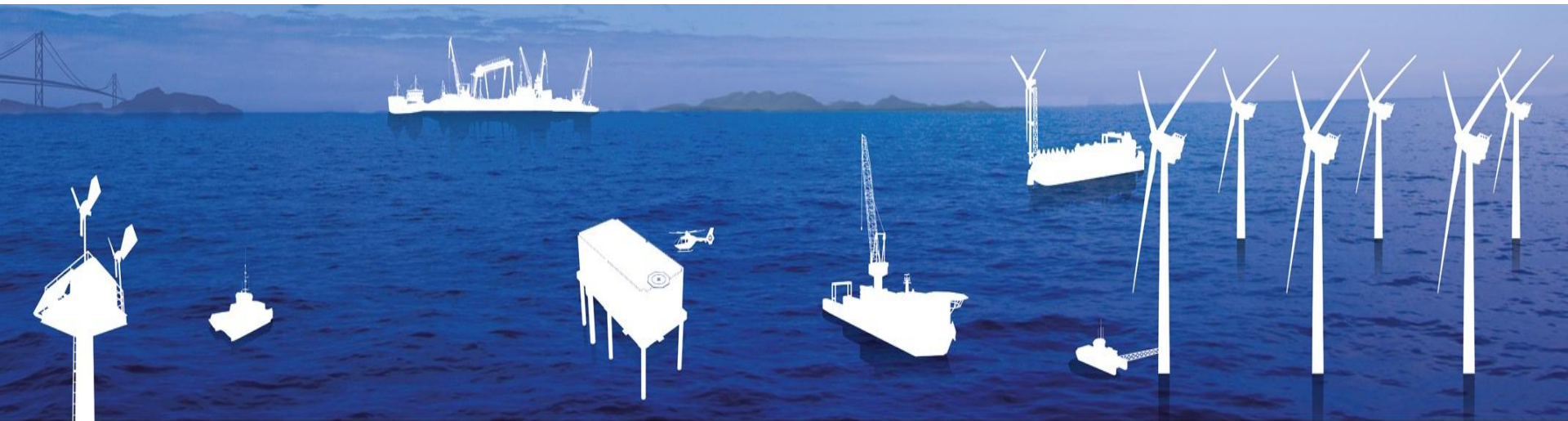




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# Babcock FORECAST

# Babcock International Group

## The Leading Engineering Support Services Company

We take real  
responsibility for  
delivering outcomes

**Managing Assets and Infrastructure**

and assure those  
outcomes through  
process excellence

**Delivering Projects and Programmes**

by bringing together  
leading-edge skills

**Integrating Engineering Expertise**



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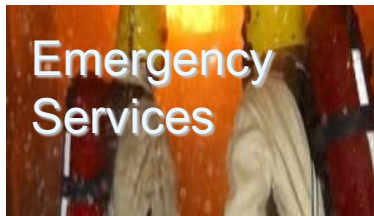
# The UK's leading engineering support services company

**FTSE 100**

- ❖ Market cap. £4.4bn
- ❖ £3.25bn revenue in 2013
- ❖ **£12bn order book**

**Managing** customer assets worth **c. £42bn**

**27,000 skilled employees** worldwide



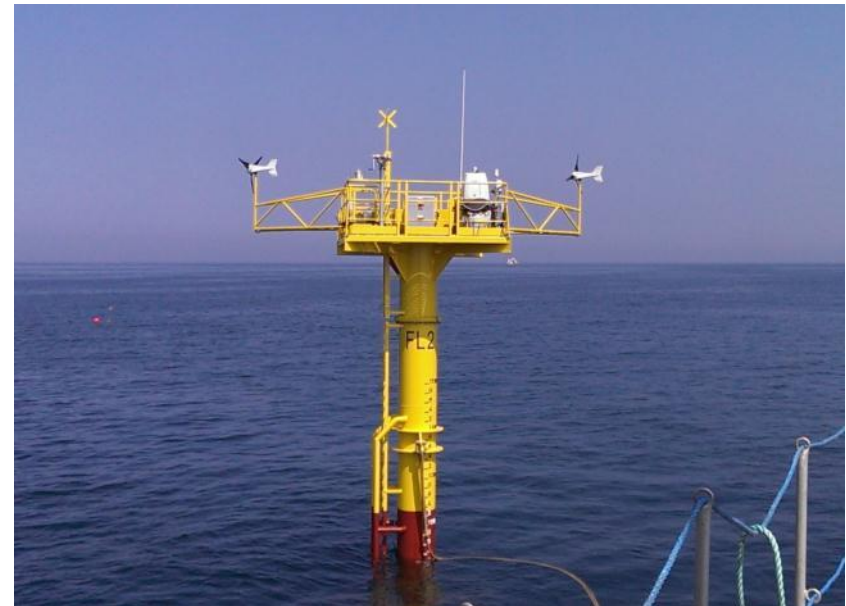
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# FORECAST Overview

