WINDS OF CHANGE

SÖREN THEMANN LOOKS AT HOW NEW TECHNOLOGY HELPS TO OPTIMISE ON-DEMAND MARINE SURVEYS THAT ARE OFTEN REQUIRED DURING OFFSHORE WIND FARM INSTALLATION, OPERATIONS AND MAINTENANCE

Offshore wind farm construction projects are demanding, potentially hazardous and always expensive. The detailed planning, including site selection and suitability investigation, as well as quantitative risk analysis adds to the cost of the dedicated vessels, specialist equipment and professional manpower needed to survey the area, prepare pilings, and install and connect new wind turbines to the grid.

Across a wind farm consisting of hundreds of turbines, this all adds to the immense overall lifecycle costs, which ultimately dictate the cost per kWH of energy produced. And while offshore wind power is essential to the world becoming carbon-neutral, the economics must work to ensure more nations adopt it as their primary energy source. Therefore, energy producers and service companies are always looking at ways to cut costs and, just as importantly, secure economic predictability.

The cost of standard marine surveying is built in at the planning stage of a wind turbine installation, but the unpredictable nature of such projects – caused by the maritime environment – has seen the need for so-called 'gap-filler' surveys rise in line with growth in turbine installations over the past five to 10 years. The reasons are various: a completed survey may have missing, corrupt or suspect data that needs to be checked or an expensive specialist tool may have been lost over the side of an installation vessel, where it may be faster and more cost-effective to recover it, rather than pause operations, buy a new tool and wait for it to be delivered.

Whatever the reason that on-demand, fast turnaround surveys may be needed at an offshore wind installation, the immediate requirement for the service will generally make it more costly than a standard planned survey. Critically, because the area to be surveyed will usually be localised and small, the client will need a capable survey boat and expert personnel, but only for a very short amount of survey time. This leads to service companies seeking out faster vessels of opportunity to reduce the length of transit time and therefore the cost of hire. However, vessels of opportunity may not be dedicated survey boats, which introduces the challenge of procuring, installing and operating the required hydrographic survey systems.

It is not always easy. The specialist nature of the equipment means that it won't necessarily be readily available in the closest port or even in the same country. Procuring the systems and installing them all adds to the costs for what is seemingly a small job – a gap-filler survey – rising quite sharply. Which is of course, contrary to the energy and service company's cost reduction plans that are so essential to the health of the offshore wind sector. The specific challenge then is to provide high quality data while reducing the cost of short jobs with long transit times.

Simplifying survey

Multibeam echo sounder (MBES) technology is, in combination with other diverse sensors, essential to the efficient acquisition of high-quality marine data and in the case of the application examples of gap-filler survey – re-running specific survey lines for verification purposes or locating known objects – exactly what is needed. However, MBES systems are difficult to install, complex to configure and calibrate, and certainly not always user-friendly.

These were the issues that guided the development of the new 'integrated Hydrographic Survey System' (iHSS), a technical solution that optimises the procurement, deployment and operation of MBES and associated systems on vessels of opportunity.

The iHSS concept is straightforward – take a field-proven MBES series from an established manufacturer R2Sonic (USA) and

neatly package it in a turnkey system that is configurable with all ancillary equipment and sensors, according to the needs of the survey mission. The integration allows for pre-configuration and streamlined logistics, and in most cases offshore wind service companies tasked with an unplanned survey can have the system ready for deployment in hours or days (in Europe).

When a service company needs to mobilise urgently to check data or find a lost tool, a fast vessel of opportunity will usually be available nearby and the iHSS can turn it into a survey platform able to acquire data to the new IHO S-44 Exclusive Order standards. This is in part made possible through a unique all-in-one pole mount design with multibeam transceiver, inertial motion unit and GNSS antennas in one reference frame, which simplifies installation and reduces potential errors from inconsistent or wrong offsets.

