Floating LiDAR certification

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Interreg North-West Europe OPIN
European Regional Development Fund

Interreg North-West Europe Marine Energy Alliance
European Regional Development Fund

Floating LiDAR (FLD) certification according Carbon Trust Offshore Wind Accelerator Roadmap

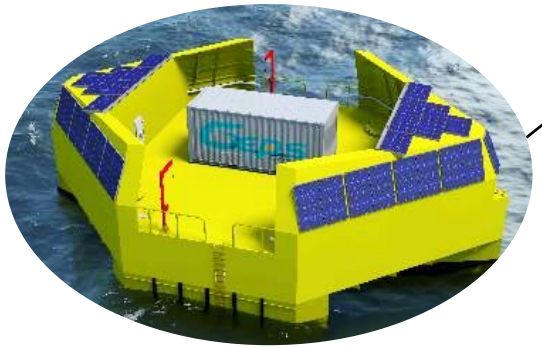
- Akrocean introduction, services & current projects
- Context
- Carbon Trust OWA Roadmap
- Stage 2 Process of Certification
- Technology
- Results & Validity
- On the Road of Stage 3

Floating LiDAR certification – Akrocean introduction

AKROCEAN is a service company which provides in situ ocean environmental data as a service.

Target markets:

OFFSHORE WIND



M.R.E.

OCEAN SCIENCES

Set up in 2017, AKROCEAN is born from GEPS Techno solutions and VALEMO expertise

Floating LiDAR certification – Akrocean introduction

Ocean Data as a Service

Geps

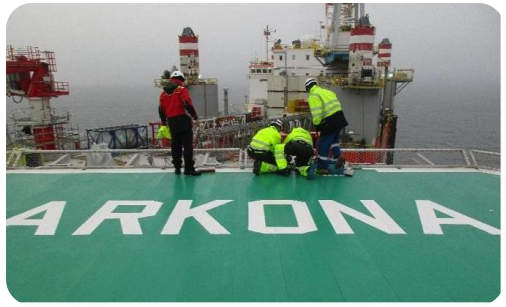
Marine engineering company




VALEMO operation & maintenance

Operating and Maintenance company



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Floating LiDAR certification – Akrocean introduction

AKROCEAN INTEGRATES AND OPERATES MODULAR FLOATING PLATFORMS COVERING CLIENT'S ENVIRONMENTAL MONITORING NEEDS.

Floating LiDAR certification – Akrocean Services

WINDSEA FLOATING LIDAR

CARBON TRUST

DNV·GL

FLY'R SEA FLOATING 3D RADAR

Gaïa

DIADÈS MARINE

SEAOBS STATION

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Floating LiDAR certification – Akrocean Current projects

Ocean Data as a Service

METEO FRANCE

2019 to 2023

New French offshore wind areas

4-years Master service agreement
(up to 6 x 12 months campaigns)

2017-2018
Oleron Wind Farm

1 year commercial wind resource campaign

For Météo-France

CARBON TRUST

DNV·GL

2018
Fécamp Offshore Wind Farm

6 months
Offshore Trials
(wind assessment)
reviewed by DNV GL

Carbon Trust OWA Road Map Stage 2

ENERGINET

2020-2021
Thor offshore Wind Farm

1 year commercial wind and metocean campaign

For Energinet

2019
LEG Light platform North Sea

Pre-deployment campaign reviewed by DNV GL

Carbon Trust OWA Road Map Stage 2

DNV·GL

ECN TNO innovation for life

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Floating LiDAR certification – Akrocean Current projects