## Key Features

- Inherently stable platform
- Industry leading ZephIR 300 LiDAR unit
- No mechanical compensation or data post processing required – reduced uncertainty
- Safe and easy access for maintenance etc
- Easily repositioned
- Elevated platform – improves survivability and marine safety
- N-2 redundant mooring system



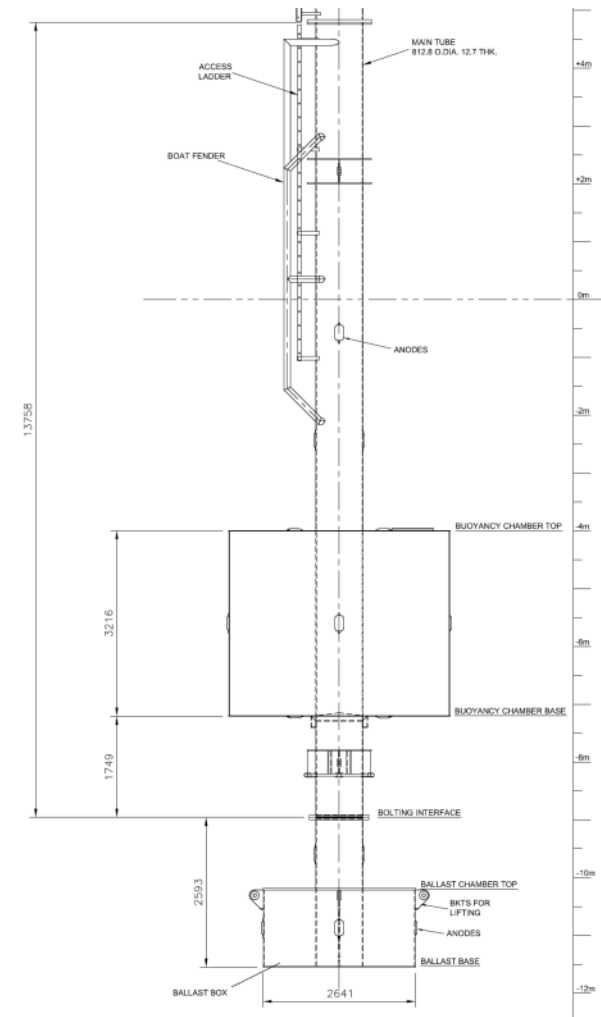
# Buoy Design

## Low Motion Buoy

- Inherently stable, shallow draft spar buoy
- Low pitch, roll and heave
- Modular design

## Three main sections

- Main Tube – 812mm OD Pipe
- Buoyancy Tank – 3800mm Ø tank with internal stiffeners
- Ballast Tank – 2600mm Ø tank filled with high density concrete

