



**Fulcrum3D CloudCAM** | simply better  
cloud detection, tracking and solar forecasting



# Fulcrum3D CloudCAM | simply better

## cloud detection, tracking and solar forecasting with CloudCAM™

CloudCAM™ is designed to detect and track cloud movements, estimate future cloud locations, and forecast cloud shadow events and solar irradiance at areas of interest. CloudCAM™ also provides standard solar measurements including global horizontal irradiance, temperature and humidity.

CloudCAM™'s real advantage is in the novel on-board software which analyses the images to accurately identify individual clouds and predict their future location.

CloudCAM™ has been designed for remote operation and either temporary or permanent installation, with various mounting and connection options available:

- ▶ a portable stand-alone system can be provided with its own mounting tripod (including anchors), solar power supply and remote communications system;
- ▶ a permanent system can be post- or wall-mounted and can include its own remote communications and solar power supply or make use of existing connections on site.

CloudCAM™ is fully supported by Fulcrum3D's *Flightdeck*, an online data delivery and analysis tool allowing Fulcrum3D clients to access, download and analyse solar and other meteorological and noise data via the web.

## typical configuration

The CloudCAM™ system is based around the FDL1 datalogger platform and includes the CloudCAM™ all-sky sealed camera head which provides 180° sky coverage at a low cost. Standard sensors include horizontal pyranometer, temperature and humidity sensor, and GPS receiver. Additional sensors can be integrated for more detailed site investigations.

## additional sensors

The FDL1 high speed datalogger can take on board a variety of sensors via RS-232, RS-485, USB and Ethernet interfaces, measuring a variety of parameters including:

- ▶ solar module temperature
- ▶ module or system power output
- ▶ air pressure
- ▶ wind speed and direction
- ▶ rainfall (tipping bucket or capacitive plate)

Instruments of various designs and classes can be supplied with or without calibration certificates.

## real-time output and forecasts

Standard CloudCAM™ outputs include:

- ▶ cloud detection (1/0)\*
- ▶ percentage cloud cover\*
- ▶ percentage shading (over area of interest)\*
- ▶ average solar irradiance (over area of interest)\*
- ▶ prediction performance statistics
- ▶ global horizontal irradiance, temperature, humidity
- ▶ GPS location

\*includes both real time and short term forecast data

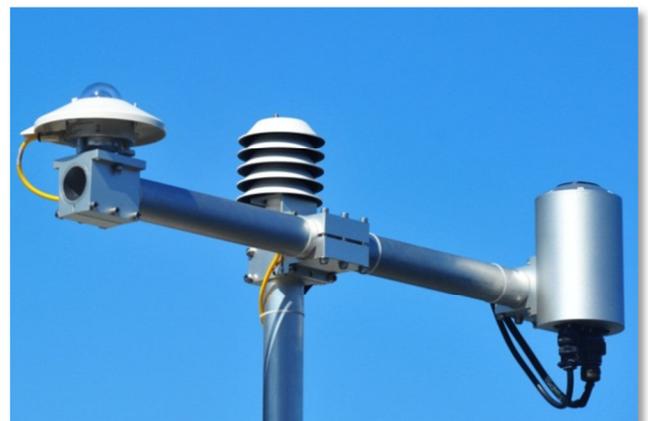
All measurements are time-stamped to internet time protocol. Logger sampling frequencies can be set from as high as several hundred samples per second, with default solar sampling at 1 second and general met sampling at 3s. All parameters are also aggregated into 10 minute statistics.

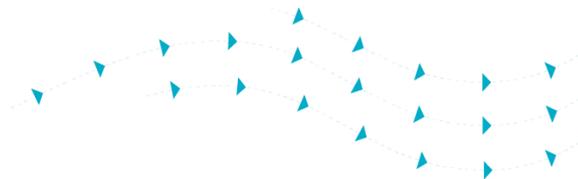
## forecasts

Solar and cloud forecasts are typically available from 0 to 15 minutes, depending on local conditions. Forecast accuracy depends heavily on local site conditions. Rather than claim an overall accuracy, CloudCAM™ provides real-time forecast performance statistics which allows end users to take current conditions into account when using CloudCAM™ forecasts.

## defining areas of interest

CloudCAM™ shadow analysis and solar forecasting is carried out at the CloudCAM™ location and nearby 'areas of interest' determined by the user. This allows specific analysis over areas such as solar farm, sports field, or sky sector depending on the application. Multiple areas of interest can also be assessed.





## key benefits

### unique design

- ▶ *CloudCAM™* is the only fully integrated solar monitoring system allowing remote monitoring and data management of solar, weather and cloud parameters.
- ▶ Its detection and tracking algorithms are unique in the sector and superior to its competitors, especially in complex cloud environments

### proven performance

- ▶ *CloudCAM™* has been demonstrated at remote solar power sites in central Australia, one of the harshest and most remote environments imaginable, with proven success.
- ▶ *CloudCAM™* relies on Fulcrum3D's robust FDL1 Datalogger and industry standard instruments with calibration available on request.

### control capability via SCADA interface

- ▶ *CloudCAM™* is designed to integrate with existing SCADA systems via Modbus, allowing minimal changes to existing plant control systems.

### Australian design, support & manufacture

- ▶ Fulcrum3D technical staff are available for design and integration support, including the engineering required to integrate with local control systems
- ▶ Our technical experts are on hand to deliver customised solutions as required.



Actual *CloudCAM™* image

## applications

### cloud detection

Understanding cloud characteristics at a site is fundamental to dynamic control of solar power systems. *CloudCAM™* provides real-time cloud detection and percentage cloud cover data.

In the site development phase, analysis of this data can guide the design of control systems and supporting equipment (including energy storage) by providing typical cloud dynamics (speed; shadow duration; time-to-shadow estimates), and allowing rates of change to be analysed.

In the operational phase, cloud detection flags can be used to dynamically set operating parameters including

- ▶ power station spinning reserve set points;
- ▶ energy storage operating status (on/off); or
- ▶ solar power export limits.

Cloud detection flags can also be used for other control applications including for sporting arenas, water management systems and even active solar architecture systems.

### cloud and solar forecasting

Cloud and solar forecasts are available for both the *CloudCAM™* location, and a number of user-identified areas of interest. This allows the output of specific solar farms, or the rooftop solar power provided by entire town or suburb to be predicted.

Cloud and solar forecasts are used in solar energy systems for:

- ▶ ramp rate control, with or without energy storage - by ramping down power output ahead of cloud events sudden impacts on the power system are reduced;
- ▶ optimising charge and discharge of local energy storage;
- ▶ reducing sudden demands on energy storage systems, reducing the energy storage required as well as reducing ongoing maintenance and replacement costs; and
- ▶ optimising energy market bidding systems.

### satellite data feeds

For longer forecast windows *CloudCAM™* can be supported by satellite data feeds which look 'over the horizon':

- ▶ short term (0 – 15 minute) predictions are provided by *CloudCAM™*'s ground based camera platform; and
- ▶ medium term forecasts (15 minute – 48 hour) are provided via analysis of satellite feeds.

The two systems are seamlessly integrated with a single forecast available to the user covering the periods required.

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## 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.*

