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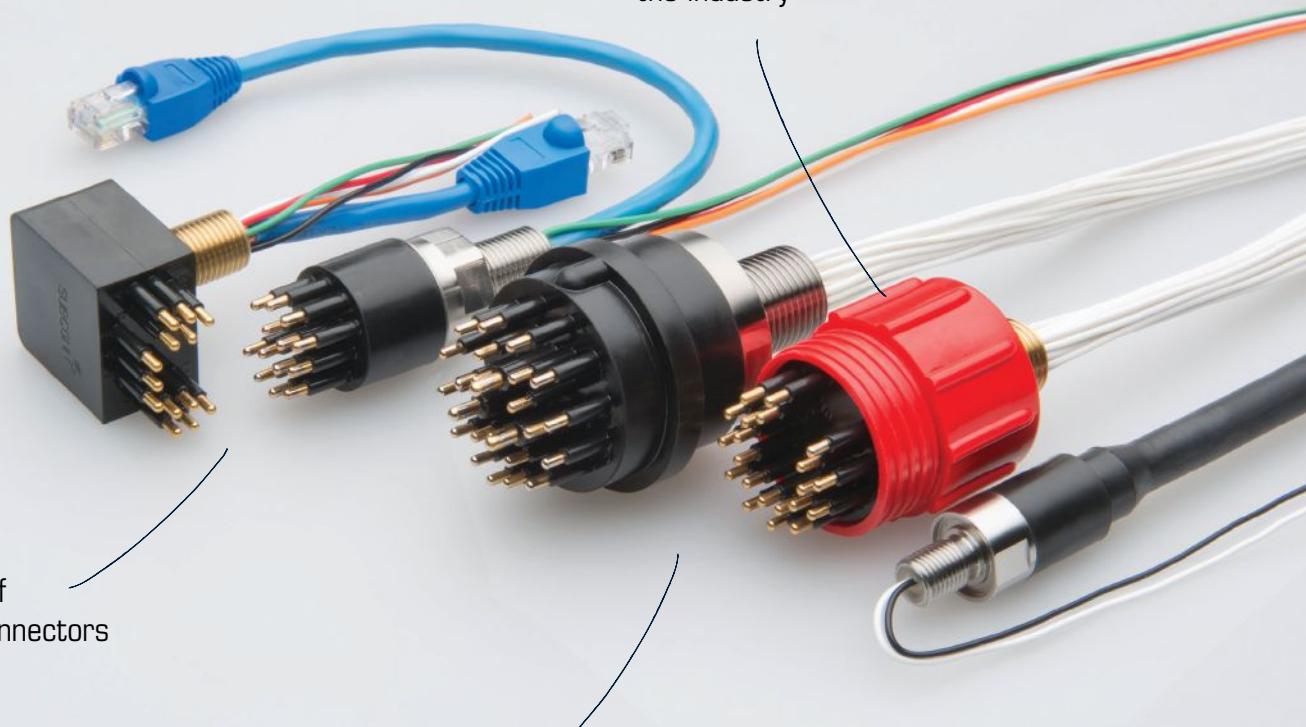
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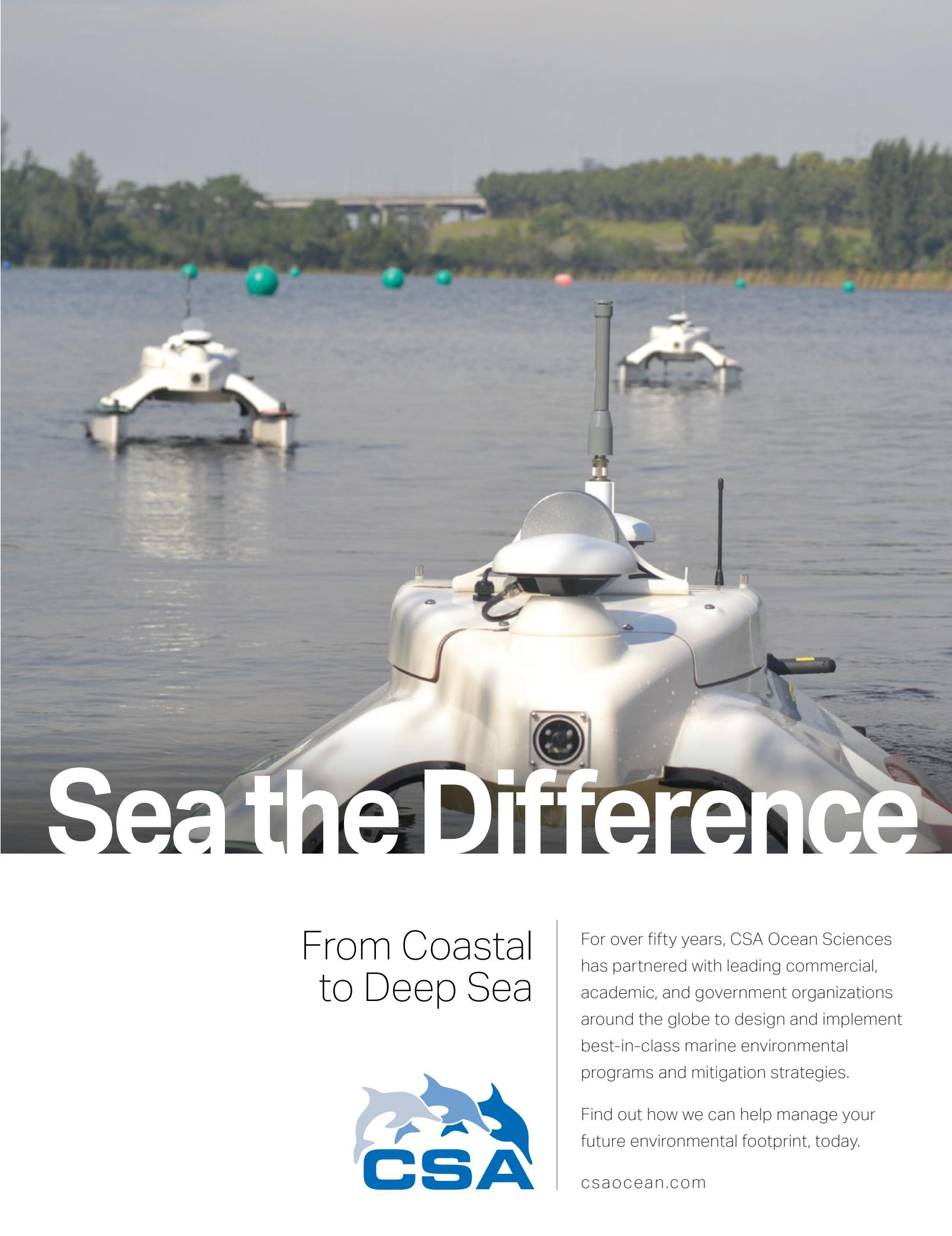
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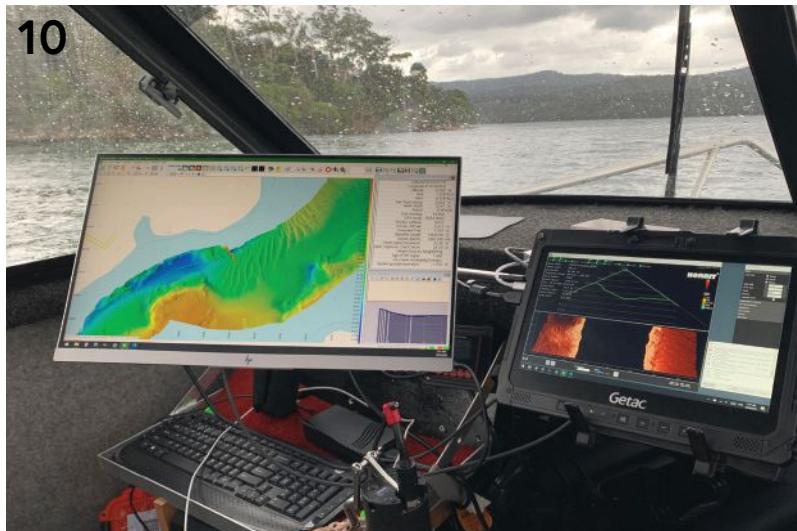
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### ON THE COVER:

Advances in subsea swarm technology, like the new Quadroin AUV (EvoLogics/Heron), are set to unlock a new era of uncrewed hydrographic survey. (Photo credit: Florian Büttner, Heron)

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### [WITH THANKS - Ed.]

As the Decade of Ocean Science for Sustainable Development (2021-2030) presses on, so does the demand for high-quality marine data. But data is purely abstract without the assurances of advanced ocean technology and the expert services provided by hydrographic survey providers. This month we bring you a marriage of both with a stellar line-up that includes Ocean Infinity, MMT, SEARCH Inc., Europe Subsea Services, and Torqeedo.

*Ed Freeman*

[editor@oceannews.com](mailto:editor@oceannews.com)

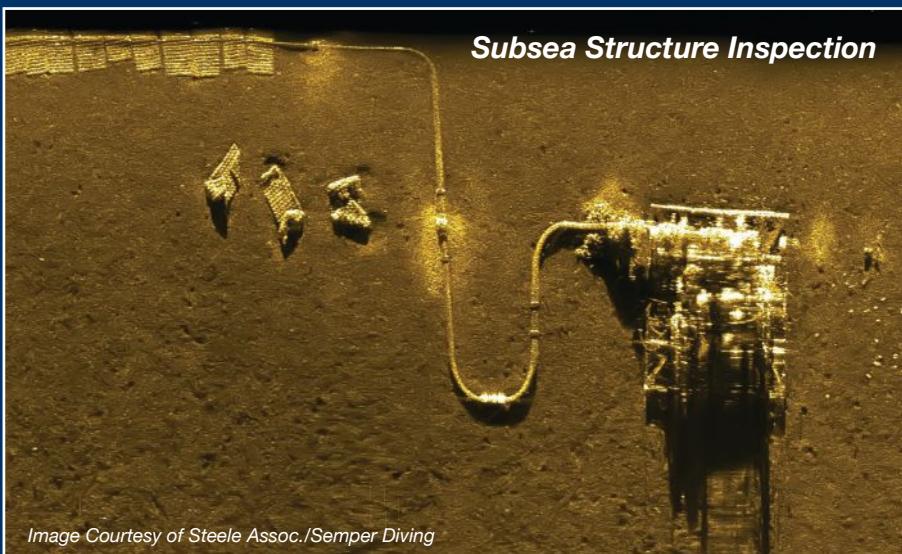
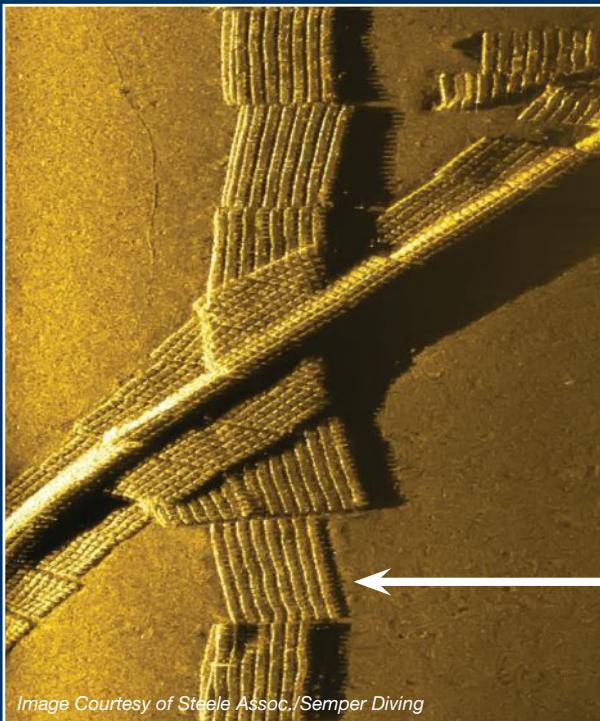
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## AT SEA WITH CREDENTIALS

**BY CHRIS ECHOLS***Commercial Manager, CSA Ocean Sciences, Inc.*

Certified Hydrographers Required! Whenever I see that request in a proposal issued by an offshore energy developer or tier contractor, I always grimace: "here we go again," I mutter to myself.

