Key insights across in-service wind farm assets using ultrasonic NDT and robotics

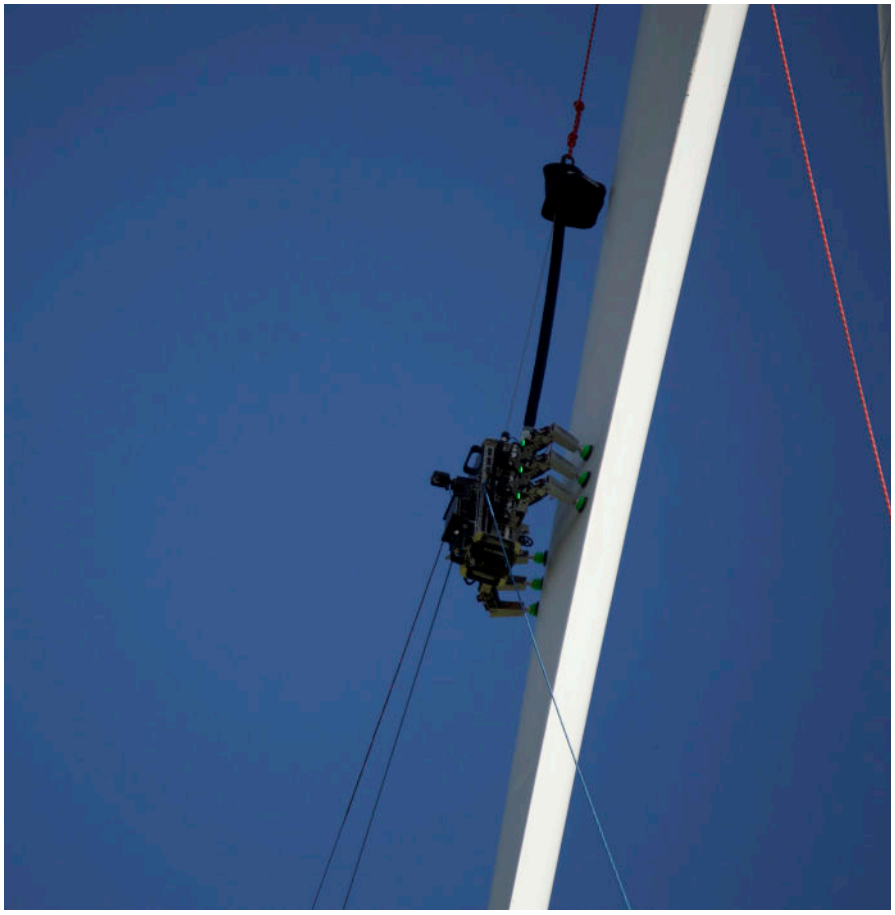
The skills shortage within the sector is a challenge for all. Could robots be the solution? Here, Stacey Rivers, Business Development and Operations Manager at BladeBUG, explains how its innovative robots will operate both onshore and offshore, working independently, or collaboratively with a drone or technician, to perform a diverse range of inspection, maintenance, and repair (IMR) tasks.

We are heading for a global shortage of skilled, experienced wind technicians, with an increase of 33% required within the next four years: up from 426,700 in 2021 to 568,800 by 2026. That's according to a joint report by Global Wind Organisation (GWO) and Global Wind Energy Council (GWEC), which revealed an additional 142,100 technicians will require training, equipment, logistics support, insurance and all other expenses incurred to carry out their role, if current labour-intensive operations & maintenance (O&M) practices continue.

This means more than half a million workers are facing the risks and challenges of rope access each day to keep lights on around the world, and that's in the wind energy sector alone. There is a safer, more efficient way.

BladeBUG is a UK-based advanced robotics company, on a mission to accelerate the green energy transition through robotics and automation. The brainchild of Chris Cieslak, a design engineer with extensive experience leading wind turbine and composite design projects, it will play a vital role in revolutionising the wind industry's O&M solutions.

In many countries, rope access is restricted due to health and safety regulations, leaving costly, labour intensive and time-consuming alternatives as the only choice. BladeBUG and other disruptive technology solutions enable a safer and more cost-effective



approach, which in turn lowers the Levelised Cost of Energy (LCoE).

Founded in 2015, in response to the increasing demand for renewable energy and a foreseen skills shortage, the company has developed its cutting-edge technology to utilise a diverse suite of tools with purpose-built capabilities, such as Non-Destructive Testing (NDT), as an answer to the wind industry's O&M challenges.

