Robotics: the next era

TSR Wind is a lively, go-ahead company in our industry, Juan Rivas, Commercial Director, was excited to share some of their solutions with PES. There's no doubt that robotics is making a big difference to the cost, efficiency, safety and downtimes of inspections for the asset owners, and to cap it all off the analysis can be done back at the office, meaning the experts don't need to move from their offices to see the results or plan interventions.

PES: A warm welcome to PES Wind, it's good to talk with you. Would you like to begin by giving us an overview of TSR Wind?

Juan Rivas: Thank you very much. Very proud to represent TSR Wind and very glad to introduce a very young, but assertive company.

TSR Wind develops new services and products based on complex robotic technology and software to provide high quality solutions to wind industry.

The company core is our engineering team, young, experienced and specialised in new robotic technology and software solutions.

We began with our first robot prototype for blade inspection and cleaning towers. Now we can offer our clients internal and external blade inspections, tower welding inspections by UT and we are continuing to develop new solutions. We always have clear targets: provide new solutions, optimizing cost and time, increasing quality and reducing risk for wind workers.

Today we have inspected over 2,500wtg, which 7,500 blades, all around the world for some of the top companies in the wind industry. These include big owners, advisory teams, turbine manufacturers and O&M companies, based for the most part in Europe and Latam.

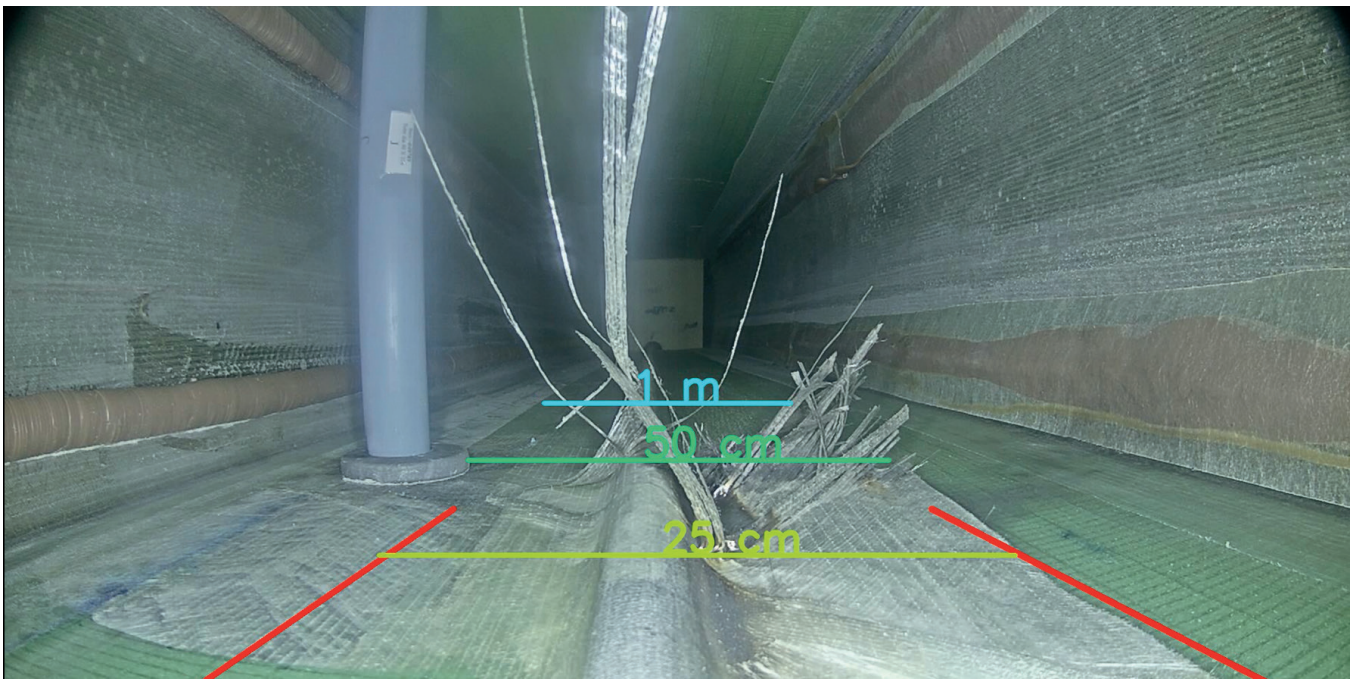
PES: Please can you tell us about your inspection process?