Compared to some more traditional professions, such as medicine or law, hydrography is a niche discipline. Suffice to say, Hydrographic Surveying often struggles for prominence on any high school career counselor's list. Therefore, the onus falls somewhat on the survey industry to educate future generations about what the job entails and, ultimately, establish a steady recruitment funnel to satisfy the market's growing insistence on "certified hydrographers" only.

Defining a hydrographer—broadly speaking someone involved in applied sciences that supports the measuring and identification of physical features under the water—is problematic enough given the potential scope of work involved, but what deems them to be certified? This is where the water runs murky. Is a hydrographer, for example, part of a trade association or a professional industry? Does spending years on the water grant someone "certified" status?

### ACCREDITING BODIES

There are various organizations around the world that focus on accrediting aspiring hydrographers, but each vary in terms of recruitment and training. Assessment also tends to be local; individuals pay a fee, take a proficiency test, and on successful completion are considered certified.

In the U.S., most certification is governed by the National Society of Professional Surveying (NSPS) and NOAA. The NSPS website states that "certification is official recognition by one's colleagues and peers that an individual has demonstrated professional integrity and competence in his or her field. To earn a certification as a Hydrographer a person must demonstrate to a certification board that one is competent performing hydrographic surveys."

Now, from an international perspective, there is the International Hydrographic Organization (IHO). The IHO doesn't award individual certificates but they do, along with the International Federation of Surveyors (FIG) and the International Cartographic Association (ICA), recognize educational institutions if their educational curriculum provides comprehensive and broad-based knowledge in all aspects of the theory and practice of hydrographic surveying and allied disciplines. Institutions can be IHO Cat A or IHO Cat B certified.

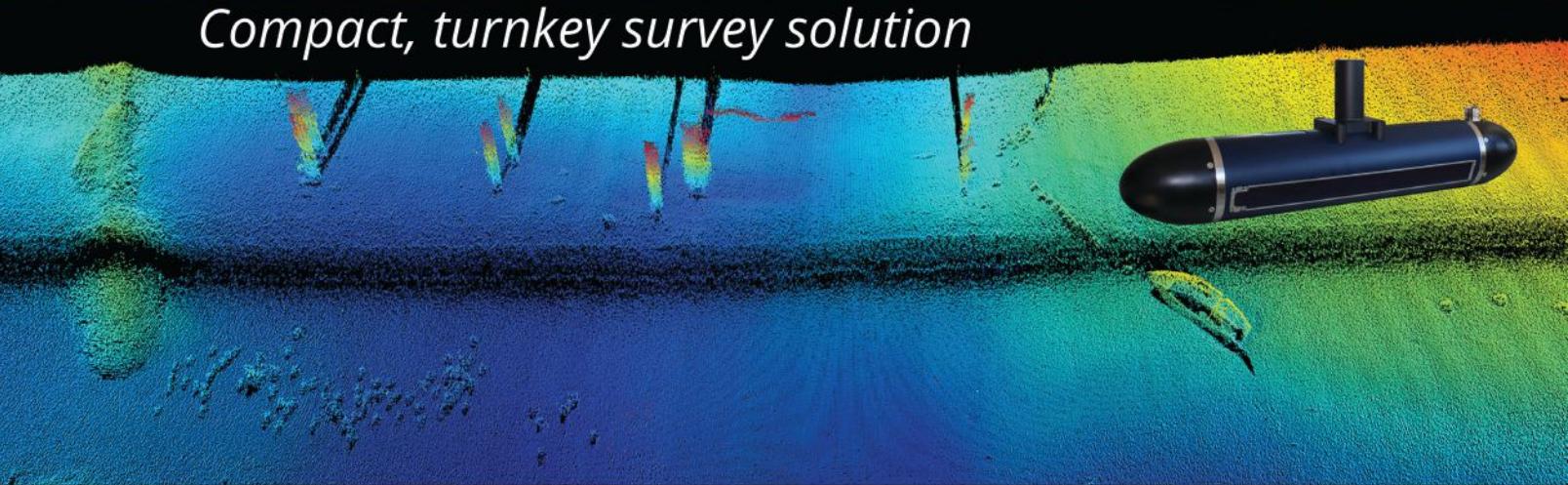
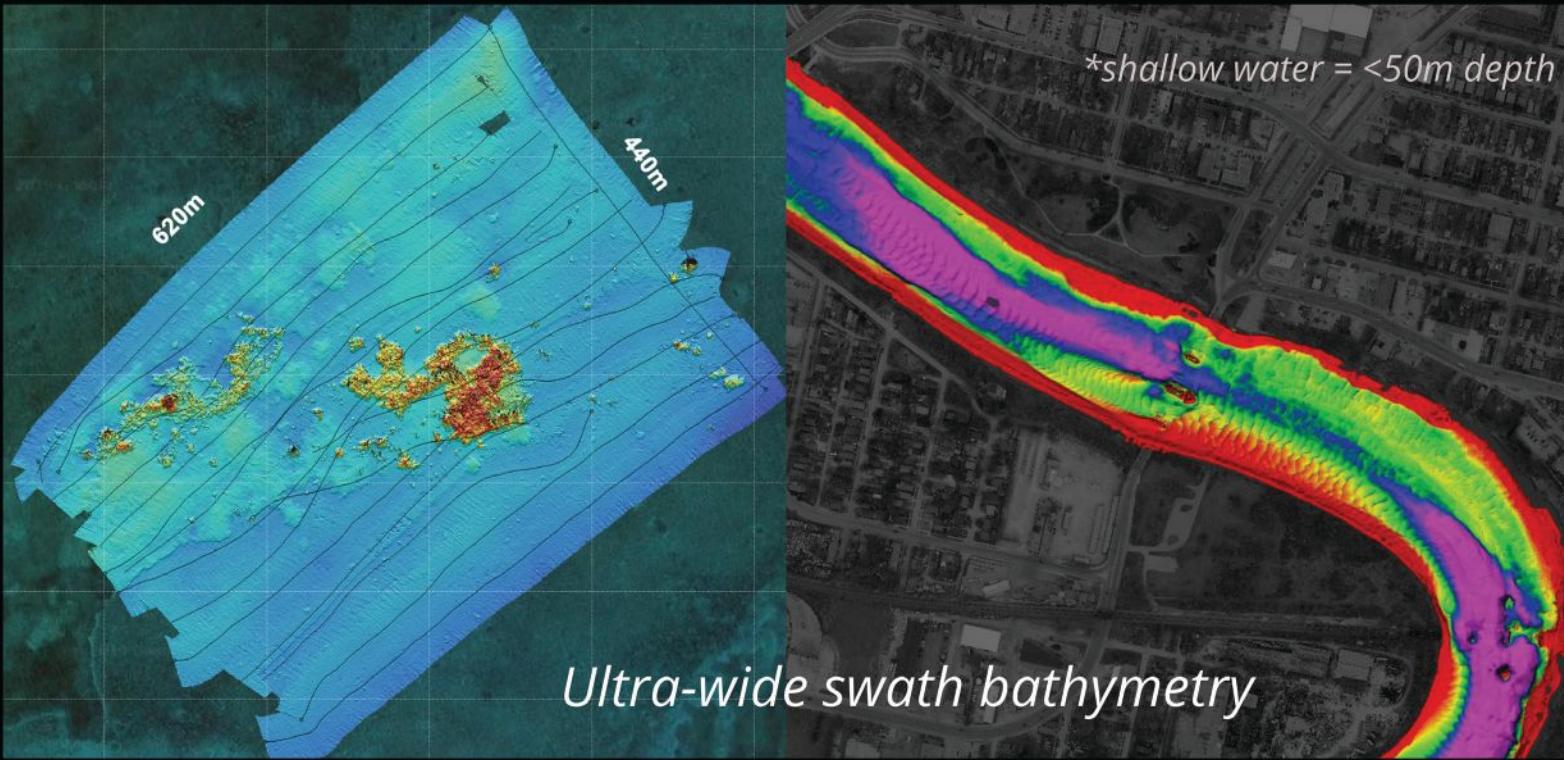
And then there is the Chartered Hydrographer certification, awarded by the Institute of Marine Engineering, Science & Technology (IMarEST) or the Royal Institute of Chartered Surveyors (RICS). IMarEST issues a Chartered Marine Scientist (Hydrography) designation.

### TIME FOR A FRESH LOOK?

With demand for hydrographic surveying evidently on the rise, all this begs the obvious question: As an employer looking to recruit top talent, against what criteria to select a certified hydrographer? Is one accrediting body more applicable than another in this determination? Or is it just as prudent to nurture homegrown talent and prepare that person for the most appropriate proficiency test once they gain enough experience in the field?

This remains a very real dilemma for survey companies looking to expand. Increasingly, employers need surveyors capable of fulfilling an ever-broadening array of tasks. As we—as an industry—consider some of the more ambitious projects of the coming decade, such as the Seabed 2030 Project and the global expansion of offshore renewable energy, perhaps it is time for a renewed effort towards developing a clearer understanding of the proficiencies, certifications and organizations surrounding that define this highly sought-after specialism.

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# REAL WORLD BENEFITS OF AUTOMATION: A HYDROGRAPHER'S STORY



**By Nathan Green**  
*Hydrographic Surveyor, Veris Australia*

## REAL-WORLD CHALLENGES

The surveying industry is constantly changing and updating, with new technologies and improvements to existing ones. Coming from a background in ICT and software design, I have always been surprised by the amount of knowledge—specifically IT knowledge—that today's hydrographic surveyor needs to ensure that a survey is successful. This is especially true with vessels of opportunity, when a rented or short-term multibeam system needs to be installed and validated. All while a timer is hanging over you and counting down to when the vessel moves onto the next job. From dealing with hardware settings, IP addresses, the ever-trustworthy Windows firewall and my personal favorite, 'why couldn't that VGA cord be a foot longer?', the challenges of prepping for the field are numerous. And, unfortunately, they do not always end there, and continue through into data processing, interpretation and presentation. More often than not, our time is hijacked once we are 'back on shore' and the data processing phase—equally as important as the collection stage—is plagued with conflicting priorities.

Learning, perhaps the hard way, I am now a strong believer in achieving as much as possible while onsite, and even better, while on the water. This is especially true for a surveying contractor who will move from site to site, and often great distances. The possibility of having to remobilize and repair missing coverage or bad data is often not possible logically or financially. There is also the often-un-accounted cost of repairing a survey, meaning not only the cost of repair, but also the delay and schedule push back for the next survey in the pipeline.

I had found our previous acquisition/processing software solution to be the 'Swiss Army knife' of software suites, essentially allowing me to turn up on location and source any piece of equipment and have enough tools and drivers to pull a survey together. But with all that flexibility it is hard to accelerate the field-to-finish workflow, and introducing new team members can be a daunting learning curve for both them and me.

## INJECTING AUTOMATION

A few years ago, we transitioned to CARIS HIPS & SIPS for our processing, as our other dongle was tied up in the field. We could no longer wait till the end of the acquisition stage before moving to processing. Certain features have proven invaluable, such as Process Designer, which allows the operator to automate the import of field data and output deliverables. For our repeat surveys or dredging projects, setting up a reference model has been a huge benefit in computing volumes and the time it takes to present results.

However, something was still missing. I had a survey workflow that seemed to hit a bottleneck somewhere, and it just seemed impossible to shorten the field-to-finish timeframe. And with the significant costs associated with multibeam sonars and navigation systems—let alone vessels—nobody can afford to have them sitting idle on deck while project processing keeps the team office bound and not on the water.





» Small survey launch. Minimal room onboard the vessel limits space to the hydrographer and coxswain. To process data on the water relies on modern approaches to automation.

