘bankable’ resource assessment
- verifying wind shear above an existing met mast
- low cost measurements for noise monitoring campaigns
- complementing met masts with additional Sodar monitoring locations to reduce yield uncertainty
- directly measuring inflow angles to confirm turbine suitability for the site
- measuring power performance of operating wind turbines, e.g. for O&M diagnostics

Fulcrum3D’s Flightdeck provides a web based data delivery interface allowing access, download and analysis of data.

proven ‘Stage 2’ performance

The Fulcrum3D Sodar has been independently verified in different climates, topography, locations and elevations by internationally recognised wind energy experts. DNV GL has deemed the Fulcrum3D Sodar to be ‘Stage 2’ allowing it to be used in formal wind energy assessments including bankable wind energy studies.

Correlation coefficients against high quality tall met masts are typically >0.98 at IEC Class 1 Terrain sites, with slopes comparable to cup anemometry in both simple and complex terrain. The Fulcrum3D Sodar has demonstrated higher accuracy and availability than its competitors in side by side trials.

a new innovative sodar design

compact-beam design

The compact-beam design of the Fulcrum3D Sodar minimises errors introduced where the wind speed vector is not constant across the beams, such as in highly turbulent or complex terrain. The Fulcrum3D Sodar uses a very narrow beam angle (9°/12° from vertical axis) compared with competing units which typically have beam angles up to 30° from vertical axis.

The Fulcrum3D Sodar uses physically fixed beam angles rather than electronic beam steering which requires constant frequency adjustment for local atmospheric conditions. Its broad operating frequency range (3.5 – 7.5 kHz), allows multiple units to be co-located without interference.

multi-beam sampling

The three independent beams of the Fulcrum3D Sodar can be pulsed simultaneously (“multi-beam sampling”), providing more data samples per 10min period and higher data quality and availability, especially at greater heights. Competing designs use a single steered beam which can only be pulsed sequentially, reducing the number of data points available.

full spectrum data retrieval for traceability

The Fulcrum3D Sodar records and stores full signal and noise data on the unit and transmits this entire dataset to Fulcrum3D’s secure servers for processing into wind speed data. Competing Sodar designs use on-board processing and only transmit the calculated wind speed result, meaning the full spectrum data is lost. This approach allows a consistent and fully traceable dataset to be provided to third parties for verification & analysis. Also, data can be reanalysed using improved or third party processing algorithms to maximise data accuracy.

cold climate option

Fulcrum3D has a cold climate Sodar option which is operationally identical to the standard Sodar. This version includes snow and ice melt capability on the sound reflector plate in cold climates, and can include a modular methanol fuel cell (45 or 110W) with over 6 months fuel storage to last the whole winter to avoid costly refuelling in the coldest months.

"For anyone requiring a flexible, easily-deployed, and accurate system for wind speed and direction data collection, I can highly recommend the Fulcrum3D"
key benefits for your projects

low cost, flexible deployment
- significantly lower costs of installation, operation and removal than met masts and lidar systems
- faster deployment with minimal delays as planning approval is generally not required, there is no construction lead time, and no risk of weather delays
- lower maintenance costs than met masts which are prone to damage by lightning and birds and require annual maintenance and regular sensor replacements
- standalone turnkey solution with integrated power supply and communications system

more accurate wind data
- measurement using sodar in combination with met masts reduces uncertainty for wind yield report
- wind measurements right to the turbine tip height eliminate extrapolation errors from met masts which often only cover ~20% of the turbine swept area
- direct measurement of vertical inflow angles for turbine suitability analysis and to improve site modelling accuracy
- direct measurement of wind shear characteristics which occur above mast height
- user selectable measurement heights to match turbine hub heights, met mast or other measurement
- no anemometer cup errors from mast interference, inflow angle (which cannot be corrected for in cup anemometers), over-speeding, cup icing or precipitation (rain, fog or mist)

stable and consistent measurements
- full signal and noise data is permanently stored allowing performance improvements in processing algorithms to be consistently applied to all existing data sets
- no electronic beam steering means consistency between locations and more accurate measurement
- no calibration within measurement campaign is required

expansion options available
- expansion options including additional weather sensors (e.g. solar irradiance, rain, pressure), or other equipment to connect via the Sodar’s remote communications system

design, manufacture & support
- the client managed Flightdeck data centre provides access to all client Sodar, weather and noise monitoring data

design parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Phased array</td>
<td>3 phased arrays each with 37 Piezoelectric transducers. 100% acoustic fill factor</td>
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<tr>
<td>Number of sound beams</td>
<td>1 beam per array, 3 beams total</td>
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<tr>
<td>Sound beam tilt</td>
<td>Physically set at 9° and 12.7° from vertical Beam tilt independent of frequency and temperature</td>
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<tr>
<td>Sound beam frequency</td>
<td>Range 3.5 – 7.5kHz, nominally 5kHz. 500Hz beam separation in multi-beam mode.</td>
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<tr>
<td>Cold Climate</td>
<td>Cold climate option with snow and ice melt capability. Includes additional space for fuel cell</td>
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data capture and storage
- Sampling rate: Nominally 2 seconds between pulses
- Memory storage: 32 GB Micro SD card records 6 months full noise and signal data. Expandable to 128GB.

wind measurements
- Measurement range: 40 - 200m in 10m height bands centred on nominal height (40, 50m...), arbitrary heights available.
- Horizontal wind speed: 0 to 40m/s, resolution 0.01m/s
- Horizontal wind direction: 0 to 360°, resolution 0.1°
- Inflow angle / Vertical wind speed: -8.0 to +8.0 m/s, resolution 0.01 m/s- to +20°, resolution 0.1°
- Fixed echo removal: Automatic for wind speeds > 2m/s

power and communications
- Average power consumption: 15W operating (single beam sampling) 25W operating (multi-beam sampling)
- Power supply: Standard: 2 x 220W solar panel and 3x 12V 120AH AGM batteries providing in excess of 7 days storage. Optional solar expansion pack or mains power supply kit available Fuel cell option with 45W or 110W fuel cell and large fuel storage area
- Communications: 3G/4G/GPRS, optional satellite/Wi-Fi/Ethernet

DNV GL concludes “the Fulcrum 3D Sodar... is able to reproduce cup anemometer wind speeds and wind vane directions at a very accurate level”. DNV GL go on to state that it “considers that for little to moderately complex terrain sites, data from the Fulcrum3D device may be used in a quantitative sense with reasonable error bars for the purpose of the assessment of the wind regime at potential wind farm sites.”
Who is Fulcrum3D?

Fulcrum3D combines the strengths of Fulcrum Energy’s firsthand renewable energy project experience with the specialist technical design and manufacturing expertise of Orang-utan Engineering.

The result is unique technology designed specifically to support the renewable energy sector.

Our range of remote sensing products includes:

- Wind monitoring using our compact beam Sodar
- Cloud tracking and solar forecasting using CloudCAM™
- Solar monitoring
- Integrated noise and weather monitoring

Our technology platform is based on robust telemetry, designed for maintenance-free operation in remote environments.

All data is available for web download via our Flightdeck portal.

We look forward to providing you with great Australian technology supported by first class service and support.