



# Continuous-wave (CW) Doppler wind Lidar

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# We are ZX Lidars



Established in 2007, rebranded in 2018 from ZephIR Lidar, we are a leading global wind Lidar innovation and production company:

- Wind Lidar (Light Detection & Ranging) provides remote wind speed / direction measurements in replace of traditional tall met masts and in an advancement of turbine anemometry
- 5 Decades of Lidar R&D invested – invention and patent portfolio
- UK-based, UK-technology, Global Export
- 3 Facilities in the UK – Production Centre, R&D and Commercial Offices, Test Site
- Our Lidars are used onshore and offshore to better plan, design and operate wind farms
- Our Lidars are industry approved and used by the majority of ‘significant’ wind farm development / operation key stakeholders



UK Wind Lidar Production



UK Remote Sensing Test Site



# Advantages of Lidar over meteorological masts

## Safer

According to an independent study by Renewable Energy Systems (RES), substituting masts with Remote Sensing Devices, such as Lidars, leads to fewer accidents and near misses. Additionally Working at Height is limited.

There is now a documented lower chance of an accident or safety incident comparing the use of Remote Sensing Devices to met mast campaigns.

## Faster

No planning application for tall structures is required and mobilisation of Lidars can be achieved in just a matter of hours. Nacelle-based Lidars can be installed and removed rapidly for operational wind measurements.

## Cheaper

Increasing turbine hub heights and rotor diameters demand representative wind measurements. Lidars are more cost effective for higher hub heights relative to met masts.

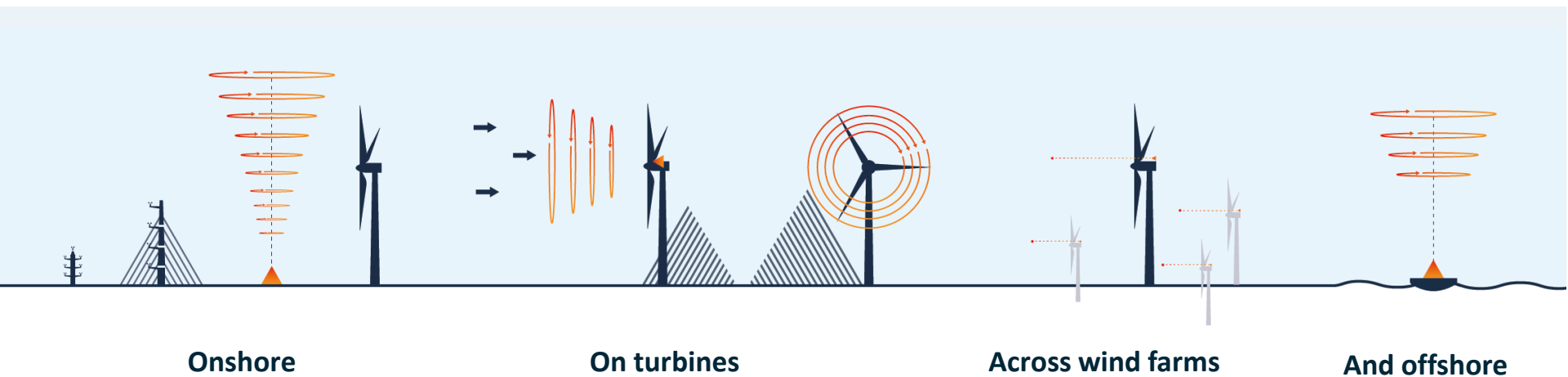
Through-life costs of Lidar are lower with minimal servicing, validation or calibration required.

In operation, coverage across the whole wind farm can be achieved with nacelle-based Lidars.

## Better

Lidar measurements can be taken across the whole turbine rotor reducing project uncertainty and validating turbine performance. Lidars are mobile and measurements can be taken across large sites.

Layouts can be optimised, operations can be tailored.



Onshore

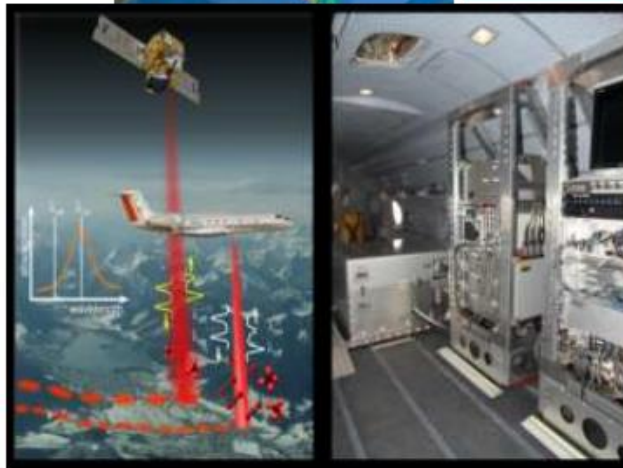
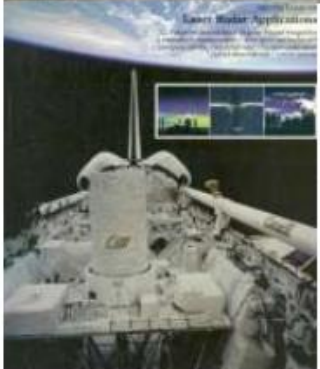
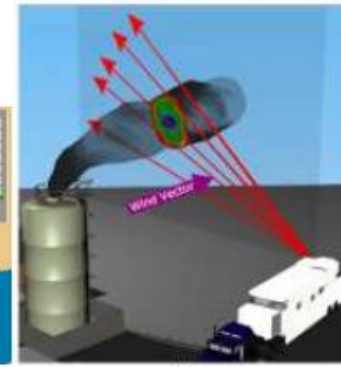
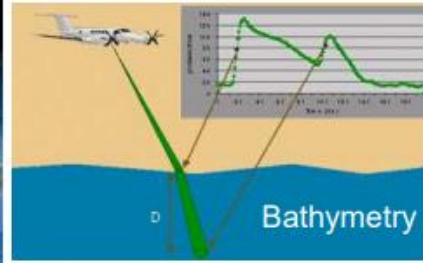
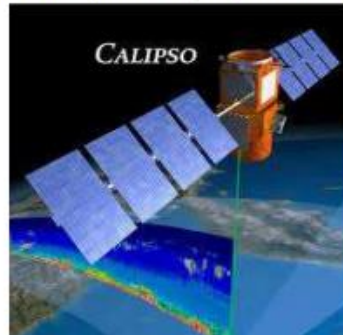
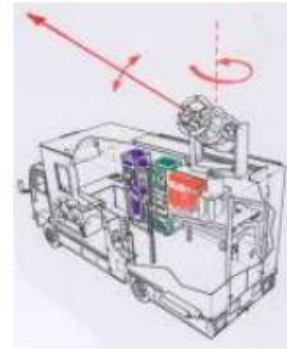
On turbines

