

Joint industry Project TULIP
Turbulence with lidar profilers

MOTIVATION & BACKGROUND

Lidar profilers are increasingly replacing meteorological masts for site assessment thanks to their lower deployment costs and ability to measure at turbine heights.
Because atmospheric turbulence plays a critical role in both loads assessment and annual energy production calculations, capturing it accurately is essential.

But retrieving turbulence from lidar measurements still falls short, leading to accuracy challenges that become even more pronounced for floating offshore deployments.

OBJECTIVE

To get advanced turbulence intensity measurement from fixed and floating wind lidar profilers towards industry-standard accuracy and bankable confidence levels

Duration: 3 years | Start: 2026 | Total budget: €1,850K

DELIVERABLES

- **Mitigation techniques addressing instrumental noise and intra-beam averaging effects, compliant with France Energies Marines' TwinDAR© methodology**
- **Motion-compensation methods for floating lidars in line with TwinDAR©'s approach**
- **Validated methods through acquisition of high-quality onshore datasets combining multi-lidar setups, controlled motions, and mast references**
- **New version of TwinDAR© software integrating newly developed methods, leading to accurate, unified, operational estimation of turbulence from fixed and floating pulsed lidars**

WORK PLANNED

1. Method demonstration on fixed lidar profilers

- Extension of TwinDAR© to several pulsed lidar technologies and preliminary assessment for continuous-wave lidar
- Development of advanced methods for instrumental noise reduction and intra-beam effects mitigation
- Onshore measurement campaign and validation against DTU's Østerild met mast up to 244 m

2. Method demonstration moving lidar profilers

- Refinement of the motion compensation methodology
- Onshore measurement campaign with realistic buoy motions reproduced using a hexapod
- Validation jusqu'à 244 m par rapport au mât de mesure d'Østerild
- Validation up to 244 m against Østerild met mast



First series of trials with a 5-beam profiling lidar on a hexapod (© France Energies Marines)

3. Improvement and validation of the TwinDAR© software

- Development of modular software components processing measurements from fixed and floating lidars
- Software validation up to TRL 5 thanks to onshore tests with the hexapod
- Progressive deployment of the software modules for partners

4. Technology transfer to industry and qualification

- Evaluation of the method according to the KPIs developed by DNV and industrial partners
- Preparation for the qualification of TwinDAR© by certification bodies
- Contribution to standards, including participation in IEA Wind Task 52

PARTNERS

This project is led by France Energies Marines.

CONTRIBUTORS

The project receives funding from the French government which is managed by the Agence Nationale de la Recherche as part of the France 2030 investment plan (ANR-26-IEED-0001). It is also supported by Centrale Méditerranée, Pays de la Loire and SUD Provence-Alpes-Côte d'Azur regions.

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