# OPERATIONS & MAINTENANCE

Vast industry knowhow combined with leading-edge technology, capturing and delivering the highest quality data to inform and de-risk your projects.
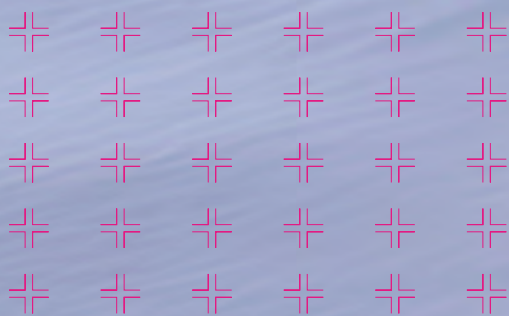
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## Beam
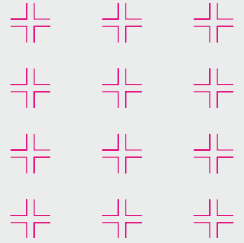
Automating offshore wind

# Your trusted partner for offshore wind subsea balance of plant O&M solutions

We grew our business by specialising in subsea asset integrity campaigns across a global portfolio of offshore wind farms. Our offshore skills were honed in the most challenging environments, and our subsequent asset and technology developments and investments have been driven by the lessons we learned along the way.

We offer industry-leading solutions that improve the safety, efficiency, and integrity, through to the design, construction, and future operations and maintenance (O&M) phases of a wind farm. From high-powered remotely operated vehicles capable of station keeping in strong currents, to the advanced autonomy we use to assist pilots in capturing the highest quality datasets possible, we enable and support offshore wind projects all over the world.

At Beam, we understand the importance of implementing an effective operations and maintenance strategy in order to maximise the uptime and productivity of offshore wind infrastructure.

We specialise in managing and maintaining critical subsea assets, offering quantitative, detailed datasets, allowing you to easily evaluate shifting trends on critical components in order to identify the need for early intervention. We believe that preventive and planned action is always better than reactive and rushed. Ensuring optimal performance and minimising downtime with novel solutions, we ensure that your assets can keep spinning and producing while we carry out our subsea missions.

We pride ourselves on being a technology enabler, and we partner with world-class technology developers and suppliers, so that our clients benefit from substantial time and cost savings across every phase of the offshore wind lifecycle.

We are committed to safety, innovation and delivery excellence, striving to exceed your expectations, and providing tailored solutions to ensure your projects are a success.

## WHY BEAM?

- Our extensive experience across many wind farms worldwide, means we excel in challenging, shallow, tidal, and low visibility environments.

- Tailored solutions designed to dramatically increase efficiency across projects.

- Industry-leading technology deployment, from the assets we operate subsea, to the sensors we use to acquire data. Our reporting delivers an unrivalled level of perspective, accuracy and coverage.

- In-house project management and data processing by a team of industry experts.

- The latest remote and uncrewed survey technologies, along with all electric ROVs, enabling more efficient working across operations whilst lowering emissions.

# VESSELS



We have established longstanding and robust working relationships with vessel partners, allowing us to seamlessly integrate their DP2 vessels into our operations. Our collaborative partnerships have been instrumental in our ability to deliver efficient and reliable solutions to our clients in the renewable energy industry.

Our carefully selected fleet of DP2 vessels are equipped with advanced dynamic positioning capabilities, specifically tailored to meet the unique requirements of offshore wind projects, providing a stable platform for conducting operations in challenging marine environments.

Leveraging these advanced vessels and our substantial industry experience and knowhow, we reinforce our commitment to delivering a comprehensive range of top-tier solutions to our clients, supporting the success and sustainable growth of offshore wind projects across the globe.
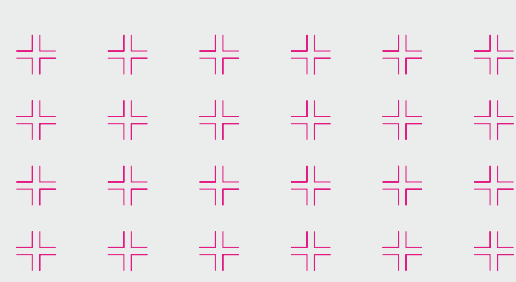
# VERSATILE ROV FLEET

Our vast range of observation, inspection, and work-class remotely operated vehicles (ROVs) are equipped as standard with industry-leading SubSLAM X2 computer vision technology, providing unparalleled insights into the subsea environment in the highest 4k resolution, with simultaneous dense point cloud 3D model production and the ability to instantly perform accurate, contactless metrology tasks subsea.