'The driving force behind the last seven years of research and development has been, and continues to be, the opportunity to step outside of the wind industry's current O&M 'status quo' to provide a safer, more cost effective and accurate solution for a range of IMR activities,' Chris Cieslak, Founder of BladeBUG, explains.

'Ultrasonic Testing (UT) technology has been utilised in highly regulated industries such as aerospace, oil and gas, and defence for decades, with a strong track record of success. By incorporating NDT solutions into operations, OEMs and O&M providers can ensure a scalable approach for the industry's future growth.'

Tried and tested technology

Dolphitech, developer and manufacturer of the UT technology platform Dolphicam2, one of the systems integrated into BladeBUG's latest prototype, has seen first-hand the cost and time savings made possible through the adoption of NDT.

'With a straightforward, quick to deploy, user-friendly system, technicians of all experience levels can generate analysis-ready images of materials in real-time for quick decision making,' Jason Smith, Chief Commercial Officer at Dolphitech, explains.

'Our latest 0.7MHz transducer enables us to penetrate wind turbine blades up to about 120mm to detect defects. To date, it has also been used by customers developing spacecraft, cars, passenger jets and other critical assets, as well as being used for in service/maintenance inspections proving it as a technology our customers can rely on.'

Dolphicam2 enables high resolution imaging and precise measurements for a wide range of material types including composites, metals and multi materials, making it an ideal fit for use on turbine blades.

'As wind farm owners look to extend the life of their assets, we anticipate an increase in proactive O&M activity which could benefit from this technology. What's more, as owners look to transfer assets, they will require accurate, reliable data to better understand their assets' value and this is where it presents a real opportunity,' Jason continues.

