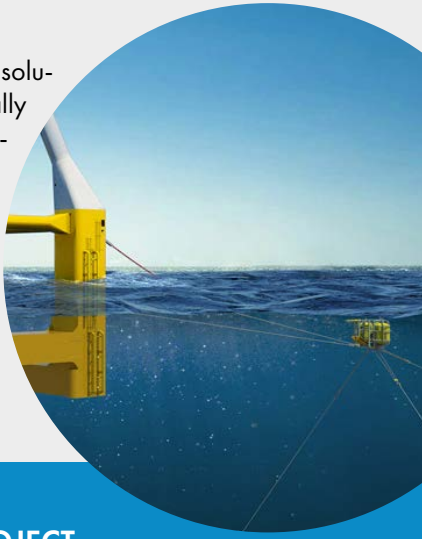
SEA TRIALS FOR OFFSHORE CABLE SHAPE SENSING

in the framework of HT-20MW project

FRANCE ENERGIES MARINES

OVERALL CONTEXT

The offshore wind sector needs to offer more competitive solutions and develop its industrial facilities to produce locally and in series. Furthermore, extending the offshore interconnection grid is vital if the energy generated by floating wind turbines is to be fully exploited. The first link in this grid is a high-power rotating electrical connection for machines that orient themselves into the wind. Mooring lines and dynamic cables are also key components. While new materials are available, they do not yet have sufficient feedback to be deployed commercially on a large scale.



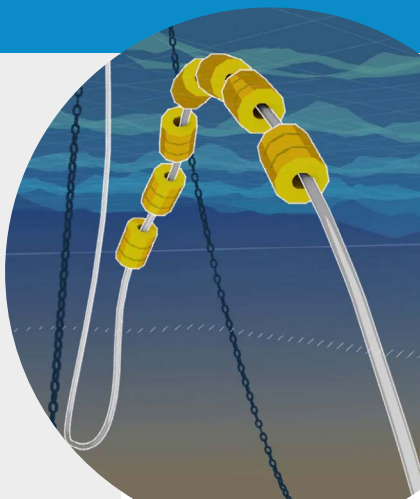
HT-20MW PROJECT

In this context, the HT-20MW project, led by Eolink and funded by ADEME, aims to design, test and certify a high-voltage rotating mechanical and electrical connection for a 20 MW floating wind turbine. As part of this project, France Energies Marines is responsible for the work on the monitoring solutions applicable to dynamic cables, including a sea trials campaign.

OBJECTIVES OF SEA TRIALS

The sea trials campaign will be an opportunity to test, challenge and improve existing in-service solutions applicable to dynamic cable monitoring with the objectives of:

- Registering the deformed shape continuously in time and space for the floater
- Having access to local curvature radius or stress peaks



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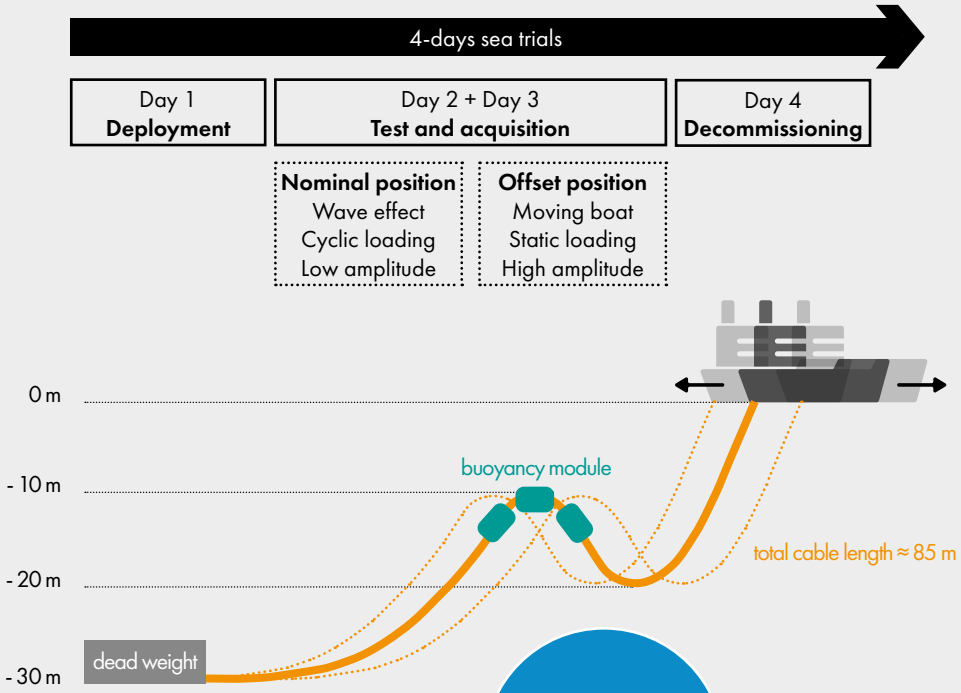
PROTOCOL