StaroftheSouth

2019 - 2021

Star of the South 2GW offshore wind project

2 years commercial wind and metocean campaign

2 x Floating LIDARs
1 x Wave Buoy

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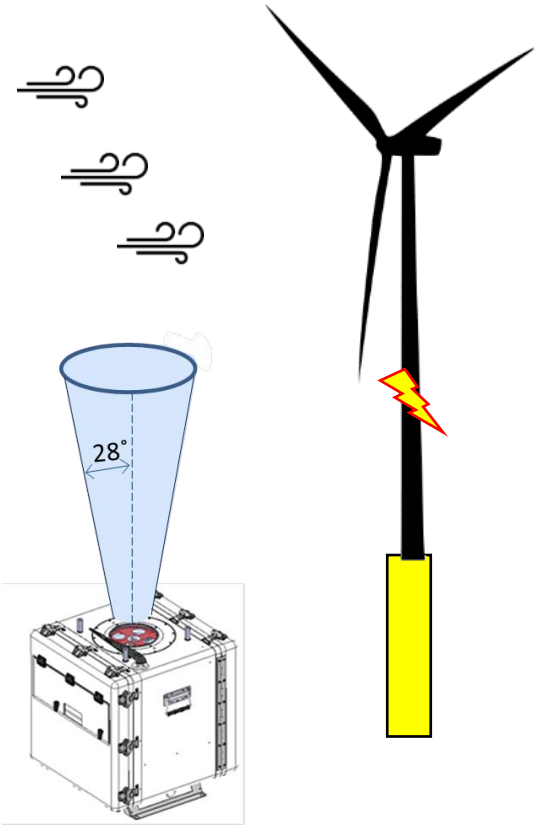
Floating LiDAR certification – Context

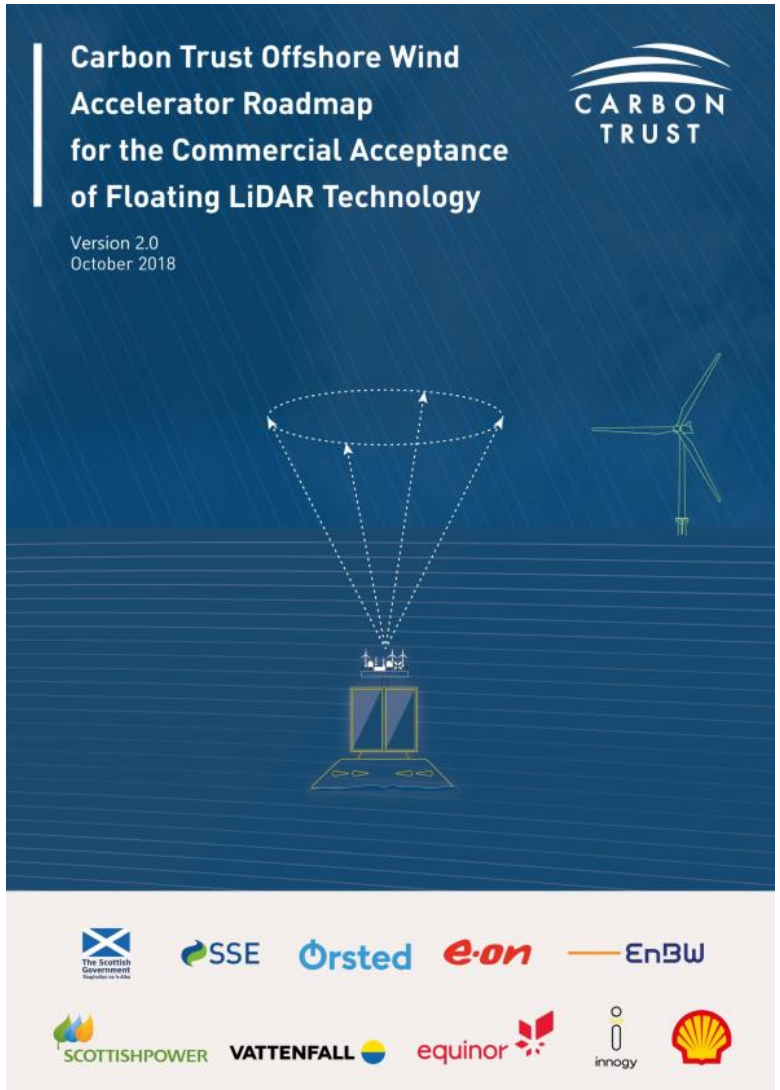
- Growth of offshore wind developments in the world
  - North Europe, APAC, USA
- Need of reliable wind data sets
  - Energy Yield assessment
  - ROI calculation => LCOE
- New method of wind measurment => LiDAR technology
  - Replacing met mast onshore
  - And offshore…



