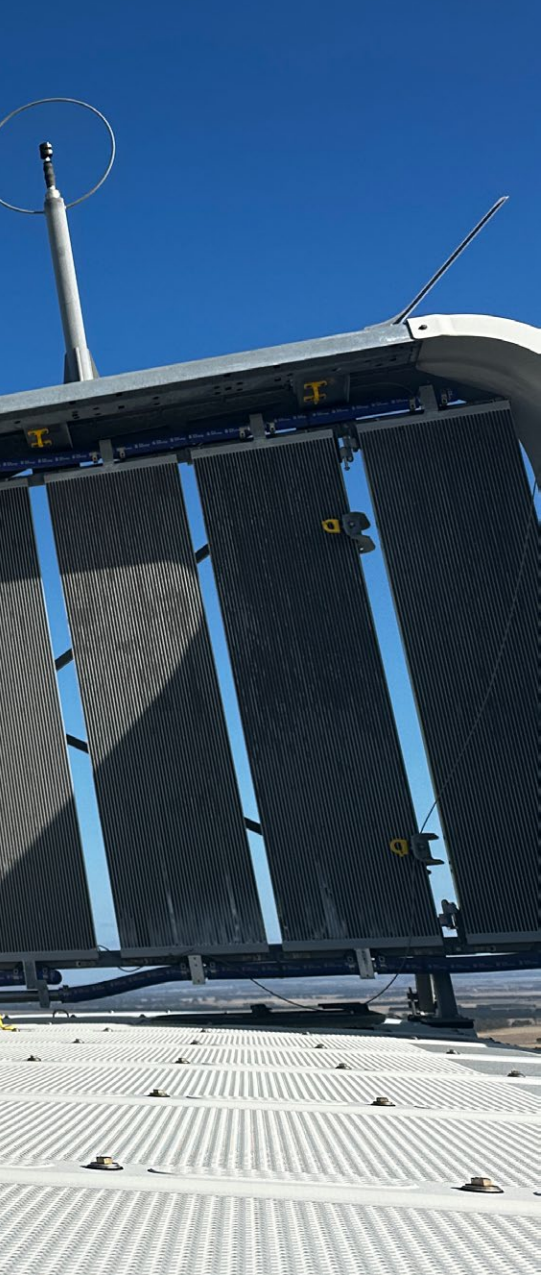
See what hurts your blades before it damages your business

As wind turbines grow exponentially in size, so do the challenges associated with maintaining them. The industry's challenge lies in the scarcity of personnel willing to perform these high-altitude tasks, compounded by the increasing size of turbines which escalates downtime costs. Aerones is revolutionizing wind turbine maintenance with robotic solutions, enhancing efficiency, safety, and accessibility.



It is estimated that an additional 240,000 new workers will be needed in the wind power industry over the next five years. Recognizing this, Aerones has developed robots to streamline these maintenance processes, making them more efficient and secure.

Lightning strikes are a frequent issue, causing substantial damage to the turbines. Aerones leads the industry in rapid and efficient lightning protection system inspections by providing exact measurements of resistance, detecting open circuits, and providing receptor oxidation cure or receptor replacement. Its services extend to lightning protection system tests, technical checkups, and drainage hole cleanings. It provides a comprehensive solution, bundling drone inspections, internal inspections, and lightning protection system tests.

When blades accumulate ice, their power generation ceases. Aerones robots address this issue by applying ice-coating solutions.

The rotation of turbine blades inevitably leads to cracks. The solution may lie with robots capable of conducting swift and thorough blade external and internal inspections and repairs. Furthermore, its robots tackle leading-edge erosion, a pervasive problem worldwide, with maintenance solutions that enhance blade longevity and improve a turbine's annual energy production.

Oil leaks from turbines can lead to ground contamination. Aerones robots excel in cleaning operations for turbine blades, towers, and nacelle, preventing environmental damage.

Robots operate at the top of the tower, handling inspections, cleaning, and repairs. We also utilize drones for aerial blade inspections and deploy internal inspection crawlers inside the blades. This comprehensive robotic service ensures unparalleled performance, enhancing safety as technicians remotely control the operations. The robots' precision and speed significantly outpace human capabilities, and training technicians for these tasks is both quicker and simpler.

Operating in wind speeds up to 15 meters per second, our robots offer a broader window of operation, reducing seasonal limitations. We have developed 15 distinct services, with ongoing innovations to meet future challenges.

This article delves deeper into blade internal inspections, drone utilization, lightning protection system inspections, drainage hole cleaning, and technical checkups conducted by our skilled technicians. We perform inspections both onshore and offshore.

Blade external visual inspections are conducted using the DJI Matrix 300 drone, equipped with a 100-megapixel camera, ensuring exceptional image quality. The drone autonomously navigates around the turbine blades, capturing comprehensive imagery in 20 to 30 minutes per turbine. The data is subsequently uploaded to our server for detailed analysis and report generation.

Drones are commonly used in the industry for turbine visual external inspections. But what truly sets Aerones apart, is its internal inspections. We have developed a unique system specifically for this purpose, incorporating a 360-degree camera, LiDAR for 3D modeling, and a sophisticated adaptive lighting system. This crawler, adaptable to various internal temperatures, traverses the blade's interior, generating a digital twin and identifying potential issues.

This innovative process results in minimal turbine downtime, approximately three to four hours, and captures every millimeter of the blade's interior. AI analyzes the data, highlighting areas of concern for technician verification and report generation. All raw data is also available for customer review through computers or even VR goggles.

With this system, it achieves up to 40% greater coverage than manual inspections performed by a human, enhancing data accuracy and risk mitigation. The downtime cost savings, combined with increased safety and precision, underscore the value Aerones brings to the wind turbine industry. Its technicians do conduct specific manual inspections when necessary, but the majority of the work is robotically executed, with detailed reports typically generated within just three days.

