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3D-Positionierung
auf See

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Autonomy enables German survey companies to leverage opportunities from offshore wind

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In the next few years, a lot of work awaits hydrographers in connection with offshore wind. But resources are limited. Therefore, more autonomy and digitalisation must enter the surveying practice. Autonomous platforms such as uncrewed surface vessels (USVs) with intelligent multibeam systems can collect data faster. Meanwhile, experts can take care of multiple projects at the same time and deal with the really tough decisions they are trained to make.

autonomy level | Autonomy Engine | Mantas T12 | USV | Survey-as-a-Service | offshore wind
Autonomiegrad | Autonomy Engine | Mantas T12 | USV | Vermessung als Dienstleistung | Offshore-Wind

In den nächsten Jahren wartet viel Arbeit auf Hydrographen im Zusammenhang mit Offshore-Wind. Doch die Ressourcen sind begrenzt. Daher müssen mehr Autonomie und Digitalisierung in die Vermessungspraxis einziehen. Mit autonomen Plattformen wie besatzungslosen Oberflächenfahrzeugen (USV) mit intelligenten Fächerecholoten können Daten schneller erfasst werden. Währenddessen können sich die Experten um mehrere Projekte gleichzeitig kümmern und sich mit den wirklich schwierigen Entscheidungen beschäftigen, für die sie ausgebildet sind.

In February 2023, the German government launched a tender related to four »un-surveyed« areas in the North Sea and the Baltic Sea with a combined offshore wind capacity of 7 GW. The immediate effect of this is clear – more work will be available for German hydrographers and their marine survey company employers. Not just for the initial campaigns but for countless surveys over many decades, as the wind farms and subsea infrastructure are planned, built, operated and finally decommissioned.

While positive news for the marine survey sector in Germany, it's only part of the story. More tenders will come as the government seeks to unlock the offshore wind production targets set in last year's so-called »Easter package«, which opened the door for significantly more wind energy production capacity. All new development areas will require the same levels of up-to-date hydrographic data over many years. This leads us to ask, are we as an industry ready to deal with the surge in demand coming from offshore wind? Are there enough of us with the knowledge and expertise offshore wind needs? And what can we do if demand outstrips supply?

Like any country, hydrography is a niche sector in Germany, and we have a finite pool of skills to go around. All clients, including wind farm owners/operators and their engineering contractors,

will need to book their data acquisition campaigns further in advance than they would before. But as we know, due to everything from the weather and licensing problems to the availability of equipment and skills, it's the dynamic factors that decide if a survey will even happen when planned, let alone produce the desired data successfully.

Making the most of your resources

At least one of these issues – the availability of skilled surveyors – can be addressed by implementing more autonomy into the marine survey workflow, with the result being that data can be acquired much faster and therefore the needs of more clients can be addressed. Instead of managing the output of a single survey package on a single survey boat, autonomous platforms present the opportunity for marine surveyors to oversee multiple independent or connected platforms and in doing so, massively increase the amount of data they are responsible for.

Of course, marine surveys using uncrewed surface vessels (USV) are already happening. But with increased autonomy levels it's possible to reduce the number of human touchpoints required, making it safe for a single skilled surveyor to oversee the output and operation of two autonomous platforms working on the same project – doubling

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Autonomy Levels	Level 0 - No Autonomy	Level 1 - Operator Assistance	Level 2 - Partial Autonomy	Level 3 - Conditional Autonomy	Level 4 - High Autonomy	Level 5 - Full Autonomy
Vessel	Crew control everything	Most functions controlled by crew but some can be done automatically by the vessel	At least 2 critical functions are automated such as speed and heading (usually via autopilot), but the crew must be ready to take instant control.	Crew still necessary, but not required to monitor the situation continuously.	Vessel performs safety-critical operations for the entire voyage, human override is still an option.	Vessel performs all tasks under all conditions. No human attention or interaction required
Sensor	Surveyor controls everything	Most functions controlled by surveyor but some can be done automatically by the sensor.	At least 2 critical functions are automated (like range and gate track), but the surveyor must be ready to take control	Sensor performs critical functions automated (range, gate, swath, power). Surveyor still necessary, but not required to monitor sensor all the time.	Sensor performs all functions automated, human override is still an option.	Sensor performs all survey tasks under all conditions. No human attention or interaction required!
Survey system	Captain and Surveyor control everything.	Most functions controlled by captain and surveyor but some can be done automatically by ship and sensor (independently).	At least 2 critical functions are automated for both, ship and sensor (still independently).	Survey System (ship + sensor) are loosely coupled and perform critical functions as a coupled system.	Survey System (ship + sensor) are tightly coupled and perform all functions as an integrated system, human override is still an option.	Survey System (ship + sensor) are tightly coupled and perform all functions as an integrated system. No human attention or interaction required.

Fig. 1: This table shows the various levels of autonomy with the red boxes denoting the development path for realising true autonomy for marine survey

the amount of data acquired when compared to traditional marine survey practices.