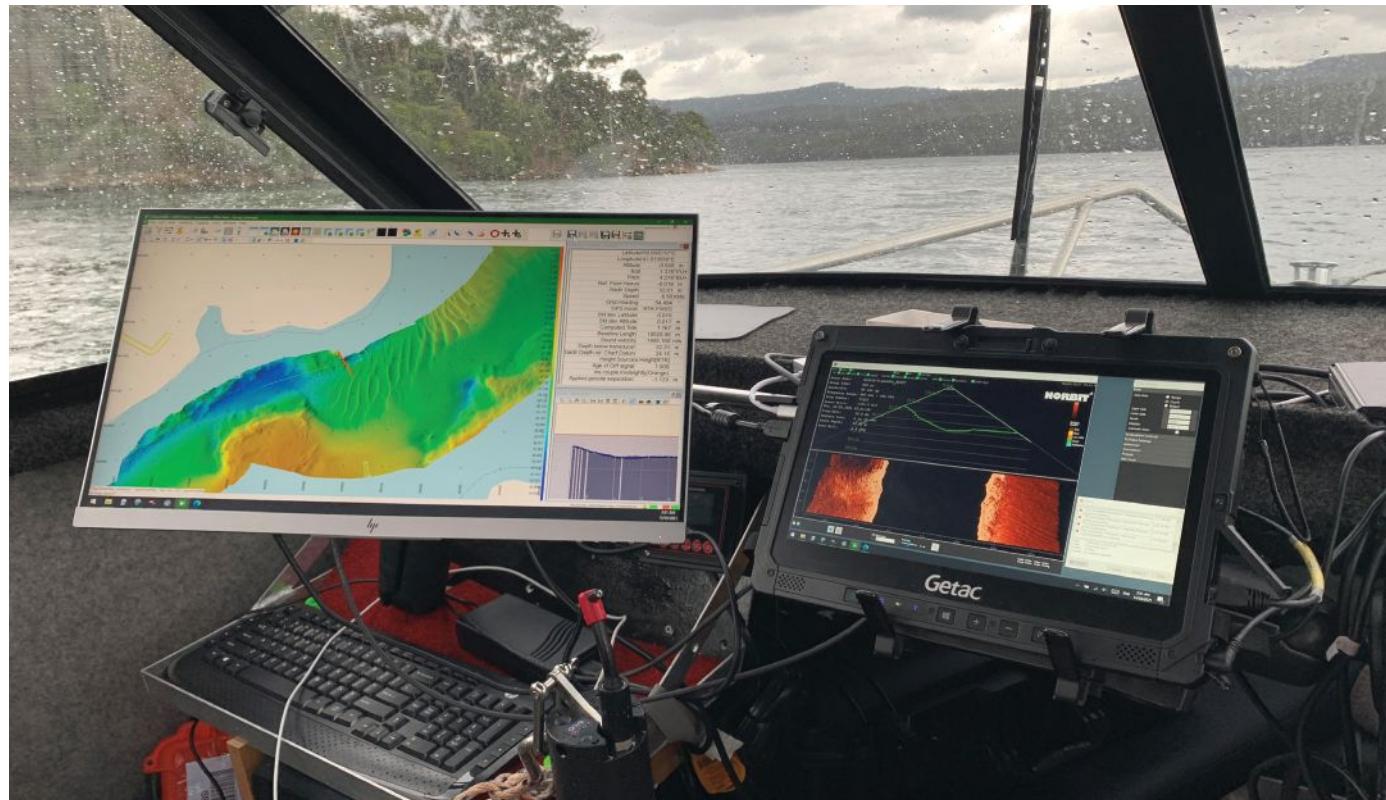
## THE MISSING PIECE

Enter CARIS Onboard360, which has really transformed our overall survey experience. CARIS Collect, the acquisition module, supports all the sensors we are currently using—Norbit, Velodyne, Riegl etc.—and the hardware setup is clean and straight forward. Being able to have multiple configurations, effectively in a dropdown list, allows us to setup a survey with bathymetry only, bathymetry and topside LiDAR, or snippets. This way we are not logging unnecessary data or dealing with device timeouts when not using the extra equipment. The survey setup is uncomplicated and adds convenient options such as web map backgrounds and background layers to your coverage map.

Stepping onto our survey vessel and plugging the laptop into the docking station, the workflow is perfectly intuitive: start CARIS Process to monitor for logged data, start the sonar GUI and launch CARIS Collect. With predefined screen layouts, the acquisition module is a joy to use. Built on Teledyne PDS, the survey coverage grid is the best I have used—responsive, scales to large surveys, and has lots of

customization of track history and background layers. You can have as much or as little information as you like, and the amount of detail you can display on the incoming sensors is excellent. The guidance editor for creating run lines is second to none, allowing you to add cross lines quickly and automatically. The software has some great online multibeam filters which can read in real-time uncertainty and filter points not meeting IHO standards.

Now where the fun begins: once a survey line is logged, CARIS Process picks it up and starts the process model designed back in the office. The model takes the raw files, applies the sound velocity drops I have been saving to a folder, geo-referencing the data to the horizontal and vertical datum the client needs. From there, via the cellular connection in the laptop, the data is sent to the CARIS Mira AI cloud noise classifier, and every data point is assigned a confidence. A final CUBE raster surface is created or updated, which can be viewed in a web-browser by people onboard the boat or onshore for that matter. The data upload is efficient enough that we are yet to have problems using the noise classifier over a 4G hotspot connection.

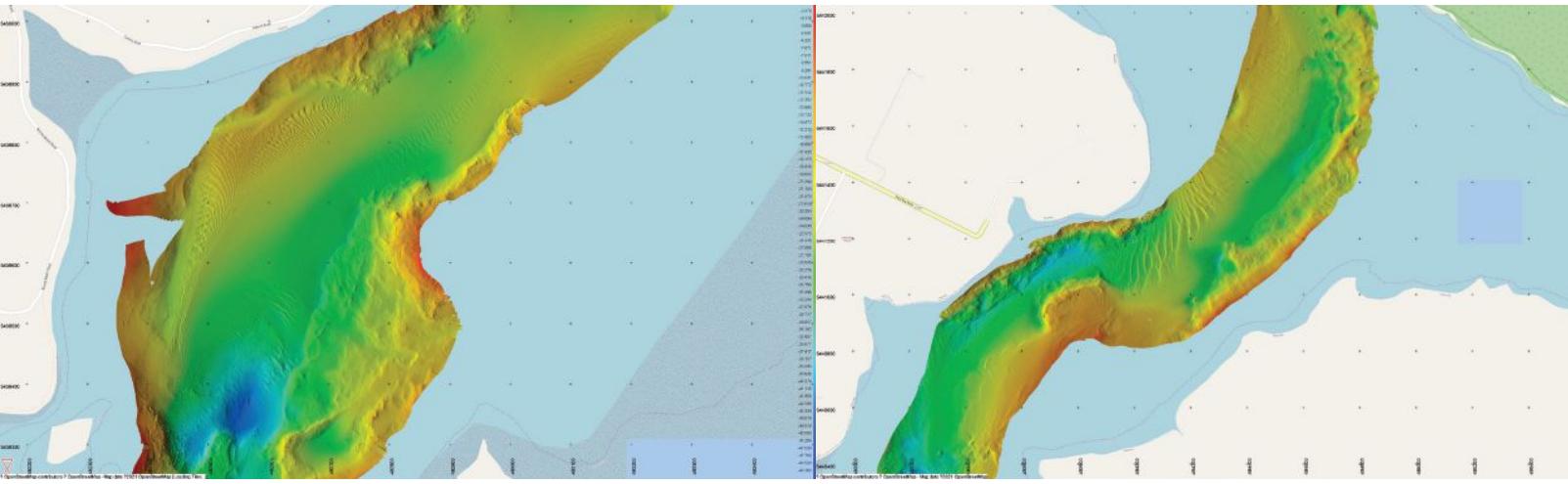


▲ Hydrographer's station with sonar control on the right, and CARIS Collect on the left displaying real-time survey coverage map and raw sensor data.

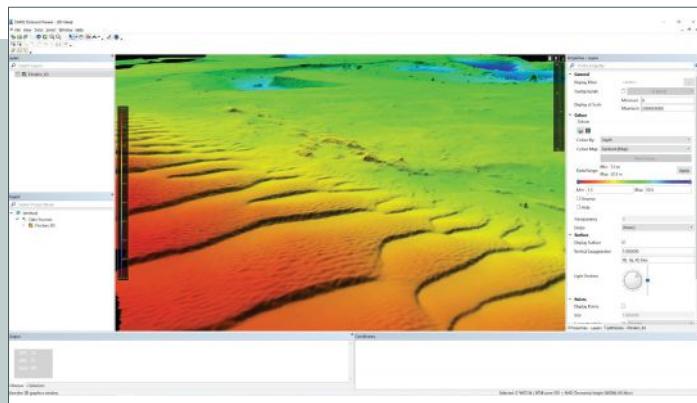
## DATA SHARING

Having the ability to stream a processed product off the vessel opens the potential for a harbor master, or the client, to monitor the progress (and therefore offer input) of the survey in real time. Based on the data coming in, for example, that person would be able to directly communicate with the field team to advise of any necessary adjustments to the survey area.

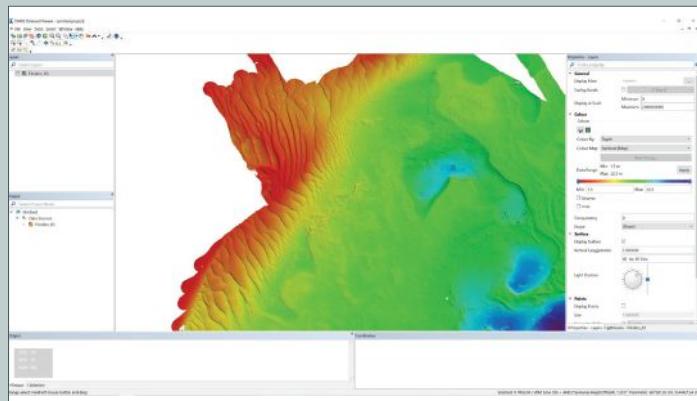
Most clients are unable to handle traditional file formats, like point clouds; the datasets are just too large, and they cannot justify the required investment in specialized software. There is only so much value you can immediately share through PDF's, DXF's, and ASCII files, and the problem of losing metadata with these methods can trigger all sorts of downstream issues. In addition to the real-time streaming, being able to deploy CARIS Easy View, a free 2D/3D viewer, to our clients is such a huge advantage; it allows them to interrogate, QA/QC, and extract information from our data, and outputs of the engineering analysis more effectively than ever before. Being able to share the native processing formats with our clients immediately eliminates any unnecessary time and frustration (on both parts) spent in educating users how to manage the data they receive.



» Sample Images of the real-time survey coverage map as displayed in CARIS Collect during the survey.



» Reviewing the processed data on the vessel using CARIS Process. Data was automatically put through a pre-defined workflow which included cleaning the data with the CARIS Mira AI noise classifier.



» Processed data can be streamed directly to the client during the survey, or directly shared following the survey. Customers can use the free viewer CARIS Easy View to access the processed products.



» Helm Station displaying a repeat of CARIS Collect with the real-time survey coverage map and additional background data to guide vessel navigation.

## CUSTOM DEVELOPMENT

Teaming up with the University of Tasmania, we were able to develop our own custom code. Leveraging the Process Designer, to output a point cloud, our code critiques the exported point data and generates a background image that shows where the survey is non-compliant for line overlap and sounding density, based on what survey standard is chosen. This background image and waypoints to the areas of remediation are then loaded into the data collection software and shown on the helm display so the surveyor can navigate straight to them. Even better, the waypoints are designed with a least-cost path algorithm so following the waypoints in order results in the fastest route to fill in gaps in survey coverage.

## END-TO-END SOLUTION

With the release of Onboard360, we now have a complete end-to-end CARIS solution which covers our full workflow from data collection to delivery. The Onboard360 suite combines simple and effective data acquisition tools with workflow efficiency and timely quality information provided by real-time automated processing. When coupled with the CARIS Mira AI noise classifier, a nearly complete project (both acquisition and processing) is ready when I leave the vessel, finally providing a real-world solution for shortening the field-to-finish timeframe. On top of this, the streaming of a processed product on the vessel enables in-field confirmation that the project requirements have been met, avoiding any costly remobilizations. Streaming off the vessel allows the client to loop-in feedback and adjust the survey there and then. By staying in the CARIS ecosystem, the project from the vessel can be directly opened in HIPS and SIPS for post processing, or in Easy View for client deliveries, preventing any clumsy and timely data transition stages.

Survey teams are always under pressure to deliver projects faster. The only solution is to identify ways to optimize your whole workflow. The CARIS ecosystem has proven to be instrumental in making this happen.



## EASING SHARING OF GLIDER DATA

The OOI's Coastal and Global Array teams regularly use Teledyne-Webb Slocum Gliders to collect ocean observations within and around the array moorings. The gliders fly up and down the water column from the surface down to a maximum depth of 1,000 meters, collecting data such as dissolved oxygen concentrations, temperature, salinity, and other physical parameters to measure ocean conditions.