## ATOM EV

**The ATOM EV is a compact, fully-electric and high performance work class ROV.**

Offering exceptional levels of performance, the Atom EV is particularly suited to high current applications. It is capable of running a full suite of WROV tools, while modular construction and advanced diagnostics ease ownership. Advanced flight control improves quality of operation and reduces the time it takes to do a task. It also consumes less energy and reduces the risk of an oil spill in comparison to hydraulic WROVs, making your whole operation more cost-effective and environmentally friendly.
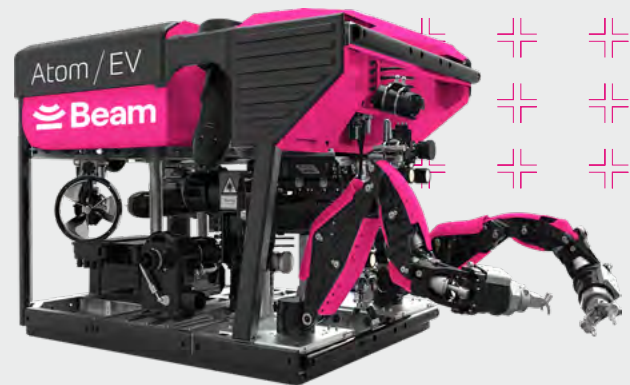
## SEAEYE LEOPARD

**The Seaeye Leopard is an exceptionally powerful electric work-class vehicle.**

Its compact features and impressive vectored thrust enables greater workability and station keeping. The vehicle has a forward speed >3.5knots and sustains a payload of 200kg. It provides a multi-purpose work-class solution ideally suited to construction support, cable and pipe surveys, IRM activities in shallow water and strong current environments while being equally capable in deep 2000MSW environments.

## MISSION SPECIALIST DEFENDER & PRO 5

**The Mission Specialist Defender is designed for greater control, heavier payloads and demanding intervention. The Pro 5 offers a small footprint with optimal performance features.**

The Mission Specialist Series vehicles are designed and built with flexibility in mind. The modular design enables easy maintenance and seamless integration with a variety of tools for a custom solution to your underwater challenges.

# SOLUTIONS

## Warranty Surveys

Offshore wind farms are costly to operate and maintain, and any problems detected during the fixed warranty period must be addressed by the original equipment manufacturer and/or installer to guarantee that your assets remain cost-effectively operational for as long as feasible. As the warranty term approaches its end, it is critical to notify the manufacturer/installer of any problems that require correction under the defect remedy period. Unidentified problems that are not discovered in a timely manner result in needless unplanned costs and production downtime.

We are specialists in providing end-of-warranty inspection solutions that save our clients time and money by quickly identifying critical component defects as soon as possible, allowing warranty claims to be filed on time. As part of this process, we thoroughly examine your subsea infrastructure, carefully assessing the condition and structural integrity of critical components. Leveraging our industry-leading SubSLAM X2 technology, we provide highly detailed digital reconstructions of defective components, allowing asset owners to effortlessly interrogate and navigate 3D digital twins of their assets to verify results and component performance against original design criteria.

We deliver the highest quality data and baseline reporting that can be easily re-visited, re-inspected, and re-evaluated against subsequent datasets, in order to plot trends and identify any need for early intervention.

Defective components usually correspond with costly remediation campaigns, and these problems often present themselves at an early stage by way of anomalies. Our team of in-house experts are equipped with extensive industry knowhow, and know exactly what to watch out for.

- Industry-leading technology, sensors and the most capable ROVs in the field - all designed and battle-hardened in the harshest environments - ensuring the capacity to operate seamlessly through currents and conditions that would bring others to an immediate halt.
- The highest quality data capture and reporting, enabling warranty claims to be secured against the manufacturer or other contracted parties.

