# SheaRIOS Wind Turbine Blade Inspection

Climbing Robot Trials on an Operational Wind Turbine

SHEARIOS
robotic rotor blade inspection

**SheaRIOS, the world's first remote-controlled shearographic wind turbine blade (WTB) inspection system capable of safe, fast and accurate assessments underwent initial field testing on an operational wind turbine at the Greek Centre for Renewable Energy Sources (CRES).**

**The system comprises four main modules:**

- A robotic climbing vehicle built by IKnowHow (Greece).
- An ICM robotic crawler adapted and integrated by Dekra (Germany).
- A shearography inspection system developed by TWI (UK).
- Control and communication software written by Leitat (Spain).

End-user perspective was provided by EDF (UK), with future system deployment performed by WRS Cathodic (Netherlands).

These initial trials focused on the performance and usability of the robotic climber used to ascend the wind turbine.

## Consortium Partners:

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780662*

## SheaRIOS Inspection

During full system deployment, the robotic climbing vehicle is directed up the wind turbine tower until it reaches the desired height, a robotic arm is then extended and the crawler, with its shearographic payload, is positioned on the WTB.

Once secure on the WTB, the crawler uses its vacuum equipped caterpillar tracks to navigate the profiled blade surface and perform an in-situ blade inpection.

During inspection, a diffused laser is projected onto the surface of the blade and is seen as a speckle pattern that changes as warm air is blown across the blade‘s surface. The speckle patterns are captured and processed by the associated software to identify a variety of defects (eg delamination, disbond, core crush, laminate cracking) within the composite structure.

A ground-level base station provides full system control at a safe distance from the tower. This significantly reduces the risks to personnel, as current practice involves inspections performed by rope access technicians, often working in hazardous conditions.

## Climbing Robot Field Trials

Extensive trials of the SheaRIOS robotic climber were performed at the CRES wind turbine facility during November 2019 to access its functionality in terms of:

- Climbing ability (ascending/descending without damaging to the tower).
- Remote control (including power and communication protocols).
- Arm extension (in preparation for crawler deployment).
- Fall-arrest (demonstration of necessary fail-safes).

The performance was particularly noteworthy, as the robotic climber was successfully driven up and down the tower multiple times, and the deployment arm extended and retracted at the maximum height each time.

The robotic climber pulled itself up the tower using guide cables suspended from the nacelle. A combination of permanent magnets and pneumatic tyres kept the climber a fixed distance from the tower and ensured the tower paintwork remained undamaged. Fall-arrest system assessments provided confidence that the necessary safety measures were in place for this safety critical application.

These mobility trials were controlled remotely from a ground-level base station located a safe distance from the wind turbine. These trials provided the opportunity to identify weaknesses within the GUI and these will be addressed to improve both performance and usability, prior to its commercial release.

## Benefits

In summary, the SheaRIOS inspection system provides the following benefits:

1. WTB blades inspected without removel from the tower.
2. Detection of subsurface defects in anisotropic composite materials.
3. Adaptable multi-payload robotic system, compatible with alternative inspection techniques.
4. Increaseed safety through minimal need for rope access inspection.
5. Significant reduction in total WTB inspection time, typically of more than one day.
6. Reduced wind turbine downtime and assocaited loss in energy generation/ revenue.

## Next Steps

Comprehensive validation trials are planned for 2021, followed by live demonstrations to the Wind Energy sector.

For further information visit the SheaRIOS website (shearios.com), or email the project team at (e.g. enquiries@shearios.com).

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