OOI shares its glider data with the Integrated Ocean Observing System (IOOS) Glider Data Assembly Center (DAC). IOOS serves as a national repository for glider data sets, serving as a centralized location for wide distribution and use. It allows researchers to access and analyze glider data sets using common tools regardless of the glider type or organization that deployed the glider.

OOI serves data to these repositories in two ways. When the gliders are in the water, data are telemetered, providing near real-time data to these platforms. Once the gliders are recovered, data are downloaded, metadata provided, and data are resubmitted to the Glider DAC as a permanent record.

The behind-the-scene process transmitting this huge amount of data is quite complex. OOI Data Team members, Collin Dobson of the Coastal and Global Scale Nodes at Woods Hole Oceanographic Institution (WHOI) and Stuart Pearce of the Coastal Endurance Array at Oregon State University (OSU) teamed up to streamline the process and catch up on a backlog of submission of recovered data.

Pearce took the lead in getting the OOI data into the DAC. In 2018, he began writing code for a system to transmit near real-time and recovered data. Once the scripts (processing code) were operational by about mid-2019, Pearce implemented them to

streamline the flow of Endurance Array glider data into the DAC. Dobson then adopted the code and applied it to the transmission of glider data from the Pioneer, Station Papa, and Irminger Sea Arrays into the repository.

As it turned out, timing was optimum. "I finished my code at the same time that the Glider DAC allowed higher resolution recovered datasets to be uploaded," said Pearce. "So I was able to adjust my code to accommodate the upload of any scientific variable as long as it had a CF compliant standard name to go with it." This opened up a whole range of data that could be transmitted in a consistent fashion to the DAC. CF refers to the "Climate and Forecast" metadata conventions that provide community accepted guidance for metadata variables and sets standards for designating time ranges and locations of data collection. Dobson gave an example of the name convention for density: `Sea_water_density`.

"Being CF compliant ensures your data have the required metadata and makes the data so much more usable across the board," added Dobson. "If I wanted to include oxygen as a variable, for example, I have to make sure to use the CF standard name for dissolved oxygen and report the results in CF standard units."

The Endurance Array team was the first group to add any of the non-CTD variables into the Glider DAC. This important step forward was recognized by the glider community, and was announced at a May 2019 workshop at Rutgers with 150 conveyors of glider data in attendance. One of Pearce's gliders was used as the example of how and what could be achieved with the new code.

To help expedite the transfer of all gliders into the DAC, Pearce made his code open access. The additional metadata will help advance the work of storm forecasters, researchers, and others interested in improving understanding ocean processes.

### KRAKEN RECEIVES ORDER FOR AquaPix® SONAR FROM AUV MANUFACTURER

Kraken Robotics Inc. has received an order for a 3000-meter rated AquaPix MINSAS 120 Synthetic Aperture Sonar from an American autonomous underwater vehicle (AUV) manufacturer. The contract value is \$0.5 million and delivery to the customer is expected in 2021. Since March of this year, Kraken has received orders for AquaPix MINSAS 120 Synthetic

Aperture Sonars from customers in the US, Europe, and Australia for integration onto three different AUV platforms.

Kraken is the undisputed leader and provider of Synthetic Aperture Sonar to third party underwater vehicle platforms. To date, Kraken has seen its AquaPix® sensors integrated on 20

unique underwater vehicle platforms from a variety of manufacturers. Kraken's MINSAS is a commercially available off-the-shelf configurable Interferometric Synthetic Aperture Sonar (SAS) which replaces high end side scan sonar systems at an affordable price, while delivering significantly higher resolution, range, and area coverage rates (ACR).

## MAMMOET ACQUIRES LAND & MARINE'S LINEAR WINCH EQUIPMENT FLEET

Mammoet recently announced the formal purchase of Land & Marine's linear winch fleet and associated pipe pulling equipment.

The purchase of the winches by Mammoet includes two state-of-the-art 800t capacity linear winches, which are unique to the industry, their innovative design is patented and allows socket passing under load as well as utilizing advanced hydraulic controls for accurate monitoring. This results in less downtime and increased project efficiency. Also added to the Mammoet portfolio are several smaller linear winches ranging from 100t to 300t, and a range of drum winches. The

equipment will be added to Mammoet's Offshore Services equipment fleet.

This latest addition in equipment offers an ideal complement to the existing capabilities of Mammoet Offshore Services in providing tailored engineering expertise, and equipment to deliver complex marine and offshore and nearshore pulling projects. The global footprint of Mammoet will allow the company to offer its customers more effective solutions to nearshore & offshore pipeline and cable pulling.

The acquired assets will support the Mammoet Offshore Services team in continuing



» Mammoet has acquired two 800t capacity linear winches as part of the fleet purchase. (Photo credit: Mammoet)

their focus in developing the offshore riser, umbilical, and cable pulling operations. Murphy / Land & Marine will continue to offer installation engineering support to future Mammoet linear winch operations.

"Land & Marine has a well-established reputation in the linear winch hire and pipe pulling market that Mammoet Offshore Services will uphold their standards whilst broadening our overall offshore services offering. The Land & Marine legacy, its specialist

experience, combined with Mammoet's innovative approach, makes for an exciting combination moving forward," explained Barnaby Mills, General Manager for Mammoet - Offshore Services.

Andrew Ball, Murphy's Natural Resources Sector Director, said: "We wish Mammoet Offshore Services all the very best going forward. We hope that with Mammoet's global network, Offshore Services will successfully continue the legacy of Land & Marine linear winch hires."



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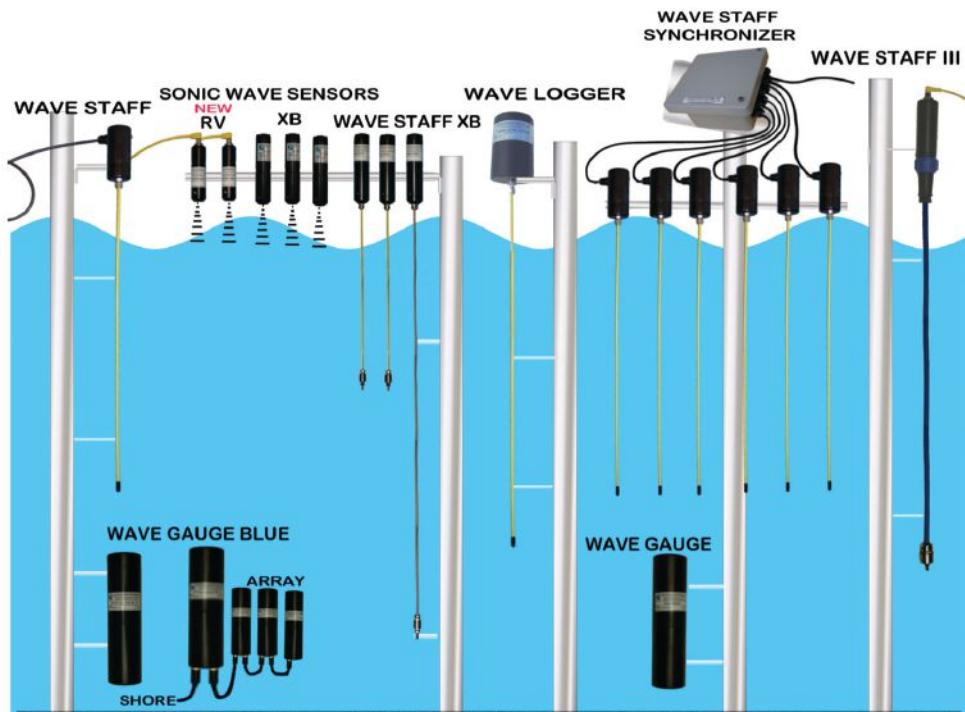
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» Three applications from Marinelsight™ by ioCurrents—Vessel Health, Automated Reports and Fuel & Emission Optimization—are available via Kongsberg Digital's Kognifai Marketplace. (Image credit: Kongsberg)

## KONGSBERG DIGITAL ADDS MARINEINSIGHT™ APPLICATIONS BY ioCURRENTS TO THE KOGNIFAI MARKETPLACE

Kongsberg Digital has signed a partnership agreement with Marinelsight™ by ioCurrents. The deal will make three new software solutions available to Vessel Insight subscribers via the Kognifai Marketplace: Vessel Health, Automated Reports and Fuel & Emission Optimization. The solutions will, respectively, assist in identifying engine failure through Machine Learning and Artificial Intelligence, create Automated Reports for all departments, and reduce fuel consumption based on proactive recommendations from automated data analysis.

"We are delighted to announce our partnership with ioCurrents and to offer Vessel Insight subscribers their solutions through the Kognifai Marketplace. The demand for solutions to predict failures, to optimize fuel and emissions, and to streamline reporting is increasing both for retrofits and newbuilds entering the market. The Marinelsight solutions can easily be adopted by our subscribers and can solve many problems already identified by our customers," said Eirik Næsje, SVP of Vessel Insight, KDI.

Marinelsight is active in the workboat, OSV, bulk, tanker industries, and in other commercial and passenger maritime sectors around the globe. The company focuses on three core competencies, Vessel Health, Automated Reports and Fuel and Emission optimization.

- **Vessel Health:** By applying Machine Learning (ML) and Artificial Intelligence, Marinelsight provides proactive recommendations to identify failures before they occur. Powered by AI, Marinelsight establishes ML models by understanding the normal operating behavior of each unique vessel. These unique ML models then identify when subsystems are trending towards failure. This gives crews

more time to identify failures and enables a proactive approach to preventing them, rather than reactively dealing with critical failures whilst in operation.

- **Automated Reports:** The InsightHub™ gives access to reports that can be used by all departments including Operations, Engineering and Maintenance, and Compliance and HSSQE. These automated reports reduce manual input by crews, increasing accuracy.

- **Fuel and Emission Optimization:** Marinelsight optimizes voyages by considering two variables: Time, and Fuel Rates. Marinelsight generates automated reports that provide proactive recommendations based on the fuel index to reduce fuel burn while not sacrificing schedules.

"Partnering with Kongsberg Digital has been a goal of ours for quite some time," said Cosmo King, co-founder of ioCurrents. "We are confident that by leveraging AI and machine learning, our data analytics platform, Marinelsight, will benefit Kognifai's Vessel Insight subscribers. Marinelsight will analyze the huge amounts of data coming from their vessels and will turn it into meaningful charts and dashboards, enabling factual decision making to improve individual vessel and fleet performance."

The three applications from Marinelsight will be available to Vessel Insight subscribers on the Kognifai Marketplace from May 25th, 2021. Customers can activate the Marinelsight platform by sending authorization to KONGSBERG.

# DNV LAUNCHES APP FOR EFFICIENT SAFETY INSPECTIONS AND REPORTING

DNV's new Mobile Inspection App helps ship owners and managers digitalize and streamline the workflow, recording and follow-up of their onboard safety inspections. The app also provides onshore staff with instant access to the results.

## EFFICIENT RECORDING OF OWNERS' SAFETY INSPECTIONS

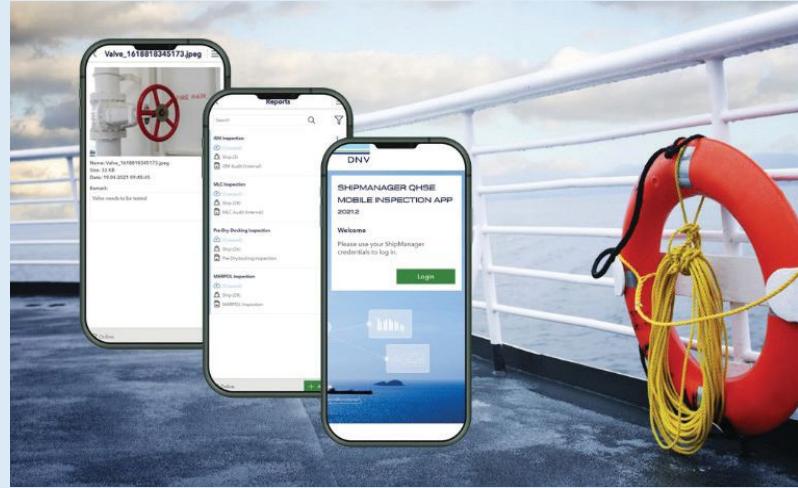
Many shipping companies are aware of the possibility of inconsistent or incomplete safety reporting and limited possibilities for gaining useful analytics if inspectors are using non-digitalized reporting methods. ShipManager's new solution takes maritime safety and quality processes to a new level of usability and availability. The Mobile Inspection App enables reporting online or offline on all devices, whether laptop, desktop, mobile or tablet.