Floating LiDAR certification – Context

- **Challenge:** Bring confidence to investors in FLD wind data replacing trusted met mast measurements
- **Benefits:**
  - Cost 10 to 15 times less (LCOE impact / lower risk)
  - Easy permitting (development schedule)
  - Low environmental impact
  - Quick installation (light vessel)
- **Risks:**
  - Low experience
  - More impacted by environmental conditions

Floating LiDAR certification – Carbon Trust Roadmap



- Joint industry project
- Roadmap/Guide for FLD to become commercially accepted (bankable data)
- 3 stages
  - 1 => Baseline (LiDAR unit)
  - 2 => Pre-commercial (type validation)
  - 3 => Commercial (significant body of operational evidence)

Floating LiDAR certification – Stage 2 process Akrocean

- Type validation trial of 6 consecutive months against a trusted measurement source (met mast or fix LiDAR)
- What is assessed? (independently reviewed with blind principle)
- **System availabilty (overall and monthly)**
    - Must be >95% overall and >90% monthly
- **Post processed data availability (overall and monthly)**
    - Must be >85% overall and >80% monthly
- **Data Accuracy R2 – Coefficient of Correlation (Wind Speed and Dir)**
    - Must be >0,97 (speed), >0,95 (direction)
- **Sensitiveness of the system to sea conditions (waves & current)**
    - Determination of a trial enveloppe and sensitivity coefficient
- **Uncertainty of the trial**
    - According IEC standard

Floating LiDAR certification – Stage 2 results Akrocean

- **Period & Place**
  - April to October 2018 at Fecamp offshore wind met mast (owned by EDF-R), English channel

DNV·GL

WINDSEA_02 FLOATING LIDAR

Validation of the WINDSEA_02 Floating LiDAR at the Fécamp offshore platform

AKROCEAN

Report No.: 01, Rev. C
Document No.: L2C149488-FRPR-R-01-C
Date: 2019-04-05

OVERALL SYSTEM AVAILABILITY (6 MONTHS): **99.6%**

OVERALL WIND SPEED POST PROCESSED DATA AVAILABILITY (6 MONTHS): **97.9% AT 119M**

R2 WIND SPEED ACCURACY AT 119M : **0,998**

R2 WIND DIRECTION ACCURACY AT 119M: **0,999**

COMBINED UNCERTAINTY OF THE FLS FOR THE WS BINS FROM 4 TO 16M/S: **1,5% TO 3.1%**

Figure 3-1 Overall system availability and Overall Post-processed Data Availability

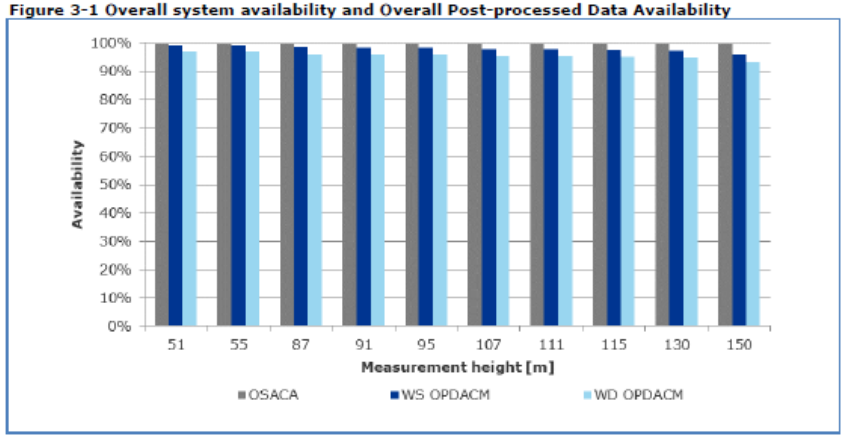
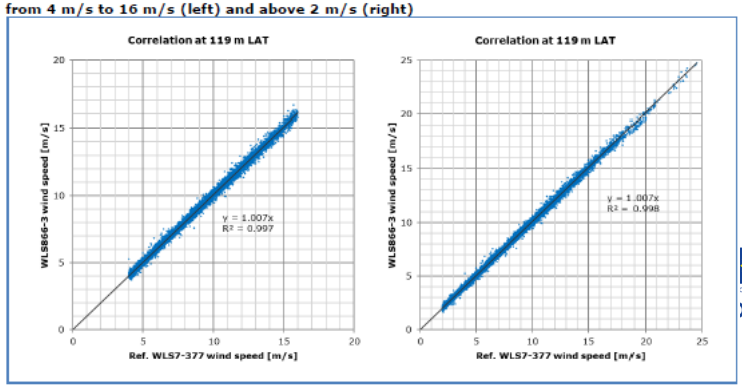


