

## WindCube Nacelle

### INSTALLATION AND OPERATION TIPS

WindCube® Nacelle lidar enables developers and operators to efficiently and accurately assess and verify performance to ensure maximum power output. Classified according to the IEC 61400-50-3 standard, it is widely accepted for contractual and operational Power Performance Testing (PPT), both onshore and offshore, and is increasingly included in manufacturer Turbine Supply Agreements (TSAs) to verify offshore turbine installations.

Nacelle-mounted lidar is overtaking met masts for PPT (both onshore and offshore) for several reasons, including providing greater accuracy and flexibility, and a shorter implementation time at a fraction of the cost.

Follow these tips to design and operate an accurate, reliable, and successful PPT campaign using nacelle-mounted lidar.

### Design

- **Timeline.** Plan on several weeks of preparation and about half a day for installation.
- **Remote access.** Ensure reliable data transmission and monitoring. Offshore wind farm intervention in particular can be expensive and time-consuming.
- **Supporting construction.** Consider turbine manufacturer authorization to install the lidar or prepare customized structure for easier lidar installation after verifying its compatibility and stability. Versatile mounting options available as alternative to the standard tripod.
- **Turbine knowledge.** Knowledge of turbine operational behavior is key for a successful nacelle-mounted lidar installation: Assess turbine tower inclination and turbine tilting before the start of the campaign.

### Installation

- **Safety.** Anticipate all health and safety risks, such as working at hub height and lifting the lidar on the turbine. Risk Assessment from Vaisala is available on demand.
- **Location.** Choose the best possible location for the lidar.
  - Tripod: Consider using the original tripod for the lidar, a mounting structure that is already available on the wind turbine, or one specifically designed by Vaisala customers.
  - Optical head: Installed outside the nacelle. The four laser beams should not be permanently obstructed by the turbine nacelle, hub, or fixed elements. Partial blockage by moving blades is acceptable.
  - Processing unit: Installed inside the nacelle and connected to the optical head with a 10m cable. Make sure the cable routing is tight and connects well with the two lidar parts.
- **Waterproofness.** Consider waterproofness of the nacelle roof when mounting the lidar tripod: Drill holes or use brackets to support the lidar installation.
- **Impact on nacelle anemometer.** WindCube Nacelle is compact and generates low disturbances; however, consider not placing the lidar right in front of turbine anemometers.
- **Alignment.** Use the alignment laser inside the lidar for the alignment procedure and define the rotor axis position on the nacelle rooftop.
- **Installation checklist.** Use our installation checklist to verify and complete your installation.

### Verification

- **Verification at Vaisala factory.** We calibrate the main constant out of the atmosphere throughout the manufacturing process, then we verify it against a calibrated lidar of the same type in the atmosphere.
- **Third-party calibration.** This is a contractual step for PPT. It is conducted at an independent test site and takes about two months, depending on the selected test site.

### Operations

- **Training.** Thanks to our installation expertise (400+ deployments), you can benefit from Vaisala's, installation training and assistance that will help you to prepare and install your WindCube Nacelle.
- **Monitoring.** Conduct regular monitoring. You can set up automatic alerts to monitor lidar performance.
- **Time synchronization.** It is highly important to get your WindCube Nacelle's data time synchronized. Two options are available:
  - NTP server is configurable from WindCube Nacelle OS. Use the same NTP server as the wind turbine.
  - The GPS included in the system can also be used to timestamp data.
- **Data collection.** Collect data on the lidar or automatically send it to an FTP server on a daily basis.

### Analysis

- **Measure.** Measure and collect all datasets for the same period of time.
- **Filter.** Consider wind farm layout, terrain obstacles, and weather conditions to design good data filtering.
- **Verify.** Verify your analyses against IEC standards to help you determine whether your outcomes are robust.
- **Analysis tool.** Have a clear understanding of the analysis tool used for data synchronization, filtering, and PPT analysis.

### Document

- **Summary.** Build comprehensive documentation for the measurement campaign setup, the collected data, and methodology applied for the analysis.

## Vaisala is changing how the world is powered.

Vaisala elevates wind and solar customers around the globe so they can meet the greatest energy challenges of our time. Our renewable energy solutions are guided by several key priorities:



#### Thoughtful evolution

Remain a pioneer in renewable energy, always providing sensible, trusted solutions at the leading edge of R&D.



#### Smarter at every stage

Provide end-to-end weather and environmental solutions and critical insights throughout the renewable energy life cycle.



#### Legacy of leadership

Extend our proven track record and global trust to reach more customers in more ways.