The solution is designed for all kinds of safety inspections by owners and managers, including planned inspections and ad-hoc vessel inspections. It is easy to capture the results of an inspection directly on site through text, audio, photos and videos. This improves the quality and accuracy of descriptions for findings, making it easier to determine the actions that need to be carried out, and with less risk of missing important information.

## IN USE BY KEY CUSTOMERS

"We have been piloting the Mobile Inspection App for some time and really appreciate how easy it is to have an immediate and full overview of the inspection results onboard for our team to analyze," said Captain Aleksejs Sidorenko, Managing Director for LSC SIA.

Using the Mobile Inspection App with ShipManager Analyzer, ship managers can track their company's safety performance more easily and identify potential improvements through state-of-the-art dashboards.



## STANDARDIZATION ACROSS THE FLEET

With the configuration options in ShipManager QHSE's Safety Management Reporting module, you can easily create and configure your company's own inspection templates, checklists and ratings. These are then made available on mobile devices through the Mobile Inspection App, ensuring standardization across the entire company and fleet.

"At DNV we are committed to supporting our customers in their digitalization journey by building the software they need," said Torsten Kappel, Head of Ship Product Line, Digital Solutions at DNV. "The Mobile Inspection App helps streamline workflows and improves data quality, which again will help our customers meet their safety KPIs," he says.

The ShipManager solutions are part of DNV's maritime software portfolio for ship management and operations, installed on approximately 7,000 vessels worldwide. ShipManager provides modules for technical management, procurement, hull integrity management, dry docking, QHSE, crewing and business intelligence.

Read more about the Mobile Inspection App:  
[www.dnv.com/shipmanagerinspections](http://www.dnv.com/shipmanagerinspections)

# EMPOWERING

world leader in electric underwater robotics

**SAAB SEAEDGE**



**SAAB**



# DRIVING SAFER AND GREENER DATA ACQUISITION



**By Michael King**  
Senior Business Development Manager, Ocean Infinity



**Thomas Mennerdahl**  
R&D Project Manager, MMT  
(an Ocean Infinity company)

In March 2021, it was announced that marine robotics company Ocean Infinity had acquired industry-leading survey company, MMT. Together, these two companies combine huge ambition, best-in-class robotic technology, and an unrivalled track record in the offshore industry. With many offshore operators now looking to pivot towards uncrewed technology to unlock a safer and more sustainable future, the freshly expanded Ocean Infinity group holds all the keys.

## WORLD-CLASS INNOVATION WITH UNRIVALLED EXPERIENCE

With more than 40 years' experience, MMT has developed a team of experts comprising marine geologists, geophysicists, geotechnical engineers, biologists, offshore and project managers, surveyors, oceanographers, hydrographers and ROV

pilots. The team's extensive catalogue of more than 800 successfully completed offshore data acquisition projects have been delivered for a long list of energy operators including Ørsted, Equinor, SSE Renewables, bp and Shell.

Ocean Infinity started making waves in 2016 when it became the first company to deploy 8 AUVs simultaneously to offer its clients seabed data on an unprecedented scale and at speeds not seen before. Since then, the Company has expanded its fleet of marine robotics to include USVs and ROVs, before its ground-breaking announcement in 2020 that it was embarking on the development of the world's largest fleet of uncrewed and optionally crewed vessels for offshore operations.

Due to be operational next year, 'Armada' will be a fleet of at least 17 exceptionally fuel-

efficient, onshore-controlled vessels.

"The impact and the scale of this robotic fleet will spark the biggest transformation the maritime industry has seen since sail gave way to steam. With our new fleet we will be able to provide sustainable services to all corners of the industry from offshore energy, to logistics and transport" said Oliver Plunkett, CEO, Ocean Infinity.

## SAFER OFFSHORE OPERATION WITH REDUCED ENVIRONMENTAL IMPACT

The vessels will be remotely operated from Ocean Infinity's state-of-the-art facility in Southampton, UK. Each vessel will be permanently equipped with a suite of market-leading sensors for marine data acquisition. The initial vessels in the fleet will carry dual-head high-resolution multibeam echosounders for collecting

detailed bathymetric information, all mounted in a hydrodynamic subsea gondola along with high-specification inertial navigation systems and other geophysical and oceanographic sensor packages. As the Armada fleet vessels are larger than existing USVs on the market, they have the capability to push the scale of uncrewed and remote data acquisition further offshore into harsher environments, and on missions with longer durations.

In addition to these vessel-mounted sensors, the increase in size of the vessels enables other technical payloads to be mobilized. From towed geophysical and seismic survey equipment, through to work-class ROVs for Inspection, Maintenance and Repair (IMR) projects, each of the equipment options for the Armada vessels is being optimized for control, data acquisition and operation over a remote satellite link, working towards a genuine uncrewed and remote replacement for a wide range of conventional data acquisition campaigns.

All of Ocean Infinity's technical development is

based around the belief that there is a safer, more sustainable, and more efficient way of collecting the information required to support offshore projects. The areas of focus are topics such as dynamic bandwidth prioritization, communications robustness and redundancy, and remote and automated data quality monitoring capability; all of which enable delivery of the highest quality information to those that really need it by utilizing cloud-based technology.

One success factor for uncrewed operation is having Artificial Intelligence (AI) support the remote operations center. The AI field using deep learning has seen massive improvements over recent years for both self-driving platforms as well as automated data interpretation. MMT has been pioneering the field in the subsea industry and has acquired extensive hands-on experience over the years. Together with the expertise in the Ocean Infinity Group, the Armada fleet will include several automated systems increasing the on-board automated processing routines. This will not only provide preliminary results to the client but also allow

the remote data processor to focus on quality assurance.

The shift to remote and automated data acquisition lends itself to greater levels of engagement by clients and stakeholders, as instant access to data and involvement in the decision-making process makes sure that the answers Ocean Infinity provides are available at an earlier stage in the project lifecycle. Combine this with an onshore facility

with greater levels of comfort, connectivity, welfare and engagement, not to mention a reduction in travel and time spent away from loved ones, and the argument for a rapid transition to uncrewed and remote-controlled data acquisition becomes even more compelling.

The final piece of the puzzle is possibly the most important—ensuring that the projects Ocean Infinity carries out have the least possible impact on our environment. Thanks to the most modern hybrid engines available, and a focused effort to reduce the emissions of vessels and operations, all Armada operations will be fully carbon neutral. The minimal emissions produced will all be completely offset through an independently verified active reforesting scheme, ensuring that the use of the Armada fleet is the greenest possible approach to data collection.

As the remote capabilities of the industry mature even further, and with a shift towards 'Data-as-a-Service' (DaaS) style contracting, the approach taken by Ocean Infinity allows greater levels of efficiency and sustainability to be realized by stakeholders, developers and operators by utilizing fleet technology and leveraging the use of robotic and remote data acquisition.

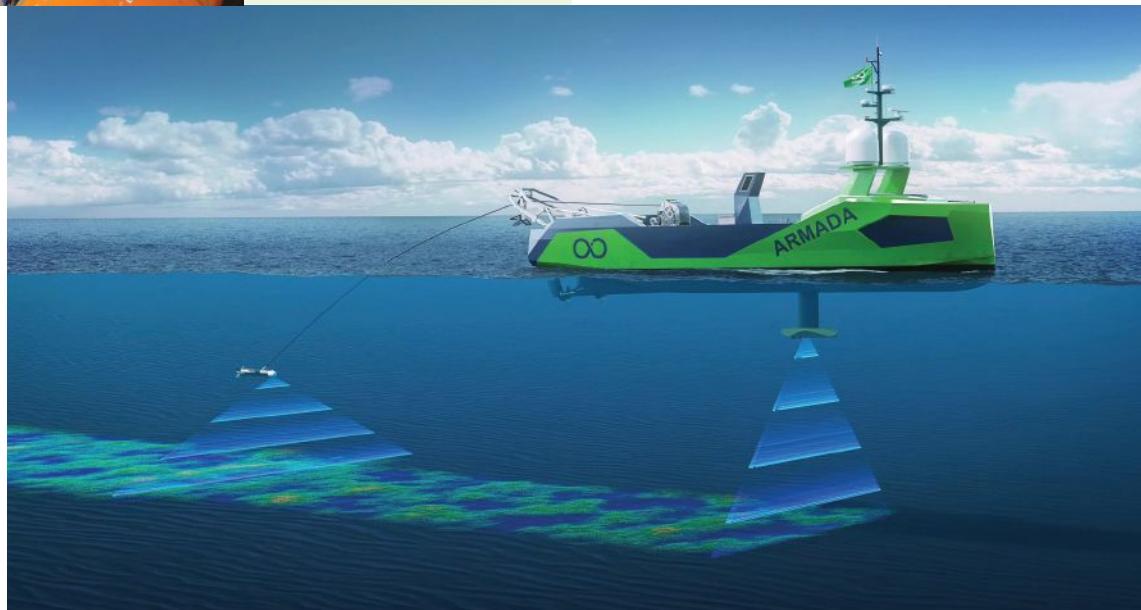
The entirety of the Ocean Infinity Group is excited for the ground-breaking Armada fleet to become operational, with the first 21 m and 36 m vessels coming online next year, to deliver the safest and most environmentally friendly solutions across the industry.

For further information on Ocean Infinity's services, visit [oceaninfinity.com](http://oceaninfinity.com) and get in touch at [info@oceaninfinity.com](mailto:info@oceaninfinity.com).



▲ Ocean Infinity was the first company to deploy 8 AUVs simultaneously, offering data on an unprecedented scale and at speeds not seen before. (Photo credit: Ocean Infinity)

» In addition to the vessel-mounted dual-head high-resolution multibeam echosounders, the size of the Armada vessels will facilitate the mobilization of other technical payloads, such as towed survey instrumentation. (Image credit: Ocean Infinity)



## TRITEX NDT LEADING THE WAY IN DRONE THICKNESS MEASUREMENTS

Tritex NDT have for many years been manufacturing ultrasonic thickness gauges and are now established as one of the leading companies offering multiple echo gauges. Multiple echo technology means that thickness measurements can be taken through 6 mm thick coatings, only the metal substrate is measured. It doesn't matter whether the coating is paint, epoxy or bitumen, it is completely ignored. This has huge advantages over having to remove coatings, both in time and money. It also has a big advantage when developing a gauge to mount onto a drone.

Taking thickness measurements at height has always been a requirement, and up until recently this has been done using scaffolding or rope access techniques. However, with the Tritex Multigauge 6000 dedicated Drone Thickness Gauge, first developed over three years ago, this is now a lot safer and cost effective than before.

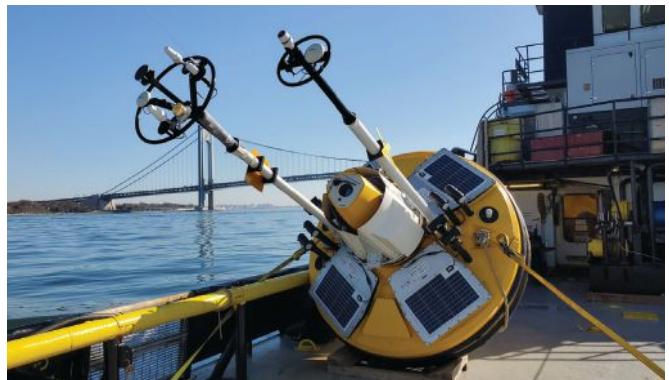
Tritex NDT are leading the way in this application and are the only company worldwide with a dedicated thickness gauge to mount onto drones. In excess of 100 systems have so far been sold, with repeat orders coming from major petrochemical companies and class societies. The gauge and technology have been improved over three years of development in response to customer's feedback and requirements.

The Multigauge 6000 consists of three parts, which includes the gauge, a gel dispenser and a probe holder for the correct alignment of the probe. The single crystal probe ensures accurate measurements on curved surfaces, such as storage tanks and pipelines. Thickness readings are transmitted wirelessly up to 500 meters, using its integrated RF transmitter, to a dedicated software that allows the operator to record measurements, set up templates and to remotely control the gel dispenser before touching the probe onto the surface.