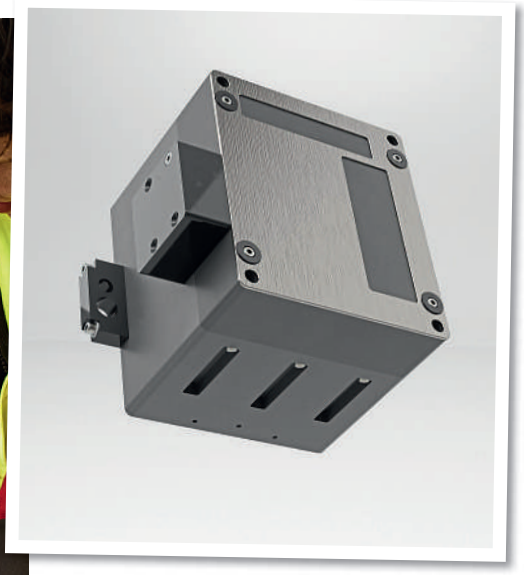
Due to the pre-configured and integrated nature of the system design, it can take less than an hour to mobilise an iHSS on almost any vessel, so full survey-ready capability can be achieved in a matter of hours after delivery. Typically, most end-users would expect to wait days or weeks before being able to start a project.

The full-size iHSS, which is based on R2Sonic's Sonic 2024 multibeam echo sounder and delivered in 2-3 Pelican cases depending on the configuration required, is used for deeper water offshore surveys, but the iHSS concept has also started to become popular in the shallow-water and inland survey sector. Accordingly, Subsea Europe Services has scaled the system, with the result a new variant called the iHSS-Compact. Able to offer the same high quality data acquisition but with an ideal depth to 50m, the system uses a smaller, lighter R2 Sonic 2020 multibeam system and can be delivered with everything need in a single Pelican case.

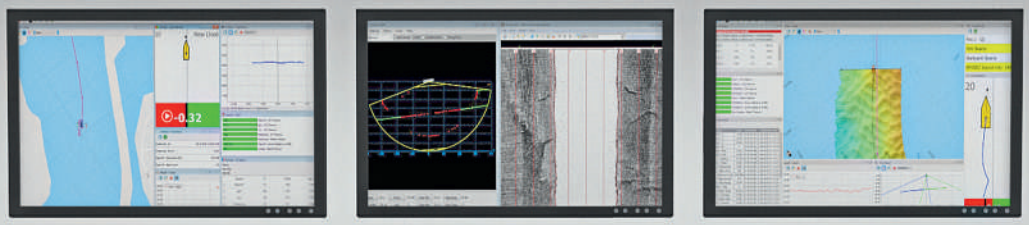
An all-in-one pole mount helps to reduce errors

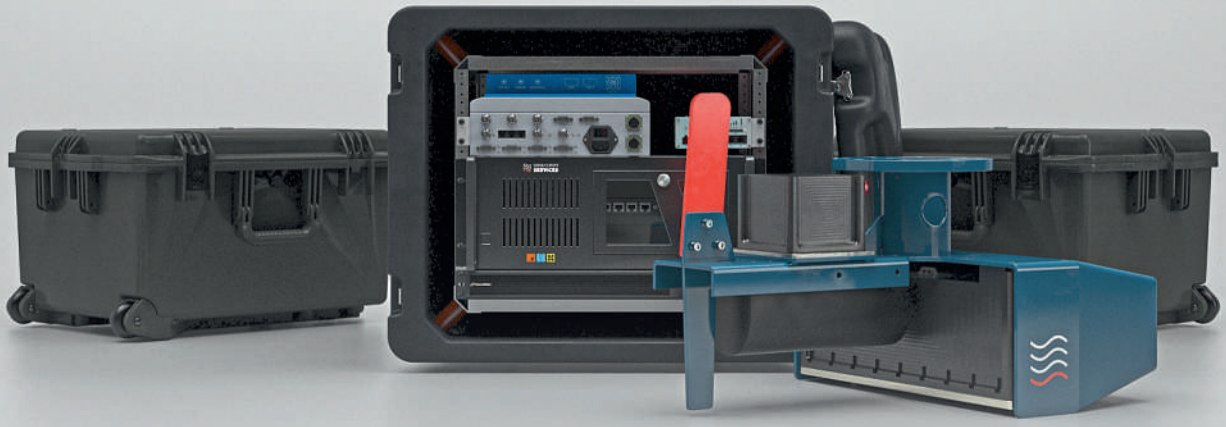
A CORE AMBITION THAT CATALYSED THE IHSS' DEVELOPMENT WAS SIMPLY TO MAKE IT POSSIBLE FOR ANY ORGANISATION TO COLLECT AND EVALUATE MARINE DATA PROFESSIONALLY