JR: We provide different inspection services and we are just developing new ones, however our process is always:

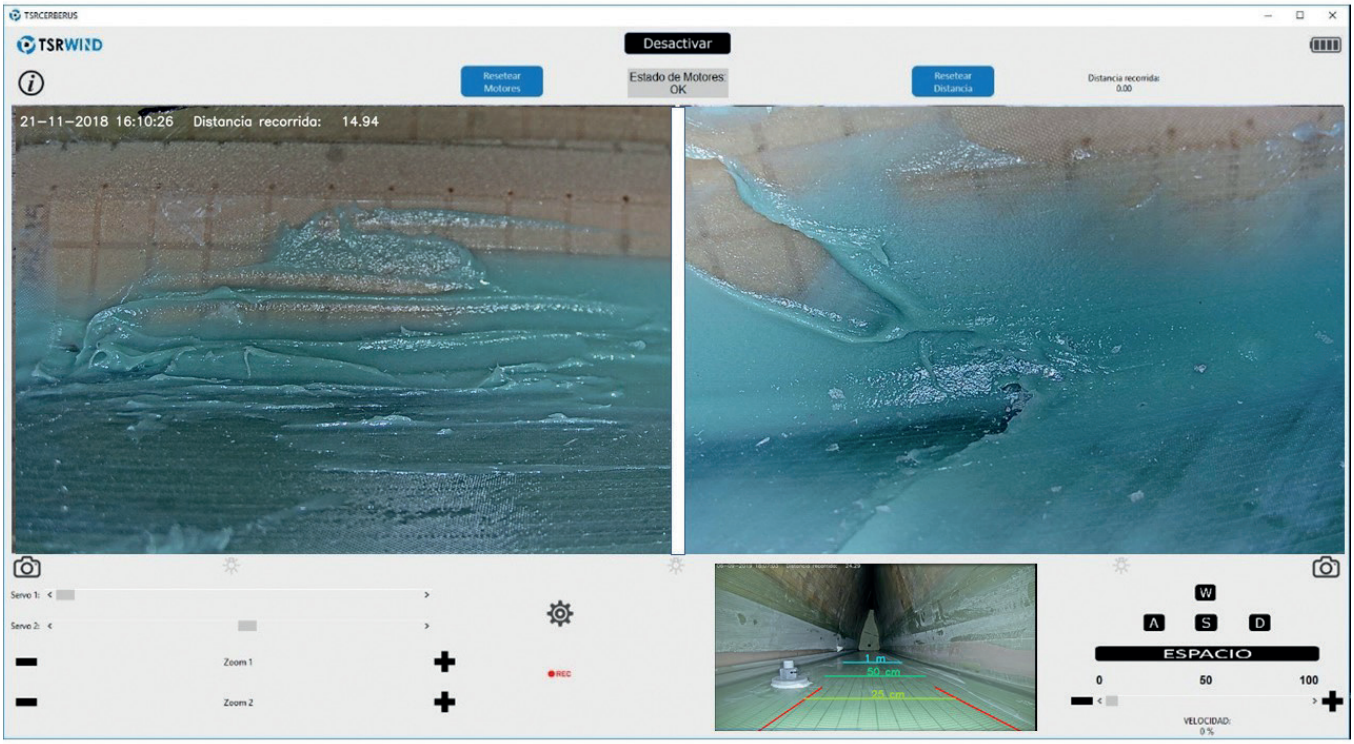
1. High quality inspection: we use the best photo cameras, video or ultrasound equipment available on the market. The quality is our target.
2. Full element data collection: we don't only take damage data, we take and collect data of the whole blade, or tower.
3. Digitalization: all the pictures, video, UT output, or any other data is processed, registered and stored.
4. The best experts available in blades and ultrasound check the pictures/video/ data in order to provide a technical damage report and advice.

Juan Rivas

5. Full info available to the costumers: all inspection data is uploaded to TSR Inspector, our webpage platform for costumers.



Cerberus lightening impact



PES: So, do your 2 robots, CERBERUS and EOLOS work together?

JR: We offer individual external and internal blade inspections, which depend on customers' specific needs. However, we recommend full blade inspections, using CERBERUS inside and EOLOS outside. This way we get a real and complete blade status at the inspection date, which we are able to analyse, make recommendations and report with high accuracy.

We are also able to link internal with external damages and TSR Inspector allow us to compare current inspection with last season inspection, so we can check damages evolution, repairing and blade aging.

PES: Is research and development an integral part of your business?

JR: Absolutely. In 2017, we developed our first EOLOS, for external blade inspections. After, and in collaboration with one of the biggest blade and turbine manufacturers, came CERBERUS, a new robot able to inspect inside the blade.

At the same time, in collaboration with Universidad Politécnica de Madrid, we developed, our own web platform, TSR Inspector, which enables customers to check their results on their own computer, tablet or even mobile phone.

Currently, we are testing our new robot, called Kratos, designed to inspect welding on towers by ultrasounds.

PES: Do you have any interesting projects in the pipeline that you are able to share with us?

JR: TSR has the knowledge, experience, and adaptation capability to solve wind industry problems quickly, with technical solutions. Our clients give us new ideas almost every day.

Our current pipeline includes the following services: AI for automatic damage recognition, checking the LPS system, small repairs inside blades, pitch alignment test, tower cleaning, vibration analysis, basement status analysis etc.

PES: What makes your solutions stand out from the competition, what are the benefits to the end user?

JR: Wind turbines evolve every year and are technically more complex, so O&M require original, technical solutions to new problems and needs.

Blade lengths and tower heights are continuously increasing, so inspections and maintenance by rope or crane, are more and more difficult, expensive and dangerous for workers.