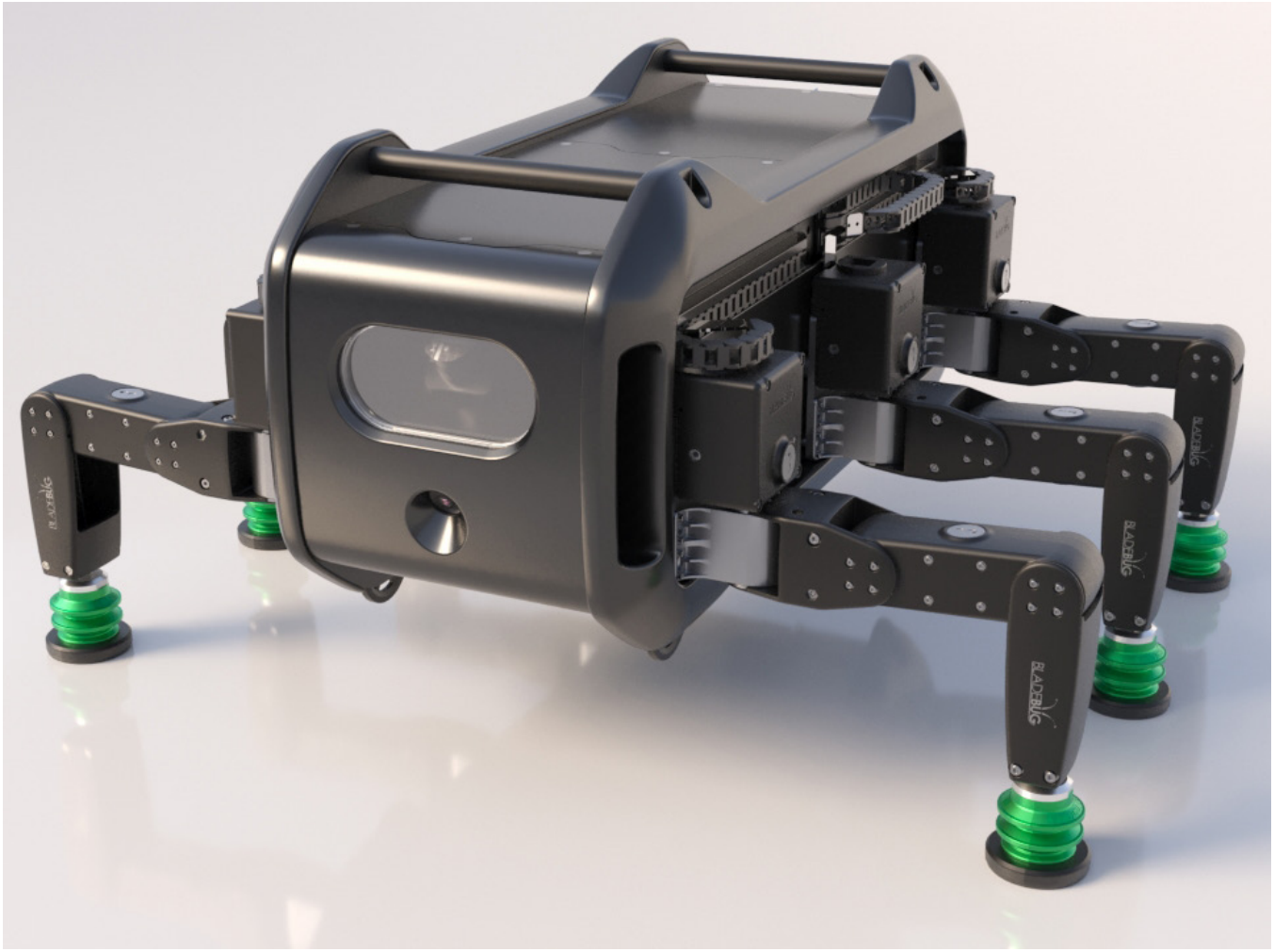
Endless opportunity

It's not just those within the NDT supply chain that have high hopes for the future adoption of its technology.

Innovate UK, Offshore Renewable Energy (ORE) Catapult, GE Renewable Energy, and RIMA provided funding or support for BladeBUG, demonstrating the positive response to the research, development, and industry adoption of this cutting-edge technology.

The company has also received support and input from all levels of the supply chain, including three Tier 1 companies within the wind sector, which asserted their interest in the development and utilisation of the company's unique robotic platforms.

'We are proud to engage with a range of trusted, knowledgeable collaborators not only across renewables, but the wider technology and innovation sector, to produce a holistic solution to the wind industry's main pain points,' Chris explains.



According to ORE Catapult, the O&M phase accounts for between 20% and 30% of the LCoE of a wind farm. When carrying out repairs, an NDT solution can help make informed decisions faster, as well as maximising asset uptime with quick deployment and collaborative working, saving time and money. This is made possible by a range of factors including the size of the equipment required and ease of use.

'For offshore wind, vessel availability is a further concern, with logistic solutions often proving expensive and harmful to the environment. By utilising a remote NDT solution for IMR activities, we can reduce the number of technicians required offshore, saving valuable space onboard CTVs and SOVs,' Chris continues.

'Upskilling and reskilling the workforce for the use of these solutions is a high priority for us, which is why we have worked with end users to ensure ease of use and an adaptive, fit-for-purpose product.'

Making history

In 2020, the BladeBUG achieved the world's first blade walk by a robot on an offshore wind turbine at ORE Catapult's 7MW Levenmouth demonstration turbine off the coast of Fife.

A year later, in 2021, it successfully performed its first remotely controlled lightning protection test on an offshore wind turbine, performing a series of checks and tasks beyond the visual line of sight whilst the robot operator remained in the safety of the nacelle.

A proven solution

Fast forward to July 2022, and the company visited An Avel Braz's wind farm, Parc éolien de l'herbissonne, to perform a UT scan on a targeted area of a wind turbine blade with visual damage.

The proof-of-concept pilot project was a success and highlighted the benefits of collaborative working between the wind farm developer/operator, An Avel Braz, the inspection services provider, GP-MC, the robotics company, BladeBUG, and the NDT technology provider, TPAC.

With over 15 years' experience in the field of composite materials, GP-MC has seen technological advancements in not only the inspection of wind turbines, but the manufacture of them, which has brought with it its own pain points.

As Gaël Panis, Senior Blades Consultant at GP-MC explains, 'new blade manufacturing processes have resulted in better blades but have brought with them the challenge of some common defects within the materials themselves, which can only be identified through NDT.

'The technology is used during the manufacturing process in critical areas, however many of the defects we see are only evident after several months or years of use.'

NDT in manufacturing can be significantly more straightforward than NDT in-service. Working in the field requires consideration for logistics, operating environment, access to material characterisation, probability of detection and reliability of data captured to name just a few.

The current in-service NDT inspection solutions are delivered either by rope access, suspended platforms, or Mobile Elevated Working Platforms, but these potentially bring HSE, logistical and cost challenges.