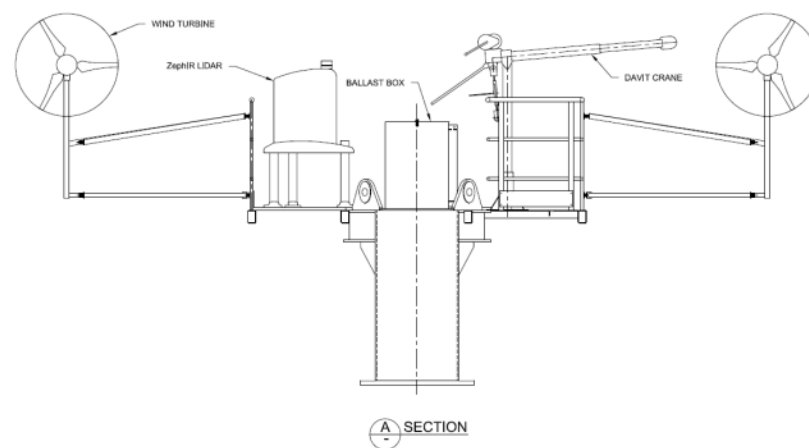
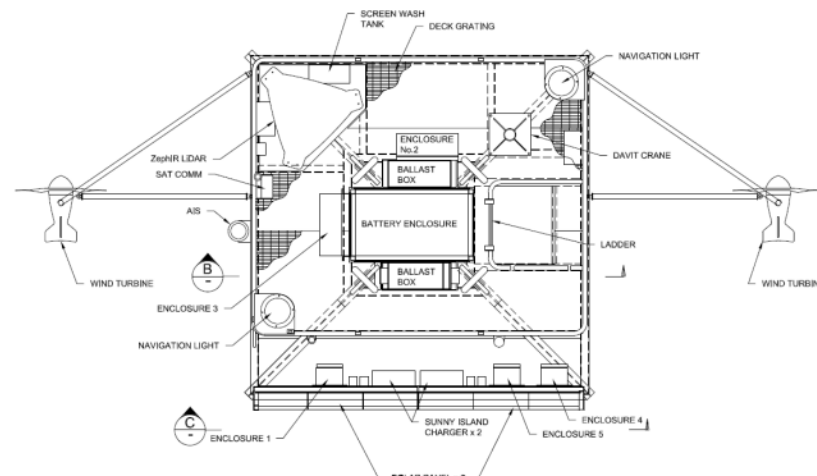




# Platform Design

## Platform

- 3.2m x 3.2m platform housing all systems
- Wind turbines mounted on outriggers
- GRP gratings provide walkway
- Main lifting points for whole buoy
- Access from ladder below
- Handrails all around



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# Systems On Board - Measurement

- ZephIR 300 LiDAR measuring:
  - Wind speed and direction at a number of heights
  - Turbulence intensity at each height
  - Temperature, pressure, humidity and rain
- 10m Met Station
  - Separate met station sited approximately 10m above MSL
  - Sonic Anemometer measuring wind speed, direction and Monin Obukhov length if required
  - Temperature, pressure and relative humidity sensors
- DGPS Compass
  - Accurately records bearing of buoy
  - Also reports pitch, roll and GPS coordinates



# Systems On Board - Power

- 2 x Micro Wind Turbines
  - Pitch controlled blades for performance and survivability
  - Independently controlled and regulated for redundancy
- 2 x Solar PV Panels
  - South facing reliable monocrystalline panels
  - Independently controlled and regulated
- 2 x Battery Banks
  - >7 days of reserve power
  - Providing redundancy and maintenance during system operation
  - Additional emergency battery for nav aids only, ~14 days
- Methanol Fuel Cell Option
  - Optional fuel cell providing up to 20 days additional redundancy
  - Ideal for far shore deployments to allow additional repair time





# Systems On Board – Data Capture

- Centralised Data Logger
  - Collects all data and provides “plug and play” option for other sensors
- Redundant Communications Link
  - GSM and Satcom link with auto switching
- Data Access
  - Daily emails or uploads with remote access as required
  - Wireless connection to ZephIR possible within ~50m
- System Status Monitoring
  - ZephIR status: wiper, voltage, temperature, fans on, heater on etc
  - Power Status: generator power (each source), battery voltage (each bank)
  - Alarms: gate opened, drift radius exceeded