Figure 4-4 All-directional correlation of wind speed between the Reference LiDAR at 118.9 m LAT and the WINDSEA_02 Floating LiDAR at 119.0 m LAT for the wind speed range from 4 m/s to 16 m/s (left) and above 2 m/s (right)



All KPIs regarding wind speed accuracy meet the best practice acceptance criteria given in /1/.

Floating LiDAR certification – Stage 2 results Akrocean

Based on the Fécamp trial campaign results as reported here, DNV GL draws the conclusion that **the WINDSEA employing a Windcube V2 unit has formally qualified for Stage 2 "pre-commercial" in the context of the Carbon Trust Offshore Wind Accelerator Roadmap for the Commercial Acceptance of Floating LiDAR Technology /1/.**

If a different unit than the WINDSEA_02 is employed for a wind resource assessment campaign, DNV GL recommends to analyse the unit's characteristics to confirm that the unit is the same "type" and that the results of this trial campaign are still valid.

For achieving stage 3 and to better assess the impact of varying environmental conditions on the WINDSEA accuracy, DNV GL recommends to perform a complete classification test, which requires several trials at different locations and with different units.

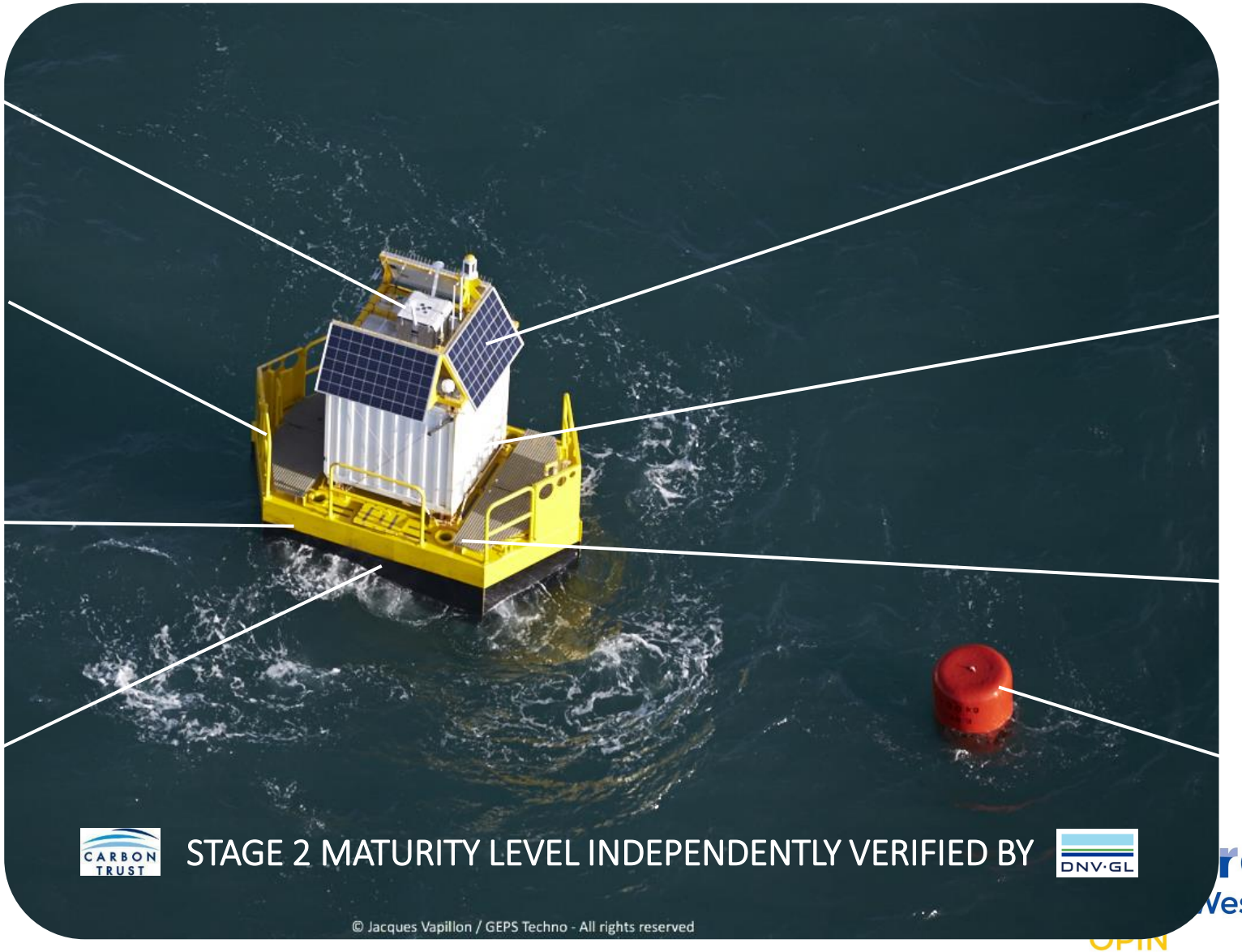
Floating LiDAR certification – WINDSEA technology