The gauge can mount onto any 'work class' type drone, with the most popular being the DJI Matrice 210 or 300. Tritex NDT have also developed their own custom drone, the Multigauge 6500, specifically designed to provide a complete solution. The Multigauge 6500 'Flying Thickness Gauge' has eight rotors to provide redundancy, as well as propellor guards so that it can be easily used inside tanks.



» The Multigauge 6000 consists of three parts: the gauge, a gel dispenser and a probe holder. (Photo credit: Tritex NDT)



» Fugro is deploying two SEAWATCH Wind LiDAR Buoys as part of their integrated metocean, geophysical and geotechnical program for the Atlantic Shores Offshore Wind project. (Photo credit: Fugro)

## FUGRO SITE CHARACTERIZATION CONTRACTS RENEWED FOR ATLANTIC SHORES OFFSHORE WIND

Fugro has received a contract renewal from Atlantic Shores Offshore Wind (Atlantic Shores) for the provision of real-time wind and metocean measurements off the coast of New Jersey in the U.S. over the next two years. The award is the latest in a set of three contract renewals between Fugro and Atlantic Shores based on a successful 2020 work season. Along with metocean services, Fugro's geophysical and geotechnical contracts have also previously been renewed, all three to support the safe design, permitting and construction of future wind farm facilities within the 740 km<sup>2</sup> lease area.

For the metocean contract, Fugro is utilizing two SEAWATCH Wind LiDAR Buoys. These systems provide cost-effective and reliable collection of wind, wave, current and meteorological data to optimize wind turbine design, installation, and operations and maintenance. The geophysical and geotechnical contracts started earlier this spring and are focused on continued characterization of the lease area, export cable routes and inter-array cable modules. The fieldwork will run until mid-July and is being performed from five vessels, including two third-party vessels local to New Jersey, equipped with advanced data acquisition and analysis capabilities for near-real-time data processing and geoconsulting.

With the potential to deliver more than 3 GW of wind power from late 2027, Atlantic Shores will play an important role in New Jersey's goal to reach 50% renewable power by 2030. Edward Saade, President of Fugro in the U.S., said: "Fugro is committed to ensuring a successful energy transition at the local, regional and global levels, so we are thrilled to continue our work with Atlantic Shores this year, building on past successes and applying innovative technologies that will help move this critical project forward."

## SEABED 2030 AND ESRI ENTER INTO NEW AGREEMENT

Seabed 2030 and Esri have entered a new formal agreement, which will see the two organizations work collaboratively towards the shared objective of assembling a global compilation of high-resolution bathymetric data, to assist us in the sustainable use of our planet.

Seabed 2030 is a collaborative project between The Nippon Foundation and GEBCO to inspire the complete mapping of the world's ocean by 2030, and to compile all bathymetric data into the freely available GEBCO Ocean Map. GEBCO is a joint project of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC), and is the only organization with a mandate to map the entire ocean floor.

Committed to solving our planet's most pressing challenges with geographic expertise and rational resolve, Esri's mission is to inspire and enable people to positively impact their future through a deeper understanding of the changing world around them. This understanding involves a commitment to ocean science and maritime industry.

Esri places high importance on increased engagement with the ocean science community, as complex ocean science questions and data are increasingly used to inform the responsible use and governance of the oceans, as well as conservation.

"As we enter our last decade, Seabed 2030 warmly welcomes the support of a renowned organization such as Esri. With experts in geographic science, software development, and data analytics, the work of Esri will no doubt greatly support our mission of compiling all bathymetric data of the entire global ocean floor by 2030," commented Jamie McMichael-Phillips, Director of the Seabed 2030 Project.

Dr Dawn Wright, Chief Scientist of Esri said: "We are dedicated to a sustainable planet and Esri is therefore committed to supporting initiatives such as Seabed 2030, which play a fundamental role in allowing us to better understand and protect our planet."

"Since our beginning in 1969, Esri has cultivated collaborative relationships with partners who share our commitment to solving Earth's most pressing challenges with geographic expertise. To this end, we are proud to count Seabed 2030 as a partner."

All data collected and shared with the Seabed 2030 Project is included in the GEBCO global grid—the most complete bathymetric dataset of the world's ocean floor, which is free and publicly available.



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» Quadroin's design was inspired by one of nature's most agile swimmers, the penguin. (Photo credit: Florian Büttner, Hereon)



» The AUV's propulsion system consists of four horizontal thrusters in a X-shaped configuration. (Photo credit: EvoLogics)

## EVOLOGICS AND HEREON INTRODUCE REVOLUTIONARY NEW AUV: QUADROIN

**E**voLogics and Helmholtz-Zentrum Hereon, both based in Germany, are excited to unveil the next-generation bionic AUV for environmental monitoring: Quadroin. Back in 2020, Hereon's Professor Burkard Baschek teamed up with EvoLogics to develop an exclusive sensor carrying AUV to support MOSES (Modular Observation Solutions for Earth Systems), a brand-new observing system developed by the nine Helmholtz research centers across Germany.

The system comprises of highly flexible and mobile observation modules which are specifically designed to investigate the interactions of short-term events and long-term trends across the planet. Heat waves, hydrological extremes, ocean eddies and permafrost thaw are all within the scope of this exciting event-oriented observation and research initiative. The objective is to build up the technical capacity to capture, with as much detail as possible, the direct impact of such events on environmental systems. MOSES' resources now include

the latest in cutting-edge AUV engineering and design.

### LOW-DRAG BIONIC DESIGN

Quadroin epitomes low-drag AUV performance and represents the latest chapter in EvoLogics' investment—over two decades of in-field research and development since the company's founding—in bionic design. Over the years, the team has developed a number of innovative systems for maritime and offshore applications—including marine robotics that push the boundaries of traditional UUV design—by studying nature's blueprints for efficiency and reliability.

In the case of Quadroin, the AUV's outstanding hydrodynamic properties were inspired by ongoing research into one of nature's most agile swimmers: the penguin. Studies showed, both in the field and in controlled test facilities in Berlin, how spindle-shaped flow bodies effortlessly achieve ultra-low drag coefficients in water. In other words, the very response that operators want when deploying an AUV: maximum

maneuverability with minimal energy consumption.

As well as the unit's sleek contours and penguin-like profile, the AUV is driven by an ultra-efficient propulsion system, four horizontal thrusters that deliver speeds of up to 5 meters per second. The X-shaped configuration of thrusters also allows Quadroin to position and hover with absolute precision, enabling the AUV to action its payload of fast Sea & Sun sensors to measure temperature, pressure, oxygen, conductivity, and fluorescence throughout the water column.

### PICKING A PARTNER

As with penguins in their natural habitat, finding the right partner to develop Quadroin was a critical step in the product's evolution. The Helmholtz-Zentrum Hereon is renowned for conducting international groundbreaking research for a changing world and is committed to addressing the challenges of climate change and the protection of coastal and marine environments. The institute's dedication to advancing

scientific understanding in the name of solution-oriented progress between ocean stakeholders mirrors EvoLogics' founding philosophy, making the EvoLogics/Hereon partnership the natural choice for the Quadroin program.

### SWARM TECHNOLOGY

One of the MOSES system's chief modules will be a mobile swarm of Quadroins, multiple ASVs deployed in unison to collect data in ocean eddies. The swarm will be programmed to operate in formation across a defined survey area for extended periods without returning to the surface, scanning the water body layer by layer and collecting geo-referenced data on the physical water parameters at different depth horizons. The harvested data will then be transmitted to Hereon from a base station on the surface.

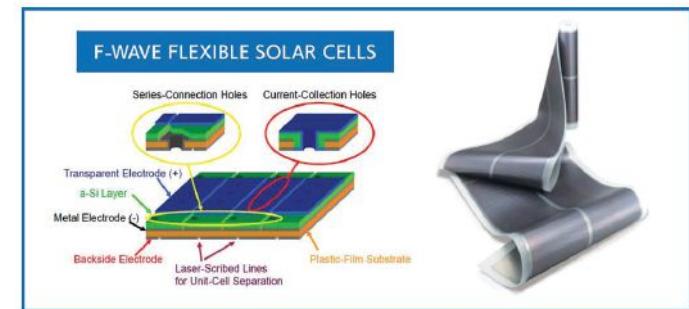
As of May 2021, the first Quadroin has passed all sea trials, both in controlled tanks and open water environments. More vehicles are currently being built for the next development phase of swarm operation.

## ECO MARINE POWER AND F-WAVE TO DEVELOP SHIP INTEGRATED PHOTOVOLTAIC SOLUTIONS

As part of its ongoing rollout of zero emission power and propulsion solutions for shipping, Eco Marine Power (EMP) has begun to cooperate with F-WAVE to jointly develop innovative Ship Integrated Photovoltaic (SIPV) solutions. These solar power solutions will utilize F-WAVE's shatter-proof and flexible PV technology combined with EMP's extensive experience in developing ship-based solar power systems.

F-WAVE's flexible solar cells use the unique SCAF (Series-Connection through Apertures formed on Film) structure allowing a wireless connection with the electrodes. This tandem construction also allows the flexible solar cells to absorb a wide solar spectrum. Additionally, the cells demonstrate high performance in hot weather due in part to the annealing effect and their efficiency increases compared to the decrease that typically occurs with crystalline cells.

EMP's Aquarius Marine Solar Power solution is ideally suited to incorporate F-WAVE's flexible PV panel technology and a customized version will also be fitted to EMP's patented EnergySail



for evaluation at the Onomichi Marine Technology Test Centre (MTTC) in Hiroshima Prefecture, Japan.

Commenting on the cooperation with F-WAVE, Greg Atkinson, Chief Technology Officer (CTO) at Eco Marine Power stated: "We look forward to incorporating the patented F-WAVE solar cell technology into the solutions we have developed for shipping & maritime applications and also exploring new ways of integrating photovoltaics into the design and structure of ships."

In addition to developing integrated solar solutions for shipping and maritime applications EMP will promote F-WAVE's products globally so that they can be incorporated into new ship building projects.

### High-performance Airborne Bathymetry

The Leica Chiroptera 4X and HawkEye 4X bathymetric LiDAR systems provide unprecedented water depth penetration and seabed object detection even in turbid waters. The system is scalable, collects seamless data from water to land and leverages the Leica LSS 3.0 end-to-end processing workflow for LiDAR calibration, refraction correction, point cloud classification, data enhancement and visualisation.

[leica-geosystems.com/chiroptera-4x](http://leica-geosystems.com/chiroptera-4x)

The image shows two pieces of LiDAR equipment. On the left is the Leica Chiroptera 4X, a compact unit mounted on a tripod. On the right is the HawkEye 4X, a larger, more ruggedized unit also mounted on a tripod. Both units are black with red accents and feature the Leica logo. In the background, there is a detailed bathymetric map of a coastal area with various landforms and water depths color-coded in shades of blue, green, and orange.

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leica-geosystems.com



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- when it has to be **right**

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# ELECTRIC AND HYBRID PROPULSION SYSTEMS HELP DRIVE GROWTH IN USV MARKET



**By Steve Trkla**  
President, *Torqeedo Inc.*

The global market for uncrewed surface vessels (USVs) is growing rapidly, and the rate is expected to accelerate. A recent research report projects a CAGR of 12.5 percent through 2025. This growth rate is being driven by market demand for harvesting more high-quality survey data for a wide range of commercial and scientific applications and, on the supply side, by improvements in technology.

A key enabling technology is the advent of more reliable and durable battery-electric and hybrid propulsion systems with solar charging, replacing the fossil-fueled engines used in the past.

Torqeedo Inc. has been at the forefront of marine electromobility since its founding in 2005 and a driving force behind recent developments in electric and hybrid USV propulsion. Since 2017, Torqeedo has been part of the DEUTZ Group, a world-class manufacturer of innovative drive systems.

## ELECTROMOBILITY REVOLUTION

To a large extent, the marine industry is benefitting from the massive R&D and engineering resources flowing into automotive electromobility programs. Most of the world's largest car and truck manufacturers have announced aggressive schedules for switching their manufacturing over to electric or hybrid vehicles in the

coming years. Major boatbuilders in the commercial marine and leisure boating segment worldwide are also looking to bring electric and hybrid boats to market.