Attaching the MBES to the iHSS pole mount system



The R2 Sonic 2020 MBES used in the iHSS-Compact





The iHSS

AI to come

Introduced at the start of 2020, the iHSS has helped experienced survey companies to build their capabilities already. German survey company Nicola Engineering used an iHSS to locate and scan a small object of concern on the foundations of a North Sea windfarm in the autumn of 2020. An urgent project for the energy supplier, Nicola Engineering was able to complete it within 48 hours by installing an iHSS on a fast vessel of opportunity.

A core ambition that catalysed the iHSS' development, however, was simply to make it possible for any organisation to collect and evaluate marine data professionally. Today, in-house or hired expertise is integral to conducting marine surveys and post processing, but increased automation and AI powered autonomy could one-day deliver results to the same standard that professional surveyors can achieve today.

AI can simplify the process of acquiring high quality marine data for all involved. It fits perfectly with the goal of making marine data available to organisations that don't have in-house experts through the integration of complex technologies into use-friendly solutions that can be operated by almost anybody. Having AI making some of the decisions or simply providing decision support is the key to opening improving access to marine data for all, which is why the iHSS manufacturer is already working on AI ecosystems for the development of new generations of AI assisted survey solutions as a member of the Artificial Intelligence Center Hamburg.

While the iHSS doesn't currently use AI, the solution can be viewed as a first step on the journey to autonomous marine survey as it is already helping companies and organisations without in-house surveyors and experts to acquire marine data easily. Today, this is mostly achieved by reducing the technical burden of deployment and calibration, but the deep integration of all the required systems allows for more automation also during the survey itself.

Automatic features, such as R2Sonic's ROBO mode, work best in controlled environments with not too many variables. It works in conjunction with the saturation monitor to correctly and accurately set the system gain and relies on empirical data provided by advanced algorithms that comes with the R2Sonic MBES. The combination of a well-tuned survey system and advanced algorithms pave the way for surveys to be conducted with fewer professionals on board.

New business models

Using optimised technology and fast vessels, suppliers in the offshore sector can look to add new services to their offering. For instance, a scientific firm monitoring the water column to secure health of the marine ecosystem surrounding a wind farm may now also be able to offer hydrographic data acquisition without investing in in-house expertise or the capital costs of purchasing a vessel. Nicola Engineering established a new business model with the iHSS, by offering a dedicated fast survey service to customers in a commercial partnership with the vessel owner ProMarine BV and Subsea Europe Services.

Since then, the scope and demand for the iHSS on fast survey boats has grown, with the result being the formation of a new survey company to specialise in providing only on-demand, gap-filler type surveys. Established by Nicola Engineering and ProMarine with survey technology provided by Subsea Europe Services, the new company – Nicola Offshore – will focus on several key services including object search and unexploded ordinance, which will be highly relevant for the offshore wind sector throughout Europe.

Unplanned marine surveys are just one tiny aspect of reducing operations and maintenance costs for a wind farm at sea, and it's important to understand that marine data alone is not a singular challenge in the economics of offshore wind power. But, when considering hundreds of parallel, unforeseen operational or maintenance problems all adding costs over the lifetime of a wind farm, reducing the costs of gap-filler surveys can contribute to the lower cost of renewable energy.

Further, the use of integrated technologies on fast vessels of opportunity is helping marine survey to become a more open, transparent and available service that practically anyone can use. It may take decades until the technology is fully automatic and AI-controlled, but then again the first offshore wind farm was established in 1991. And look where wind power is today.

The IHSS-Compact is a scaled down variant for shallower waters

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