# Systems On Board – Nav Aids

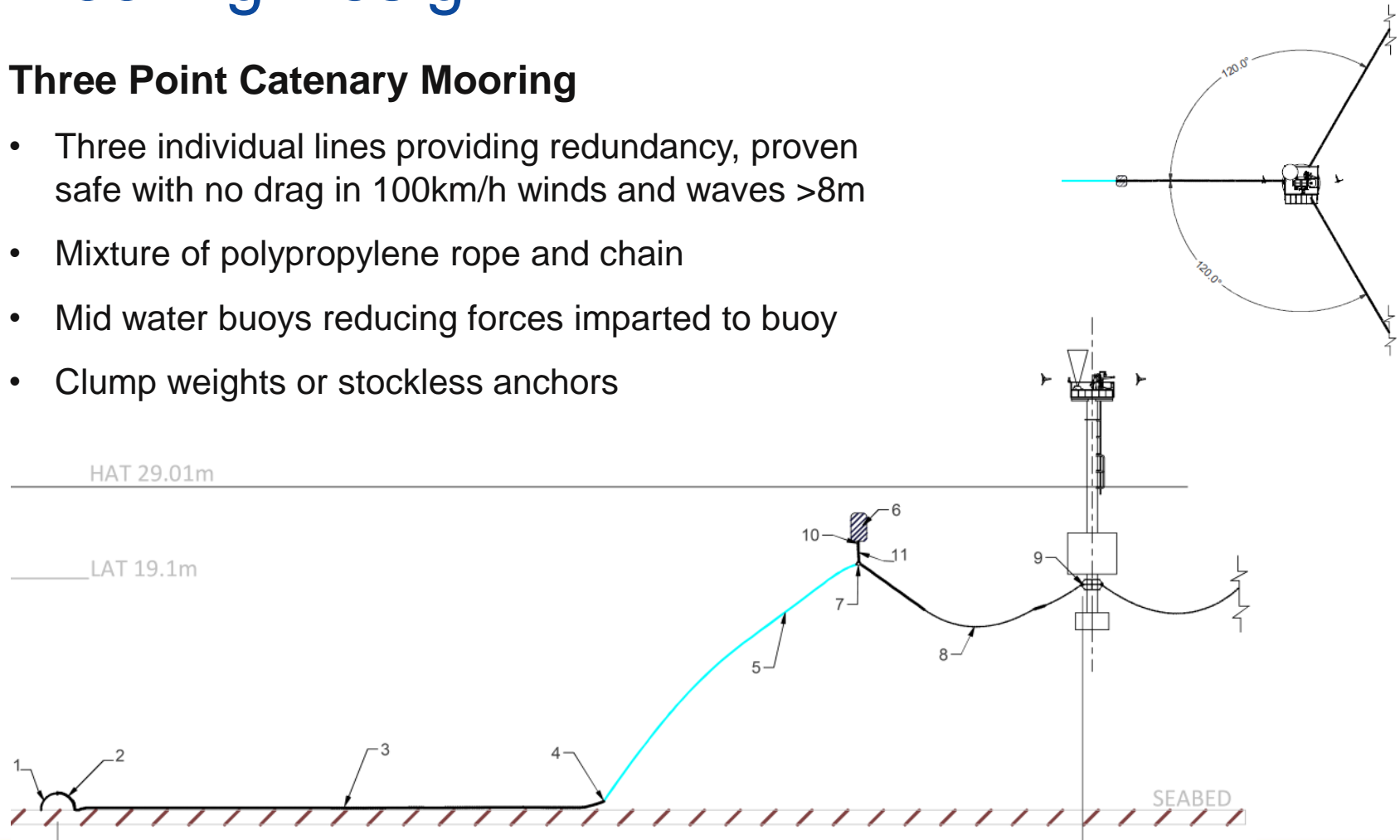
- Navigation Lanterns
  - 2 synchronised LED navigational lanterns providing redundancy and excellent all round visibility
  - Normally yellow with 2nm visibility, other colours possible
  - Auto switch on at dusk
- AIS AtoN
  - Automatic Identification System Aid to Navigation
  - Reports exact position to marine traffic every 3 minutes
  - Provides additional method of tracking position



# Mooring Design

## Three Point Catenary Mooring

- Three individual lines providing redundancy, proven safe with no drag in 100km/h winds and waves >8m
- Mixture of polypropylene rope and chain
- Mid water buoys reducing forces imparted to buoy
- Clump weights or stockless anchors