Builders and operators of USVs are experts in integrating sensors and systems for gathering, communicating and analyzing data. They are not necessarily experts in marine propulsion systems, and they have typically installed commercial off-the-shelf gas or diesel outboards for power.

Most of them are now turning to more sustainable solutions. Electric boats produce less air and water pollution, offer quieter operation, less downtime, lower operating costs and savings in maintenance over the life of the vessel. There is also an obvious safety benefit in not having leaky gas lines or tanks of flammable liquids on board.

As battery capacity has improved in recent years, operating range and time on station has improved. Most survey work is done at relatively slow speeds of just a few knots, which results in much slower drawdown of battery capacity between charges.

Electric motors also have intrinsically better torque performance at slow speeds than internal combustion engines. In addition, station-keeping often requires rapid cycling back and forth between forward and reverse thrust. On an autonomous vessel,

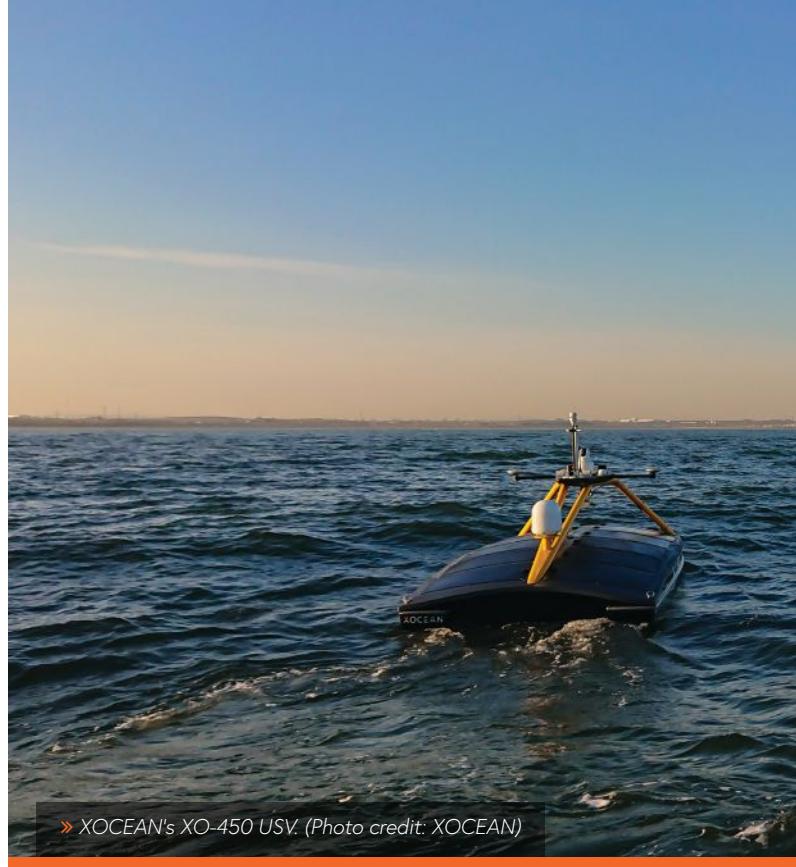
the use of a computer to rapidly shift gears can chew up a transmission quickly. The electric motors can switch from forward to reverse indefinitely without damage.

One of our customers, Don Darling, president of Sea Robotics, sums up the case: "USVs have the ability to transform many vessel intensive coastal and oceangoing activities. A greatly reduced carbon footprint is possible when vessel/ship crews are reduced or removed. Numerous manual tasks in the maritime environment are being assessed for the application of advanced automation and sensing systems making uncrewed vessels practical, and the electrification of the propulsion systems greatly reduces the carbon footprint for many tasks. Advances in battery and fuel cell technologies and integration of solar, wind and wave energy provide further benefit to the environment."

We are currently working with several prominent USV companies to incorporate Torqeedo's electric propulsion solutions on a range of vessels.

## SWITCHING FROM GAS

Marine Advanced Robotics has developed a unique class of watercraft called WAM-V, which is based on a patented technology that radically improves seakeeping capabilities. Instead of pushing, slapping or piercing the waves, the flexible pontoon



» XOCEAN's XO-450 USV. (Photo credit: XOCEAN)



hulls continually adjust to conform to the water's surface. Originally, the company used gas outboards which vented their exhaust underwater. The decision to develop an electric power package for the new WAM-V 16 model was driven by customers desiring to reduce noise and air pollution that can interfere with certain types of data collection. The company worked closely with Torqeedo's engineering team to design an integrated propulsion system tailored to the specific mission requirements and unusual performance characteristics of the hull configurations.

The propulsion package on the WAM-V 16 consists of two Torqeedo Cruise 2.0 electric outboards with high-torque propellers, powered by multiple Torqeedo Power-series 24V lithium-ion batteries. Each motor provides propulsive power equivalent to a five-horsepower gas outboard. Kurt diSessa, operations manager for Marine Advanced Robotics reports that with the twin Torqeedo outboards and six batteries, the boat can do a full day's work of 8-12 hours. The batteries can be charged overnight and be ready to do the same again the next day.

#### EXTENDED ENDURANCE ON STATION

When designing the new seven-meter SR-Endurance 7.0 ASV for underwater acoustic surveys, SeaRobotics had a set of very specific requirements, including



» SeaRobotics' SR-Endurance 7.0. (Photo credit: SeaRobotics)



» Marine Advanced Robotics' WAM-V USV. (Photo credit: Marine Advanced Robotics)

dependable performance, extended time on station and quiet operation. Accordingly, the company worked with Torqeedo to develop a powertrain consisting of a 50-kW Deep Blue electric motor, a 360 VDC high-capacity lithium propulsion battery, a water-cooled DC-DC converter, a 24 VDC lithium battery for DC-DC backup and a 25-kW diesel generator. The system provides up to six days on station at survey speeds and up to 10 hours between recharges from the onboard generator. The recharging cycles are fully automatic under computer control.

The SR-Endurance 7.0 can operate under remote control by an operator ashore or semi-autonomously to implement a mission plan. All on-board systems are monitored with data connections to the remote base station. The operator can control all interfaces, view video feeds or put the ASV into automatic waypoint navigation mode, in which throttle and steering are under full computer control.

According to Darling: "The Deep Blue electric drive, with 80 horsepower-equivalent output, provides ample power for a wide range of towed or statically deployed systems. In addition, the smooth, continuous and rapid transition from forward to reverse thrust assists in station-keeping as well as near-dock maneuvering."

#### LONG-DISTANCE REMOTE-CONTROL SURVEYS

XOCEAN, based in Ireland, provides turnkey underwater data acquisition services with a growing fleet of USVs. The company's XO-450 UV is a custom-designed composite wave-piercing catamaran powered by a pair of Torqeedo Cruise 2.0 electric pod drives. Solar panels on deck provide efficient recharging during daylight hours, and the company estimates its vessels emit 1,000 times less carbon than traditional survey vessels. The two electric thrusters are controlled separately to adjust the speed on each side, steering the boat on the desired course. A pair of Torqeedo Ultralight outboards at the bows enhance station-keeping when gathering data. XOCEAN reports that the boat has an operating range of 1,500 nautical miles, providing up to 18 days of mission endurance running 24/7. The boats are under the remote command of qualified pilots at XOCEAN's operations center, which monitors battery status and data quality using a broadband satellite transceiver on board.

XOCEAN has 13 USVs in operation with four more currently in build and expects to have a fleet of 40 USVs by 2022. They have operated in 14 countries, delivering over 100 projects including seabed surveys on 16 offshore wind farms.



» Arkona offshore wind farm in the Baltic Sea. (Photo credit: Eskil Eriksen/Equinor ASA)

## EQUINOR, RWE AND HYDRO TEAM UP IN THE NORWEGIAN NORTH SEA

Equinor, RWE Renewables and Hydro REIN have signed a collaboration agreement for offshore wind in Norway. The partners will jointly prepare and submit an application to the Norwegian authorities to develop a large-scale bottom-fixed offshore wind farm in the Sørøyskogen Nordsjø II area in the Norwegian North Sea. Together, the partners have strong expertise in all parts of the offshore wind value chain from development, production, and route to market.

The Norwegian Ministry of Petroleum and Energy has opened two areas for offshore renewables (Utsira Nord and Sørøyskogen Nordsjø II) and is currently working on the licensing process for offshore wind power projects in Norway. The area borders the Danish sector in the North Sea and is ideally located for supply of electricity to Europe.

The partnership between Equinor, RWE and Hydro represents a strong combination of experience and expertise from offshore wind development, energy market insight and large-scale industrial project execution. Together, the three companies have the complimentary capabilities as well as experience needed to develop a large-scale offshore wind farm at Sørøyskogen Nordsjø II.

"The North Sea has among the world's best wind resources. A large-scale offshore wind farm at Sørøyskogen Nordsjø II could play a key role in expanding the North Sea as an offshore energy hub and create new industrial opportunities for Norway as an energy nation. Between Equinor, RWE, and Hydro we have the industrial capabilities, from the turbine to the consumer, to create value and supply renewable power to Europe," said Pål Eitrheim, Equinor's executive vice president of New Energy Solutions.

Anja-Isabel Dotzenrath, CEO of RWE Renewables, said: "Offshore wind is key for meeting the increasing demand for renewable power, supporting local industries and creating new, future-proof jobs. We will bring our 20 years of experience and expertise in the offshore industry together with our partners Equinor and Hydro to contribute to delivering Norway's offshore wind ambitions."

"Offshore wind will be an important component in the future energy mix to decarbonize Europe and reach the 2050 targets. For Hydro, this cooperation is part of our strategy to diversify and explore growth opportunities in new energy. Through Hydro REIN, we bring our industrial capabilities and energy markets knowledge to the partnership, and we are happy to cooperate with RWE and Equinor. Together, we form a strong partnership for developing Sørøyskogen Nordsjø II," added Arvid Moss, Hydro Energy's executive vice president.

The Sørøyskogen Nordsjø II area has among the best wind resources in the world with water depths between 53 and 70 meters. The area has a potential to deliver a significant amount of renewable energy to countries aiming to transform their energy mix, following EU's and the UK's stated ambitions for 300 GW and 100 GW respectively of offshore wind capacity by 2050 to reach their net zero ambitions.

Both Equinor and RWE have strong track records in developing large offshore wind infrastructure projects and operate them efficiently while achieving the highest standards in safety. They have jointly developed the 385-megawatt Arkona offshore wind farm in the German part of the Baltic Sea. This was successfully commissioned in 2019 and is delivering sustainable renewable electricity for the equivalent of 400,000 German households.

With its world-wide industrial operations, top-three position on renewable power production in Norway and large-scale power market activity in the Nordics and Brazil, Hydro's participation in the partnership brings extensive experience in large-scale project execution, industrialization, and power market optimization. Hydro has over the last years been one of the world's largest corporate buyers of renewable power, and it has been central in shaping commercial concepts which has contributed to wind power development in Norway and Sweden. Hydro's participation in the partnership will be organized through its newly established company for renewables development, Hydro REIN.

# INTEGRATED E&Ps RAPIDLY ACCELERATE OFFSHORE WIND MARKET SHARE

By Michelle Gomez, WindLogix

A paradigm shift is occurring in the offshore energy sector with the recent surge in momentum to achieve net-zero emissions by 2050 having a profound impact on oil & gas company strategies.

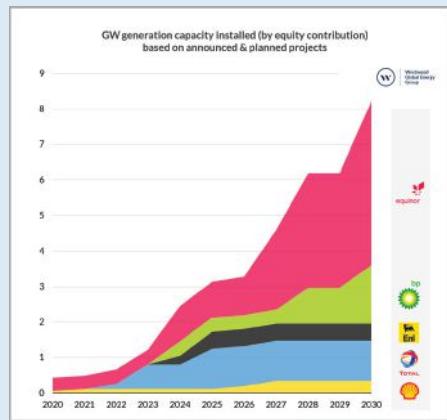
European supermajors are at the forefront of this energy transition with the results of February's UK seabed leasing auction a clear signal of intent. Of the 8 GW up for grabs, JVs including European supermajors were awarded 56%.