- Identify the need for remedial work early, preventing avoidable costs.
- Pinpoint defects and anomalies that might lead to future damage, enabling asset owners to plan any necessary pre-emptive action.
- The highest quality data sets, allowing easy interpretation of critical subsea component condition and performance against design.
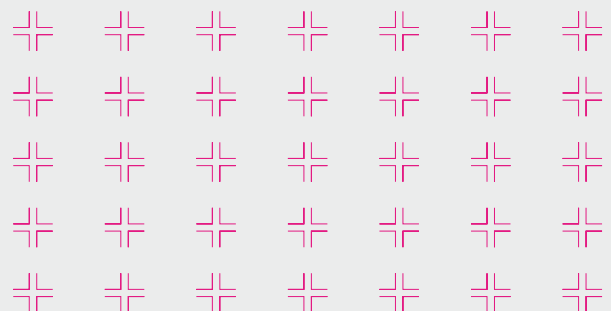
## Export & Array Cables

From offshore to inshore, we understand the importance of thoroughly checking and monitoring the integrity and condition of subsea cables post-installation, and ensuring that they remain buried in order to reduce exposure to future issues and risks such as being trawled or subjected to dropped objects.

We offer a comprehensive range of subsea cable survey solutions. These range from scour monitoring and seabed surveys, using sensors such as multibeam, side-scan sonars and acoustic sub-bottom imaging technology, through to highly detailed ROV inspection surveys, using state-of-the-art 3D vision and digital twinning technology combined as standard with the highest definition 4K video footage.

- Examine the burial status of cables and efficiently identify or monitor cable exposure or free-span.
- Pinpoint any existing or potential future cable damage, enabling preventative action if required.
- Understand extent of mobile seabeds and sediment movement and/or sediment level changes in comparison to previous surveys.
- Efficiently identify any maintenance required, and assess the state of existing remedial work.
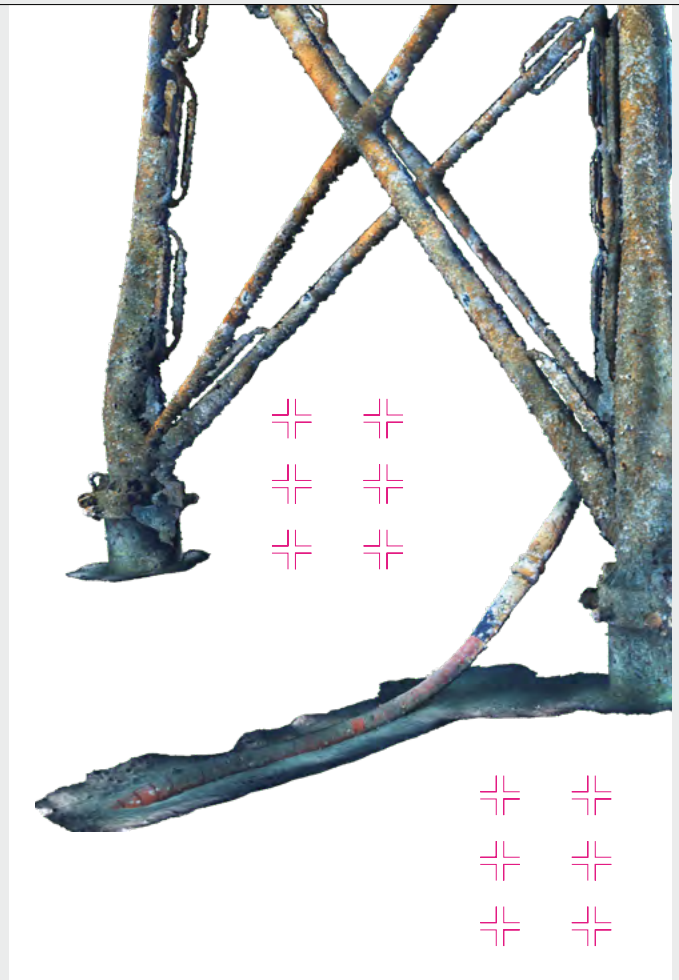
## Cable Depth of Burial

We perform efficient cable depth of burial (DoB) surveys, delivering precise and accurate data insights and reporting. Our surveys span critical areas ranging from the shore, subsurface to the substation, and then to the arrays, into and out of burial for entry into the monopile/bellmouth. The information we provide is essential for cable security and in order to reduce cable maintenance or replacement costs through risks such as fatigue, dropped objects and trawling.

Our team is experienced in deploying an extensive suite of leading-edge tools, including acoustic sub-bottom imaging technology, and integrated cable tracking systems to find the perfect solution for your required integrity assessments.

- Accurate and repeatable DoB data that identities where remedial engineering is required.
- Precise location and size estimates of boulders and other objects that may pose a risk to cables.
- Assess the level of scour protection.
- Identify any areas of exposure or freespan.