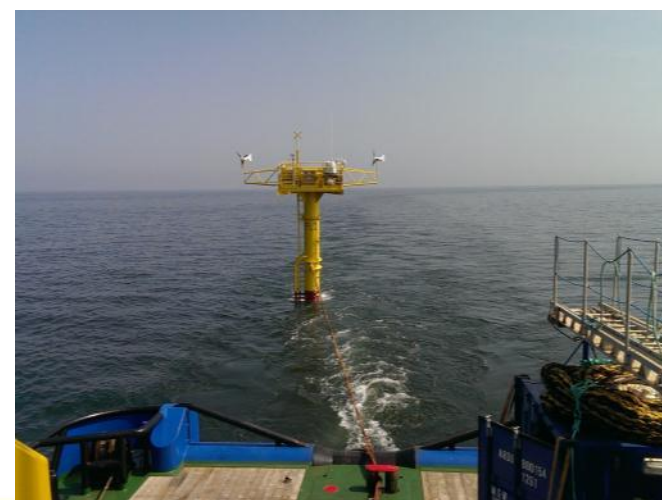
# Fabrication & Installation

## Fabrication

- Modular build allowing simultaneous fit out
- 12-14 week build time for new build
- All major commissioning done on shore

## Installation

- Towed to position using small tug / workcat
- Moorings deployed in advance
- Systems checked and commissioned
- Installation time 1-2 days (weather dependent)



# Operation and Maintenance

## Maintenance

- Design maintenance intervals of 6 months
- Routine maintenance includes:
  - Screen wash top up
  - Structural condition inspection
  - Systems condition inspection
  - Equipment wash down

## Access

- Stable platform provides safe working environment
- Accessed via fendered ladder
- Small vessel used for transport
- Access weather limit of c1.5m significant wave height



# Carbon Trust OWA Validation – Gwynt Y Mor

- Validation on Gwynt Y Mor under the Carbon Trust OWA programme
- Key Criteria measured against fixed met mast
  - Wind Speed Accuracy
  - Wind Direction Accuracy
  - System and Data Availability
- Frazer Nash Consultants conduct data validation, verified by GL Garrad Hassan

OWA Partners:



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# Gwynt Y Mor Trial – Accuracy Results