Full and available inspection information enables customers to make decisions based on the real status of their assets. Our web TSR Inspector is a friendly hub from which to manage, store and check all inspections of a wind turbine in a single and useful place.

Our target is to improve quality inspections and save costs, and always keep technicians safe. On the other hand, reducing time on the inspection procedures, means a reduction in turbine downtimes, a key point for the clients.

PES: We were wondering about your geographical reach and if you have plans to expand into other areas?

JR: Until now our main markets have been Europe and Latam. In Europe we have experience in Spain, Portugal, France, Romania, Poland, UK, Sweden, Germany, Croatia and Greece.

We have inspected blades since 2017 in Latam: Uruguay and Mexico. Today we also go as far as Chile, Peru and Panama. We also have experience with our inspection robots in the USA, Canada and China.

Our current business plan is to expand in key markets through collaboration agreements with experienced companies, well stablished in these markets.

Currently, we are dealing with several renowned companies, who have local knowledge and structure with large experience in blades or ultrasounds for the USA, Latam, China and Brazil.

In 2021-2022 we expect and believe that TSR Wind services will expand greatly through our collaborators in these markets.

Cerberus robot Internal blade inspection

Due to the increasing need to check the condition of the interior of the blades, the TSR Wind company developed, in collaboration with one of the main turbine manufacturers worldwide, a robotic solution for internal blade inspection.

The result of this is the Cerberus robot, which is already in the third improved version, Cerberus 210. It is a tool that we are able to use to systematize and improve the quality of inspections, by reducing costs, increasing the length of the inspected blade and, above all, minimizing the work of operators inside the blades. Thus, the high risk and complications associated with these confined space inspections can be avoided.

CERBERUS 210

One of the objectives of the wind sector in recent years has been to minimize the accident rate. Ensuring the safety of workers is already an imperative for the wind companies. They continually search for new methods to protect the safety of their technicians.

This is one of the reasons that led one of the largest wind turbine manufacturers to promote and participate in the development of a robot, which is capable of carrying out work in a small and potentially hazardous space. In this way, the staff can work from the hub or the nacelle, monitoring in real time the work of the robot and the images transmitted.

The other objective of the sector is to reduce the cost of wind farm maintenance operations in order to optimize their profitability. TSR Wind has developed a technological solution that significantly reduces the cost of inspection minimizing: the time required, the hours of the qualified personnel, the need for specific training for work in confined spaces. This makes it possible to inspect the graphic material afterwards, which avoids the movement of specialists since they are able to do it centrally from their offices.

The TSR control software allows the control of the two inspection cameras throughout, with the front driving camera on the same screen. It also makes it possible to control the speed, direction and position of the robot, as well as the lights and lighting.

The recordings can be studied at the time of inspection or later, by downloading the videos. The format used, facilitates the treatment by software, which leads the way to developing an automatic detection of damage, or points of interest in the video. Thus, we reduce the time spent reviewing the results.

TSR Wind has been using several units of the CERBERUS robot for months to inspect the inside of blades. These robots are already working in countries such as Mexico, USA, Peru and the UK, as well as in Spain.

The robot, which has 3 high resolution video cameras for a maximum quality inspection, can be used on blades in service, but can also be used in the factory, or in storage fields. It is powered by long life batteries and can be controlled remotely and safely from the hub. It has a safety cable and is able to accurately determine the point of the blade where it is located, facilitating the subsequent analysis of the collected graphic material.

This little robot is able to go where a person cannot, so it is able to inspect a greater length of the blades. Tests have been carried out on 62m blades, where the robot has exceeded 40m between spars and 20m in the gap of the leading edge. Furthermore, its weight and dimensions make it easy to transport inside of the wind turbine.

It works with long-lasting military batteries, although TSR Wind has a cable-powered version. The inspection speed is approximately 40 minutes for a 62-meter blade.

Although the Cerberus robot has been designed to optimize the inspection of blades in operation, it can also be used to verify blades at the factory in post-production. This makes it easier to inspect a longer blade length and reduces the need for operators to go into the blade.

The company is already planning the first tests of inspections in offshore wind farms, where the length of the blades is even greater and the working windows are very short. So, it is imperative to find solutions that improve and optimize the inspection work.

In addition, TSR Wind is working on a modification of the CERBERUS robot that includes a robotic arm, which will allow small repairs. For example, in the LPS cable.

This internal inspection service is complemented by the one already offered by TSR Wind through its EOLOS robot, for external blade inspections. Thus, TSR Wind currently offers a complete inspection blade service, both external and internal, with a very high quality, along with minimizing the risk for workers.

All these services, which are collected in a single TSR Inspector web platform and developed by the company, provide clients with a guarantee of total control over the status of their assets and their evolution over time.

TSR Wind has already inspected the blades of more than 2,500 wind turbines worldwide and continues to develop new technologies to reduce the costs, the risks of the turbine inspection and the maintenance operations.

The company is currently developing artificial intelligence solutions for automatic damage recognition, blade pitch alignment measurement, vibration analysis and the natural tower frequencies, as well as studying the foundations, and many other ideas.

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