- Assess the surrounding seabed to track changes to the environment.
- Surveys can be performed on energised cables, using acoustic technology.
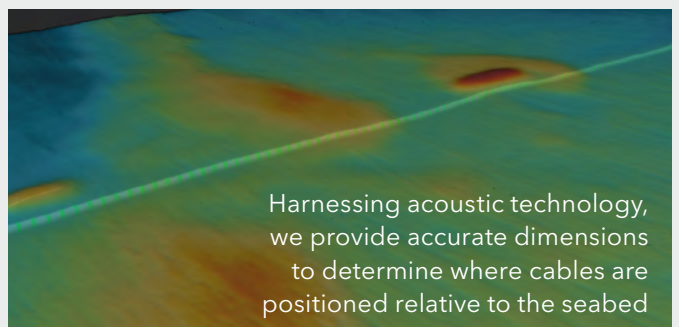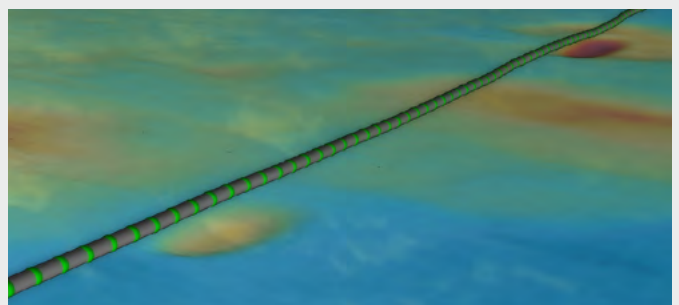
Harnessing acoustic technology, we provide accurate dimensions to determine where cables are positioned relative to the seabed

## Cable Protection System Remediation

Faults with offshore wind cable protection systems (CPS) have become an industry-wide problem in recent years, affecting multiple developments across the UK and Continental Europe. Issues commonly arise where continuous movement of the CPS across installed rock scour causes excessive abrasion, posing the risk of eventual cable failures in the field.

Harnessing SubSLAM X2 technology, we have revolutionised CPS inspections, providing stakeholders with a level of accuracy, detail and perspective that no other technology can offer. Our systems deliver contactless subsea measurements in real-time, as well as creating live digital models with sub-millimetre precision.

Our technology, which delivers live underwater 3D point clouds, produces a precise model of the entire length of the cable structure in one go, from cable entry/exit points through to seabed burial. Generating digital twins of the CPS, we offer clients a complete picture of the problem at hand, viewable live via our data platform, Vaantage. This not only gives users a greater degree of coverage with the ability to thoroughly inspect models from all angles, but they can also examine the finer detail.

By comparing this reference model to subsequent inspection difference models, we provide an easy way to track changes over time, guiding early informed decisions to prevent CPS failure, and enabling stakeholders to monitor whether conditions are constant or deteriorating year-on-year.

Dense point clouds are streamed back to shore in real-time, allowing asset integrity engineers to take instant
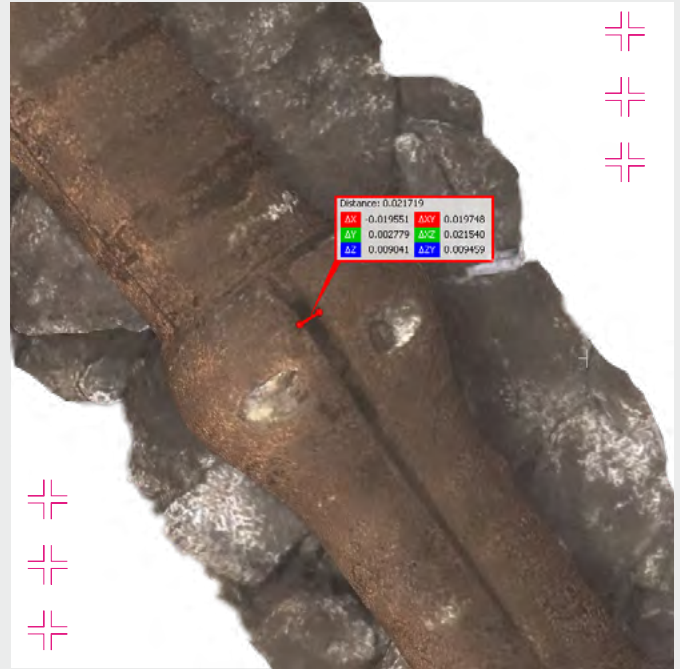
measurements of free-span, distance from the bell mouth into burial, gaps manifesting on CPS half shells, and much more from the comfort of their office. From one single scene that can be viewed on any device, anywhere in the world via Vaantage, users have a complete overview of the problem at hand, together with the information needed to start discussing solutions and inform potential remediation techniques such as underpinning or stabilisation by rock bag placement.