Douarnenez Bay, Brittany

DYNAMIC CABLE CHARACTERISTICS

- 6/10 (12) kV
- 3 x 35 mm²
- Lead sheath
- Double armour (galvanised steel)
- PE outer jacket
- Outer diameter: 68 mm
- Minimum bending radius: 690 mm
- 18 single mode fibres (off-centre loose tubes)

SENSOR TECHNOLOGIES TESTED

CADDEN & Sonardyne, FEBUS Optics, NKT and Viper Innovations are the four winners of the call for expressions of interest launched by France Energies Marines and supported by Pôle Mer Bretagne Atlantique.

CADDEN Sonardyne

The solution combines Sonardyne's Mini-Ranger 2 USBL system, Nano acoustic transponders mounted on the cable and Origin 600 ADCP deployed on the seabed. The transponders are positioned using the USBL transceiver and the Mini-Ranger 2 can also harvest data from Origin using the ADCP's built-in acoustic modem. This whole solution offers a real-world dataset showing the cause and effect relationship of the cable's behaviour.

FEBUS optics

The system is a combination of 2 types of distributed fibre optic sensing systems: Brillouin Optical Time Domain Reflectometer (B-OTDR) and Distributed Acoustic Sensing (DAS) to calculate accurately displacement of the dynamic power cable from the strain measured and acquired by the 2 instruments.

NKT

The curvature monitoring based on Fiber Bragg Grating (FBG) allows for high resolution monitoring of cable movements in an area of interest, at a high sampling rate. The sensor of the cable and can be used for shape estimation and fatigue calculations of cable. It is installed in such a way that it follows the shape and curvature of the cable.

VIPER INNOVATIONS

The Spread Spectrum Time-Domain Reflectometry (SSTDR) injects a signature pseudo-code on to coupled wires and receives a reflection signature back based on the operation and change of impedance of the cable. The power cores of the cable will be monitored, but also the spare low gauge quad in the dynamic cable. Coupling a number of measurement lines would give a 3D picture of the cable conductors, which is dependent on local stress.

exail

The multi-beam sonar provides metrological target strength (TS) and volume backscattering strength (SV) on multiple swaths. Each detection is referenced in 3D in the water column and is automatically reported on a real-time built map that includes local bathymetry.

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HT-20MW KEY FIGURES

Duration: 3 years (2023-2026)

Total budget: €6,194K

Partnership

EOLINK Cost-effective Floating Wind Farms · EVERAXIS · FRANCE ENERGIES MARINES · Ifremer · Université Gustave Eiffel · WINDGLAZ Engineering Services

Eolink

Eolink was founded in 2016 by Marc Guyot, a former car engine engineer, who patented the Eolink floating wind turbine concept. This turbine is specifically designed for an offshore floating application. Eolink's disruptive design takes into account the unique conditions of the marine environment, maximizing its advantages and minimizing its constraints. Eolink's lighter, scalable design is suited for large wind turbine generators, a key competitive advantage that will help reducing electricity prices. Backed by a highly skilled and experienced team, Eolink is currently building a pre-commercial scale 5 MW prototype, in partnership with Open-C foundation, Ademe and Valorem. Based in Brest, France, the company is supported by a strong supply chain environment and by public stakeholders, demonstrating strong ambitions in the floating offshore wind sector. Eolink is on track to move to full industrial scale and support the development of commercial floating offshore wind farms in Europe and beyond.

France Energies Marines

France Energies Marines is the French Institute for the Energy Transition dedicated to offshore wind energy. Its mission is to define, set-up and apply a scientific and technical framework necessary to remove the obstacles facing this rapidly developing sector.

With a multidisciplinary team of 100 employees and a model of public-private collaboration, the Institute has one purpose: R&D, whether collaborative or carried out as part of a service activity.

France Energies Marines provides support for the various offshore renewable energy technologies by relying on four cross-disciplinary and complementary R&D programmes: site characterisation, design and monitoring of systems, environmental integration and farm optimisation.

Financial supports

The project is financially supported by ADEME, Corimer, BPI France and the France 2030 investment plan.

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