Its defect categorization system ranges from urgent, requiring immediate attention, to minor issues, advising monitoring and potential future action. This comprehensive approach ensures the longevity and safe operation of wind turbines, demonstrating Aerones' commitment to innovation and excellence in the field of wind turbine maintenance.

The inspection schedule for wind turbine blades is not set in stone. It varies from every two months to annually, depending on the data analysis conducted by our team. It provides tailored recommendations for inspection and repair timelines based on our expertise and statistical data. However, it is adaptable to the preferences and categorizations of its clients, ensuring they receive reports and recommendations in a format they are accustomed to. The system is versatile, accommodating various categorizations and sub-categorizations.

The importance of internal inspections lies in their ability to reveal issues that may not be apparent from the exterior. For instance, a small pinhole visible from the outside may turn out to be a significant problem when viewed from the inside, measuring 1.2 meters by 650 millimeters, and categorized as a level four issue. Internal inspections allow for early detection of potential problems, such as wrinkles, internal cracks, delamination, and debonding in the webs, which might not be visible from the outside.

The company's comprehensive inspections also look for issues like dry glass, lightning damage, glue problems, and insufficient previous repairs. The external paint job may conceal these issues, making internal inspections crucial. Additionally, it checks for foreign objects, water ingress, oil stains, and other potential problems inside the blade.

Contrary to some beliefs, it is not sufficient to only inspect the root area of the blade. Aerones data, based on thousands of turbines inspected, shows that many serious issues are found deeper within the blades, emphasizing the importance of thorough internal inspections also in areas unreachable by humans.

For example, it saved nearly a million dollars on a five-megawatt turbine by identifying an internal crack, eight meters long, which was invisible from the outside. This underlines the effectiveness of internal inspections in preventing catastrophic failures and resulting financial losses.

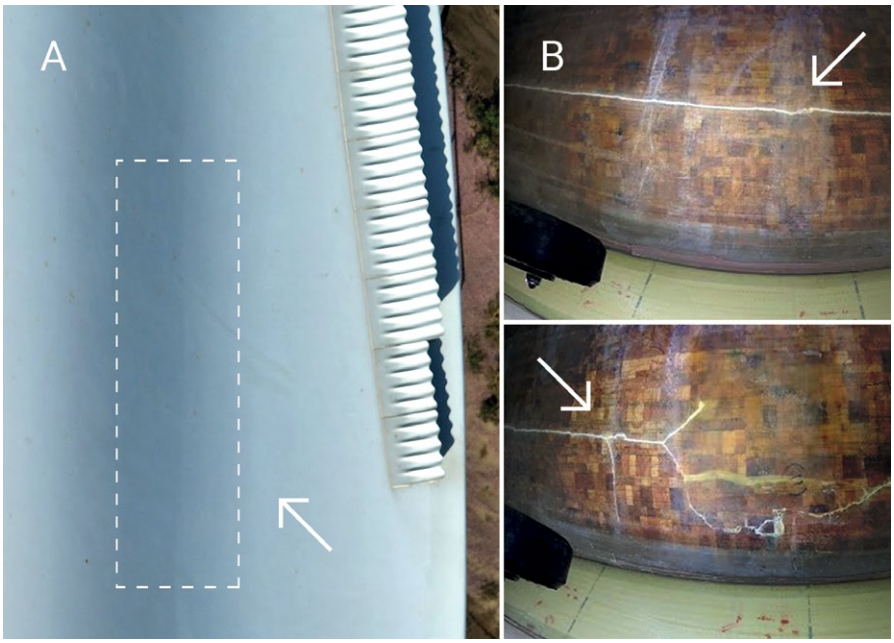
In the first photo below, drone detected a suspicious shadow on the outside of the blade. After thorough internal inspection, a severe 8-meter-long, category 5 crack was revealed, posing the risk of significant damage.

The client portal centralizes all data from external and internal inspections, as well as lightning protection system tests, providing a timeline view of each blade's inspection history. The data can be exported in various file formats and can be integrated with other systems through our API. Its reporting is customizable, and it offers white-labeling options for client branding upon request.

In the near future, the company will introduce a risk calculation system based on various factors. including the erosion levels of your turbine blades, providing an overall assessment of your assets, and aiding in prioritizing inspections and maintenance. Its portal also facilitates project management, tracking progress, and providing analytics to help optimize your maintenance strategies.

In conclusion, Aerones' approach to wind turbine blade inspections is data-driven, versatile, and comprehensive, ensuring that hidden issues are identified and addressed promptly, ultimately contributing to the longevity and efficiency of your turbines.

www.aerones.com



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About Aerones

Aerones is a Latvian tech startup, founded in 2015, that has garnered attention for its innovative approach to wind turbine maintenance.

Specializing in robotics, the company has developed a ground-breaking robotic system designed to conduct inspections, repairs, and cleaning of wind turbines, to make these processes more efficient, safer, and cost-effective.

Aerones' solution addresses a growing need in the wind energy sector. As the world shifts towards renewable energy, the number of wind turbines has been increasing exponentially.

However, maintaining these turbines, especially their blades, is a challenging and risky task, often involving human workers performing high-altitude operations.

Aerones' robotic system not only mitigates these risks but also offer a more efficient and potentiall more affordable solution.

Aerones' range of robot-enabled solutions already serves customers that represent 50%t of the world's wind power capacity.

In 2023 the company secured $30 million in growth capital to scale its business globally.

The capital is used to help it meet surging demand in a market that is expected to reach $50 billion in value by 2028.