Across wind farms

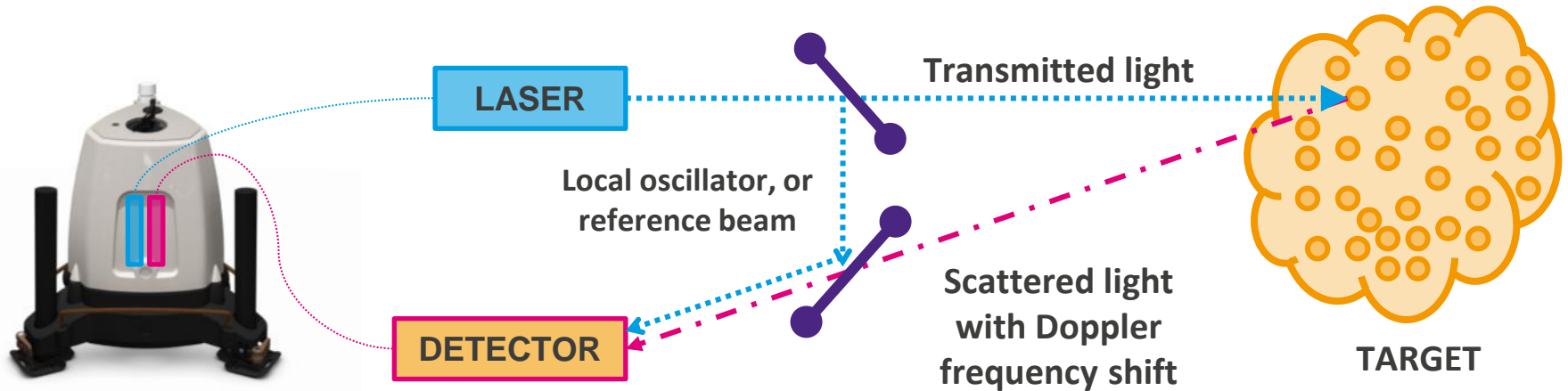
And offshore

# What is Lidar?

- Invented in the 1960ies
- Remote sensing of:
  - Topography
  - Atmospheric gases (e.g. Ozone, CO<sub>2</sub>, O<sub>2</sub>, NO<sub>2</sub>)
  - Properties of clouds, volcanic ash, rock samples, ocean chlorophyll
  - Lightning probability
  - Temperature
  - Albedo
  - Wind
  - ...



# How does CW wind Lidar work?



- Atmospheric aerosol motion follows the wind
  - A laser is focussed at a point and scattered by the aerosols
  - The scattered radiation is Doppler shifted by the moving aerosols
  - The Doppler shift is proportional to the line-of-sight speed (LOS) of the aerosols
  - A detector records the beat between the received, scattered light and a reference beam to determine the Doppler shift
- ⇒ The LOS component of the wind speed is then determined

# Our wind Lidars



**ZX300**

**Onshore wind energy & meteorological applications**

Hub height and beyond wind measurements to reduce the risk of, and increase the value of wind energy projects



**ZXTM**

**Turbine-mounted wind energy applications**

Wind measurements out in advance of a wind turbine to optimise turbines and wind farms through accurate power performance measurements, identifying production improvements, yaw / nacelle calibration and wake / wind sector management



**ZX300M**

**Offshore wind energy & meteorological applications**

Hub height wind measurements to reduce the risk of, and increase the value of wind energy projects, deployed on fixed and floating platforms

# Wishlist



- Low cost, narrow linewidth laser modules
- Near diffraction limited focussing optics (e.g. prise sensitive aspheric lens)
- Diffraction limited beam steering optics (3" aperture)
- Low NEP detector modules near 1550 nm

# Thank you for your attention!



## 10,000+

Lidar deployments onshore,  
offshore and on turbines



## Accepted

Lidars for Bankable Wind  
Resource Assessments and in  
Turbine Supply Agreements



## First

Offshore fixed & floating,  
Project finance & re-finance



## SCADA- Integrated

in many turbine OEM  
platforms



## No. 1

Lidar offshore in the most  
challenging, and most heavily  
financed wind sector