## Wind Speed

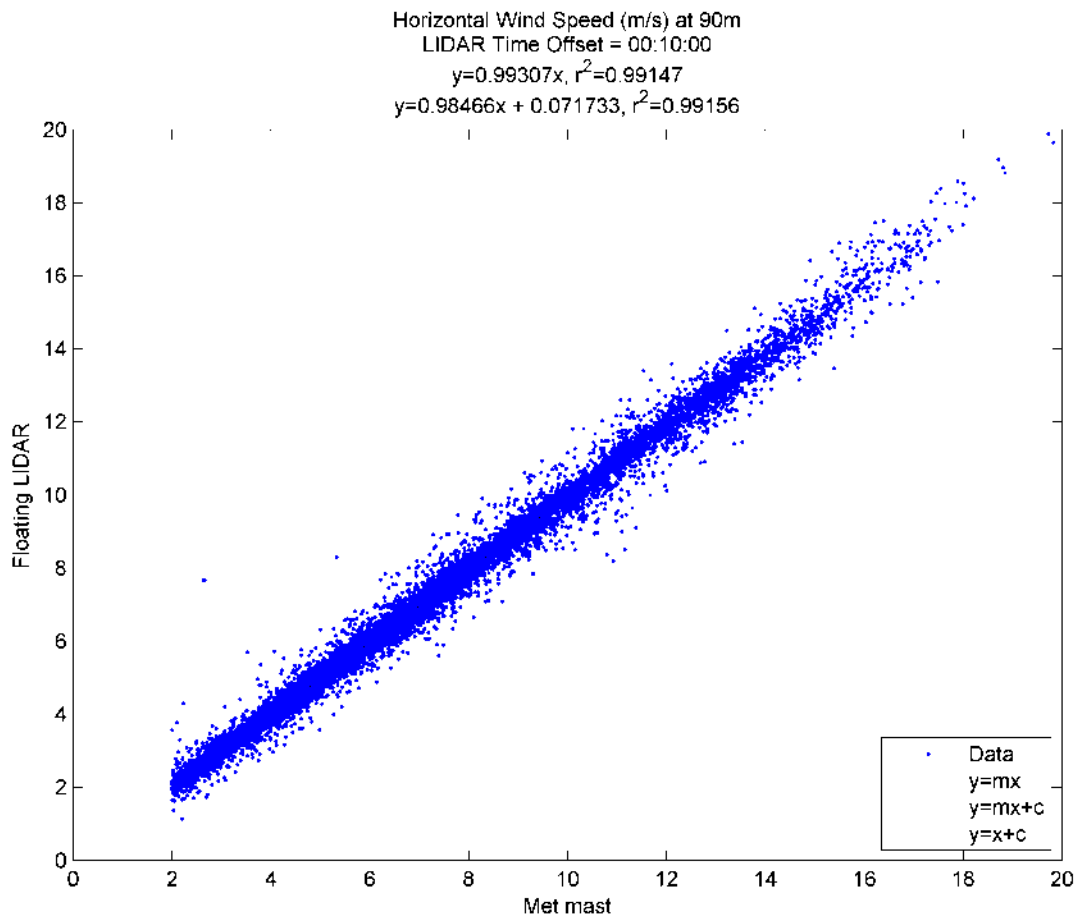
- Excellent correlation

## Wind Direction

- Good correlation
- Robust commissioning procedure to eliminate offsets

## Data Availability

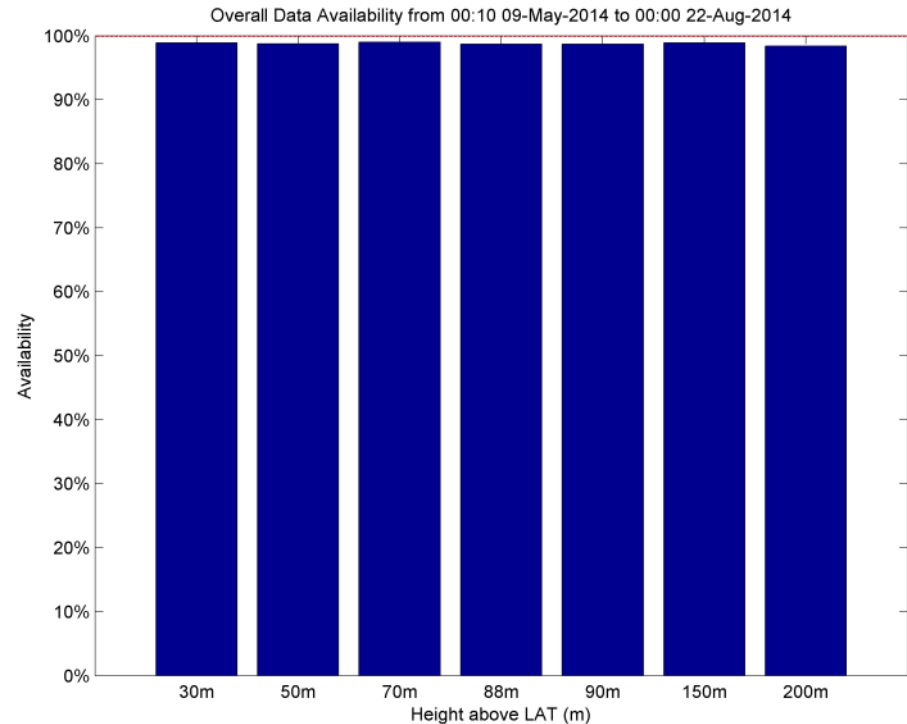
- 99.86% system availability
- >98.5% data availability



# Gwynt Y Mor Trial – Availability Results

## Excellent availability

- Data availability indicates percentage of data available after removing 9999 and 9998 values
- System availability indicates number of returned time stamped data entries compared to max possible
- Carbon Trust OWA roadmap acceptance criteria states a requirement for 95% system availability and 85% data availability



Summary of data availability (blue bars) and system availability (red dotted line)



## **For More Information Contact:**

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