WINDCUBE LIDAR

ALUMINIUM
5 X 3M FLOAT

WAVE ENERGY
CONVERTER
(400W)

PASSIVE
STABILIZATION
(Pitch & Roll)



1,2 KW SOLAR
POWER CAPACITY

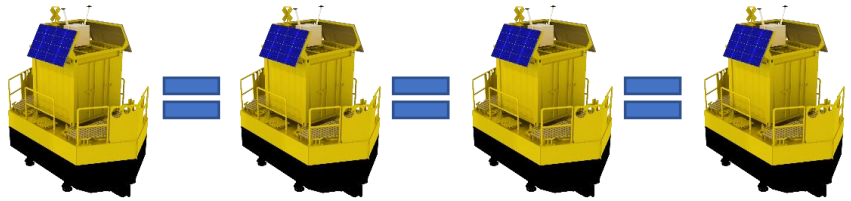
CONTROL ROOM
WITH BACKUP
POWER (UP OT
500W)
NO DIESEL

SUBSEA SENSORS
MOON POOLS

DAMPING
MOORING SYSTEM

Floating LiDAR certification – Stage 2 validity

- New units (WINDSEA 3, 4, 5,…) have to be of same type than WINDSEA 2 (hired for Stage 2)
  - Same float
  - Same LiDAR unit
  - Same RAO



- Before each new commercial Campaign
  - Each new Lidar unit has to be verifed onshore (against met mast)
  - Each new floating LiDAR of same type has to be prevalidated at sea (same conditions and KPI's than stage 2 trial but on short period (1 month at least) ideally in the same site type than commercial site (reducing uncertainty))
- Possible post validation in case of major change during commercial campaign or if prevalidation not performed

Floating LiDAR certification – on the road of Stage 3

Significantly higher pre-requisites:

- **Higher KPI's (Best practices)**
    - Ex: System availability must be >97% overall and >95% monthly (95/90 Stage 2)
    - Ex: Data accuracy must be must be >0,98 (speed), >0,97 (direction), (0,97/95 Stage 2)
- **6 x FLD unit verifications (3 short and 3 long)**
    - Meet best practices KPI's, against trusted reference source
- **3 x FLD offshore classification**
    - 2 individual FLD units to be trialled at the same test site (3 months min)
    - 1 FLD unit trialled at 2 different test sites
- **5 early commercial project deployments**
    - 12 month continuous single campaign meeting stage availibility KPI

Thank you!

AKROCEAN
Ocean Data as a Service

Feel free to contact us for further information:

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Thank you!