The approach puts no extra pressure on marine surveyors and support staff. In fact, the automation of many factors makes the job less demanding while being more rewarding, as professionals still get to exercise their training and judgement whilst delivering even more value for their employers and clients. According to the intelligence of an autonomous platform or hydroacoustic package, it is possible that marine surveyors could oversee even more USVs simultaneously as a »swarm« at an individual location from a mothership or split across different projects geographically, from an operations and control centre ashore.

There is still work to be done to get to this point, but improving the autonomy level for marine sur-

vey platforms and sensors will result in much more intelligent systems (Fig. 1).

Sensors are getting more intelligent

In order to get to »True Autonomy«, where USVs and USV swarms can operate with fewer humans in the loop, there is still work to be done on autonomy controller technology – the »Autonomy Engine«; an AI-powered »brain« that ensures safe and effective mission planning, navigation, obstacle avoidance and self-directed decision making.

Central to this is the integration of more intelligent multibeam systems that can process acquired data on board and together with the Autonomy Engine, enable independent operation based on real-time data. Subsea Europe Services focuses the efforts of its R&D centre (Fig. 2) at the Ocean Technology Campus Rostock on integrating these technologies and the required software development; with the goal of improving data acquisition and on-board processing for boosting the capabilities of today’s autonomous platforms.

Further, new generation multibeam systems will include the ability to acquire data at greater speed – IHO Executive Order at up to 20 knots even (of course depending on water depth), which makes them ideal for use on smaller, more agile USVs like Subsea Europe Services’ 12 ft long »Autonomous Surveyor«, a Mantas T12 model from US manufacturer Maritime Tactical Systems Inc., MARTAC (Fig. 3). With multibeam systems capable of data acquisition at up to 20 knots, a single Mantas T12 has the potential to collect five times as much data in the same timescale as is possible today. The difference is exponential – scaling two platforms results in 10 times as much data, and so on.

Reducing the cost of data depends heavily on optimising the man-machine-ratio, which in turn,



Fig. 2: Subsea Europe Services conducts its R&D work from a new facility at the Ocean Technology Campus Rostock



Fig. 3: The »Autonomous Surveyor« USV is ready to deliver high-speed hydrographic surveying as soon as new multibeam systems are available to provide this functionality

demands the application of even more intelligent autonomous decision-making intelligence. Currently, the company's »Survey-as-a-Service« offering has a man-machine-ratio of 1:2, but Autonomy Engine and project workflow automation developments in the pipeline are expected to make it possible for a single operator to manage even more systems concurrently. Subsea Europe Services is aiming towards autonomy levels 4 and 5 in the next 18 months, which is complete automation of platform and payload for 80 % of survey time.

The Autonomous Surveyor will be able to leverage the capabilities of the next generation of multibeam systems as soon as they are available, as it is already one of the fastest and most agile offshore-capable marine survey platforms available today.

Digital workflows help to manage the data

Subsea Europe Services' R&D track also connects the acquisition of bathymetric data to subsequent data management, processing and delivery. The company's mission to simplify marine data acquisition by providing clients with truly autonomous survey systems that deliver high-quality data at extremely low operational costs and do not require large operations centres to scale, is completed with the addition of digital data management in the Cloud, which also opens up the ability to offer »Data-as-a-Service«.

The rationale is simple; once the acquired hydrographic data is digitalised, its management

and processing can be easily automated. The time and cost savings of reduced human interaction at this stage can be added to efficiencies that Subsea Europe Services is creating during data acquisition that have the potential to reduce the marginal cost of data to game-changing levels.

Moving marine surveyors to motherships (Fig. 4) and shore-based control centres for the management and oversight of autonomous survey platforms reduces operational expenditure massively but not because it is cutting jobs. It's



Fig. 4: A central mothership can be used to manage a single USV or a swarm consisting multiple survey platforms

a change in thinking in how marine surveys are carried out but skills and experience are still required. The objective is to leverage more from the available resources as demand for marine data grows in line with offshore wind development. There won't be enough surveyors to go around, so the autonomous platforms will fill the gap and make the industry more profitable and sustainable.

There are further savings to be made elsewhere. Autonomous craft are less expensive to build than crewed platforms that must cater for the humans on board. They are smaller, more agile and easier to maintain. And due to more favourable economics, they can easily take advantage of innovative electric propulsion solutions, which can reduce fuel costs and be 100 % carbon neutral (if batteries are charged using renewable energy sources).

Subsea Europe Services' mission to chain the data acquisition efficiencies of True Autonomy at sea to the significant marine survey workflow advantages unlocked by Cloud data management are already well advanced. The company is using the TrueOcean Marine Data Platform to manage data from the Autonomous Surveyor regularly and while today it is mostly data acquired during trials of new autonomy controller software or workflow automation, the ability to share data in a single platform on the cloud will provide value for commercial clients.

Overall, autonomous operations and digital data management have the potential to complement and enhance the work of skilled workers, rather than replace them entirely, by allowing them to focus on more complex and higher-value tasks while reducing the burden of repetitive and time-consuming work. //

Die nächsten Schwerpunktthemen

- HN 126 (Oktober 2023) **BIM und Digitale Zwillinge**
- HN 127 (Februar 2024) **Ozeandekade**
- HN 128 (Juni 2024) **Munition im Meer**