Combining SubSLAM X2 with our extensive portfolio of ROV capabilities and expertise, huge savings in mobilisation costs, project time, and vessel days are realised.

By minimising offshore personnel requirements, human intervention and removing the need for in-water calibrations or additional navigational equipment, the reductions in schedule time, cost and emissions across operations become immediately apparent.

- Detailed 3D reconstructions of CPS are transmitted back to shore in real-time.
- Allows users to interpret datasets quickly and easily in real-time, through our intelligent data platform, Vaantage.
- Precise, instant measurements can be taken by the user in a high definition 3D environment.
- Point clouds for monitoring via digital twin/difference modelling.
- Facilitates immediate planning for stabilisation pro-grammes.

## Critical Components

Using Edge ML and volumetric difference modelling, critical components can benefit from the data sets that SubSLAM X2 unlocks. Artificial intelligence can highlight depletion status, whilst 3D digital twins allow a more detailed assessment to calculate the rate of depletion or change against the original component design or baseline model.

The utilisation of 3D point clouds provides quantitative analysis of components, allowing stakeholders to monitor whether conditions are deteriorating over time, across critical components and features such as:

- Cable protection systems
- Anodes
- Coatings
- Marine Growth
- Scour
- Seabed mobility
- Cable relative depth to seabed surface
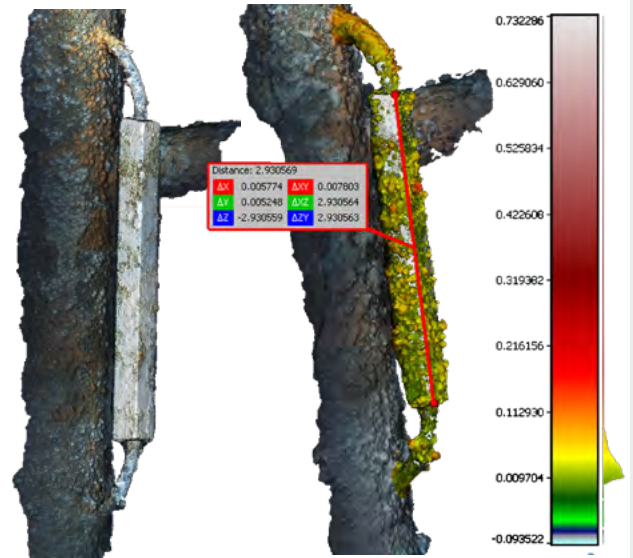


- Conduct volumetric calculations to inform condition and rate of deterioration.
- Difference modelling - compare against original design or previous survey to plot trends and assess performance of components over time.
- Enables anodes to be replaced at the right time, avoiding costly corrosion issues.
- Using machine learning to categorise component conditions.
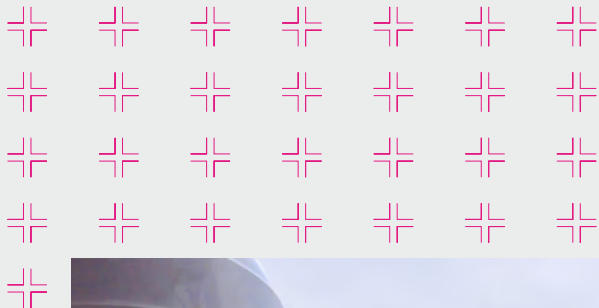


## ALARP Extension

Often the jack-up vessels that constructed our wind farms are not available to revisit the same site to perform repairs such as blade or gearbox replacements.

With the advances in heavy-lift vessel designs, and the sheer scale of their ever-changing footprint, it is more than likely that at some point you will need to open up the envelope that was originally surveyed in order to locate the jack-up spudcans, and ensure there is no risk of potential UXO, before placing them on the seabed.

We are experts in deploying survey solutions to widen the grid around wind turbine generator locations. Deployment of uncrewed surface vessels with multibeam, sub-bottom profiling technology, as well as towed magnetometer, provide the datasets required for our geophysicists and UXO consultants to examine the location and provide ALARP sign-off.