There are a few alternative innovations being trialled onshore, but these are significantly larger and/or heavier than BladeBUG, and require multiple skilled people onsite, numerous ground anchors and specialist ropes or cable systems.

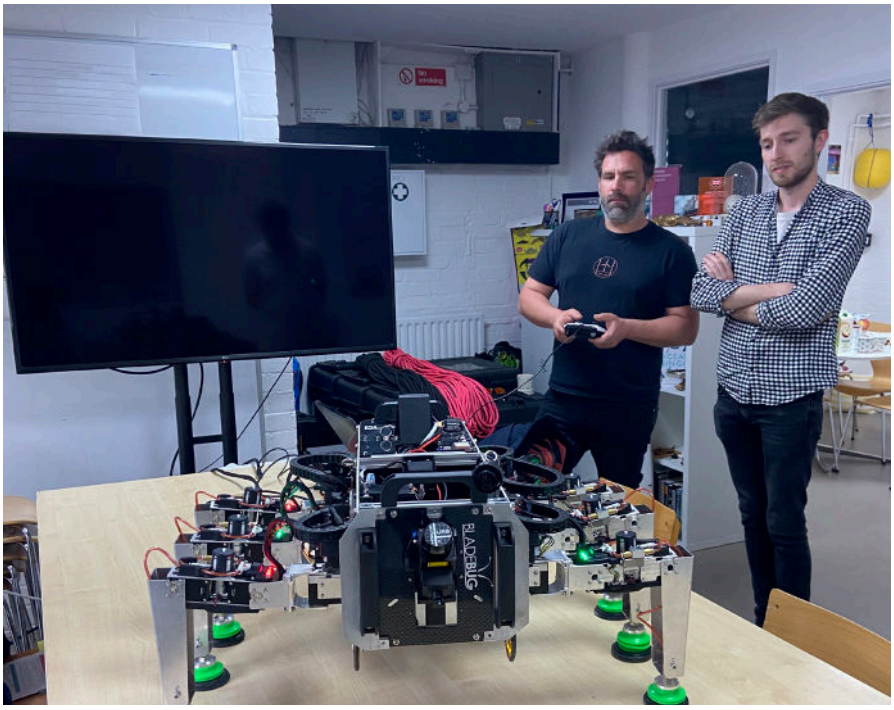
Gaël was instrumental in the pilot project, and saw first-hand how a smaller robot, utilising the latest in NDT technology, could improve the cost, accuracy, and efficiency of IMR. He continued, 'although relatively new technology, with early-stage application within the wind industry, the technology is necessary for the future of wind farm O&M activity, especially as turbines increase in size and quantity.

'That is why this technology has the potential to be one of the best on the market. This was evident in the on-turbine testing we carried out this year, which highlighted the opportunities this compact robot presents for the wind industry.'

Gaël's sentiment is one shared by Cyril Thibault, Sales Manager at The Phased Array Company (TPAC), which provides UT hardware, software and technical support to a range of industries globally, and supplied the phased array UT for the pilot project.

'The size and adaptability of BladeBUG offers a new opportunity for the wind industry. Using a crawler, in conjunction with, or in place of, a drone, means better control over the inspection as the crawler is in contact with the blade, and offers a stable platform for the tool that is being utilised,' Cyril explains.

'The pilot project proved that we could build on our learnings and adjust the platform to suit the solution. This presents huge opportunities for BladeBUG and similar advanced robotics in the wind industry.'



Next steps

The use of NDT technology in wind farm IMR presents a range of opportunities, from improved turbine efficiency through cheaper, safer proactive maintenance, to cost savings within every area of the O&M project, from logistics to insurance.

To realise the potential of this technology within the wind industry, we need further collaboration with all levels of the supply chain, and more early-adopters, like GP-MC, to support the development, testing, trials and industry adoption of this innovative, adaptable and enabling technology.

www.bladebug.co.uk

About the author

Stacey Rivers FIMarEST CMarTech is Business Development and Operations Manager at BladeBUG.

With 27 years' experience in maritime operations, working both offshore and shoreside, Stacey brings a wealth of knowledge and experience to her role.

As a Fellow at the Chartered Management Institute, a Fellow member at IMarEST and a Chartered Marine Technologist, Stacey helps drive positive change through industry collaboration and more than two decades of innovation.

She is also a STEM Ambassador and was previously a Women in Engineering Society (WES) Mentor, supporting and encouraging women and young people to pursue a role in Engineering, Technology, Maritime and Renewable Energies.