BP, in partnership with German utility EnBW, were a big winner, receiving the rights to 3 GW of this new capacity. This was preceded by BP's first foray into the offshore wind sector, the 50% acquisition of the Empire Wind and Beacon Wind prospects in the USA from Equinor back in September 2020. Combined, the Empire 1, 2 and Beacon Wind 1 could add up to 1.7 GW of further generation capacity for BP.

Equinor has arguably led the pack. They entered 2021 with almost 400 MW of generation capacity at Sheringham Shoal, Dudgeon & Hywind Scotland off the UK and Arkona offshore Germany. In addition to the US projects being developed with BP, Equinor is also investing heavily in Poland and South Korea with 2.4 GW of generation capacity being planned. The Norwegian E&P is also pioneering commercial scale floating wind with the 2019 sanction of the 88 MW Hywind Tampen development which will link to the Snorre & Gullfaks oil platforms in the North Sea.

Total has also been busy with the acquisition of a 23% interest from WPD in the 640 MW Yunlin development off Taiwan back in April. This move builds on the French E&Ps 51% interest in the up to 1.5 GW Seagreen complex off the UK.

Currently, European supermajors are expected to increase their offshore wind



generation capacity from around 400 MW in 2020 to 8,200 MW by 2030. Although this only accounts for 3% of our expected total installed capacity it should be noted that this figure represents only current equity participation with significant potential for upside given the rapid momentum observed over the past 12 months. In particular, all eyes will be on the results of the upcoming ScotWind leasing round with a further 10G W potentially up for grabs and BP & EnBW hoping to enjoy similar levels of success.

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# 3DSS SONAR: A COMPREHENSIVE TECHNOLOGY FOR SHALLOW WATER SURVEYING

## SHALLOW WATER CHALLENGES

With growing demand for full coverage and high resolution in shallow water surveying (<50 m water depth), there is an opportunity to foster business growth using a compact, comprehensive sonar technology in the same way that compact LiDAR systems have fostered business growth in terrestrial surveying.

In water depths less than 50 m, bathymetry coverage from traditional single beam echo sounders is coarse and sparse, while coverage from multibeam sonars is hampered by the water depth itself (e.g., coverage is typically only 3-4 times water depth). Full vertical coverage of walls or pilings and high-resolution 3D imagery are also beyond traditional multibeam capabilities, despite their importance in shallow water for identifying hazards, locating objects, habitat mapping and mapping of, and around structures.

Furthermore, combining a multibeam survey with a complementary sidescan sonar survey in shallow water also has drawbacks. These include the additional survey time and cost, the high potential for snagging the sidescan sonar in shallow water, the challenge in overlaying unregistered datasets, and the lack of a true 3D imaging capability to accurately visualize structures on the seabed and in the water-column.

## 3DSS SONAR TECHNOLOGY

Ping DSP's 3DSS sonar is a compact, comprehensive shallow water survey solution available with or without a fully integrated INS and sound velocity sensor and is easily mounted on manned and unmanned vessels, including small USV's. 3DSS sonar simultaneously provides, ultra-wide swath bathymetry, co-registered 3D sidescan imagery (true 3D sidescan), and enhanced 2D sidescan imagery. See advertisement on page 9 for data samples.



» 3DSS sonar head with full inertial navigation system (INS) and sound velocity sensor (SVS) together with the 3DSS Sonar Interface Unit (SIU) all in one transport case. (Photo credit: PING DSP)

## ULTRA-WIDE SWATH BATHYMETRY

3DSS bathymetry meets or exceeds IHO Special Order, CHS Exclusive Order, NL Norm A standards and covers a swath width of 8-16 times water depth to a maximum of 200 m in depths from 0.7 m to 75 m with full vertical coverage of structures such as walls and pilings. In 20 m of water it is not unusual to achieve a swath width greater than 200 m and in very shallow depths (<5 m) it is not unusual to achieve a swath width of 16+ times depth. 3DSS bathymetry acquisition and processing is also supported by almost all third-party hydrographic software suites.

## TRUE 3D IMAGERY

True 3D sidescan is unique to 3DSS sonar technology and provides the same image resolution as conventional 2D sidescan. However, with 3D sidescan, each image pixel has a geometrically correct location in three-dimensional space relative to the sonar. 3D sidescan imagery is inherently co-registered with 3DSS bathymetry and can be best described as a high density, LiDAR-like, backscatter point cloud. While there can be as many as 1024 bathymetry soundings across the swath per 3DSS ping, there may be more than 10,000 3D imagery points. In addition to 3D sidescan, the 3DSS Sonar provides enhanced 2D sidescan imagery so that direct 2D/3D imagery comparisons can be made.

3DSS sonar provides a compact, comprehensive solution that enables more efficient, and more detailed, surveys in near shore coastal areas, ports and harbors, riverine environments, and inland waterways over a wide range of applications that include; hydrography, environmental surveys, surveys around complex structures, rapid assessment and change detection surveys, pipe and cable inspection surveys, search and recovery, ice profiling, and water-column surveys.

[info@pingdsp.com](mailto:info@pingdsp.com) / [www.pingdsp.com](http://www.pingdsp.com)



» 3DSS sonar on small survey launch in bow mount configuration. (Photo credit: PING DSP)

## ØRSTED, JWD, AND EURUS FORM OFF-SHORE WIND PARTNERSHIP IN JAPAN

Ørsted, Japan Wind Development Co. (JWD) and Eurus Energy have formed a partnership with the aim of jointly developing offshore wind projects in the Akita Prefecture. The three companies have been developing two designated offshore wind sites under Japan's Offshore Renewable Energy Act of 2018, both of which are located off the coast of Akita: The Noshiro/Mitane/Oga Offshore Wind Farm and the Yurihonjo Offshore Wind Farm. Both projects are currently progressing with the necessary permitting. The consortium is fully prepared to participate in Japan's upcoming offshore wind auction round which closes on May 27, 2021.

The partnership combines market-leading strengths in global offshore wind with a strong local renewable development footprint. JWD brings deep knowledge of the Japanese power market and supply chain as well as a strong track record in onshore wind in Japan; Ørsted has unparalleled experience in developing, constructing and operating offshore wind farms world-wide; and Eurus Energy has for decades been the leading onshore wind company in Japan with a strong development and operational track record in the Akita Prefecture.

Matthias Bausenwein, President of Region Asia-Pacific at Ørsted, said: "As a strategic market for Ørsted, Japan has great potential and optimal conditions to develop offshore wind. We are excited to further expand our footprint in the country and assist in developing renewable energy through our partnership with JWD and Eurus in the Akita Prefecture. Ørsted has a unique opportunity and obligation to be a catalyst for the green transformation in Japan and can be a key player in realizing the cost-down journey for offshore wind in Japan."

The Noshiro and Yurihonjo offshore wind sites have been matured by JWD since 2017, conducting site investigations including wind measurements, seabed surveys, and environmental impact assessments. The



wind turbines for both wind farms will be installed on bottom-fixed foundations.

Japan has outlined a 30-45 GW offshore wind ambition by 2040 and plans to execute offshore wind auctions every year. Japan's west coast is expected to host up

to 5 GW offshore wind by 2030, and 9 GW by 2040. The grid capacity is 415 MW for Noshiro City, Mitane Town, and Oga City, and 730 MW for Yurihonjo City, as stated in the auction guidelines.

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## NATIONAL GRID AND RWE RENEWABLES AGREE TO PARTNERSHIP

National Grid and RWE Renewables have announced the signing of a partnership agreement to jointly develop offshore wind projects in the coastal region of the Northeast U.S. With this agreement, National Grid Ventures, the non-regulated division of National Grid, and RWE will be working together to explore opportunities in the Northeast U.S. offshore wind market. This includes an intention to jointly bid in the upcoming New York Bight seabed lease auction.

Both companies share a common goal of enabling the clean energy future, and offshore wind will be critical for the U.S., particularly in the Northeast, to reduce emissions, meet climate goals and create local jobs. This partnership brings together two leading energy companies to help drive forward the emerging offshore wind industry in the U.S. and help bring critical economic development to communities across the Northeast.

"We're very pleased to partner with RWE as we take our first steps towards developing offshore wind projects in the Northeast U.S.," said Cordi O'Hara, President of National Grid Ventures.



"This partnership further solidifies National Grid's role in advancing a clean, fair and affordable energy future and will also complement our growing onshore renewables business, which includes a strong pipeline of solar, wind and battery storage projects across the country."

National Grid and RWE will bring complementary capabilities and expertise to this partnership. National Grid will bring local expertise in the Northeast along with its experience developing large-scale infrastructure projects, including industry-leading subsea cable capabilities from its portfolio of interconnectors that facilitate the transfer of renewable energy between the UK and Europe. RWE will bring its wealth of experience in global offshore wind project development across the entire value chain, from project conception to construction and operation. The unparalleled experience the company has earned over the last 20 years has resulted in 20 successful projects, ranking RWE in the top tier of the global offshore wind market.

"Our partnership with National Grid represents an exciting milestone for RWE as we further grow our renewable energy business in the U.S.," said Sven Utermöhlen, Chief Operating Officer, Offshore Wind Global for RWE Renewables. "While we are an established presence in the U.S. with our onshore wind, solar and storage activities, this partnership will support RWE's plans to realize a sizeable position in the offshore wind space. We look forward to working with National Grid to advance the clean energy transition in the U.S."

RWE is a leader in the field of renewables and is among the top offshore wind companies globally. The company has a robust pipeline of offshore and onshore wind, solar and energy storage projects throughout the Americas, Europe and Asia-Pacific.

## PD&MS ACQUIRES SYNERGIE ENVIRON LTD TO STRENGTHEN CARBON REDUCTION SERVICES

PD&MS Group has acquired cleantech specialist engineering firm Synergie Environ Ltd for an undisclosed sum to bolster its decarbonization capabilities and further support the energy sector's net-zero emission ambitions.

For more than a decade, award-winning Glasgow-based consultancy SEL has been instrumental in developing innovative solutions to cut carbon consumption and cost across a range of industries including energy, power generation and storage as well as pharmaceuticals, waste and sustainable material, and transportation. During this time, it has supported more than 500 businesses resulting in an

estimated cumulative carbon reduction impact in excess of 1 million tonnes of CO<sub>2</sub>. The firm has also won several business and industry accolades for its achievements.

The acquisition will leverage SEL's specialist low-carbon engineering expertise and advisory services and help determine CO<sub>2</sub> reduction measures for PD&MS' clients to achieve carbon neutrality targets and support the industry's energy transition. PD&MS will provide additional engineering resources, project management and site construction support allowing the business to target larger scale engineering, procurement, construction and commissioning (EPCC) campaigns as well

as supporting SEL on larger turnkey opportunities across the cleantech sector.

As a result, the leading international engineering and design business plans to increase its workforce with 75 new hires across Scotland and the UK in the next 12 months.

PD&MS recently announced it has been awarded a contract from Montrose Port Authority to repurpose its 50 m communications mast for the Seagreen offshore wind farm off the coast of Angus. Over the past 18 months, its renewables team has also completed a range of significant projects including mast decommissioning for Moray East offshore wind farm as well



» PD&MS rope access technician working at a wind farm, off the coast of Scotland. (Photo credit: PD&MS)

as other wind and solar front-end engineering and design work, engineering and construction scopes.

## TOTAL RAPIDLY EXPANDS WIND POWER ACTIVITIES

Total is focusing efforts on offshore wind power, a technology that has great potential because it can be deployed far off the coast, tapping larger wind resources than onshore wind turbines while having less of an impact on the landscape. To ensure success, Total is applying their recognized, long-standing expertise in managing large offshore projects.

In 2020, Total invested in a number of landmark floating and fixed-bottom wind projects, in both mature and growth regions across Europe and Asia. This has positioned the company as a key player in the industry—with cumulative wind power generation capacity of more than 3.5 GW—and contributed to its goal of being one of the world's top 5 renewable energy companies.

Large-scale projects in the pipeline set to start operations in the years to come include:

- **Erebus**, a pioneering floating wind project located off the coast of Wales in waters 70 meters deep, making Total one of the first movers in this technology in the UK, the world's largest offshore wind market.
- **Seagreen**, the largest fixed-bottom offshore wind project in Scotland, with a production capacity of 1,140 MW, equivalent to the daily electricity consumption of one million homes in the UK.



- **Bada**, the biggest floating offshore wind project in the world, with a production capacity of 500 MW, which we are developing off the coast of South Korea in partnership with Macquarie.

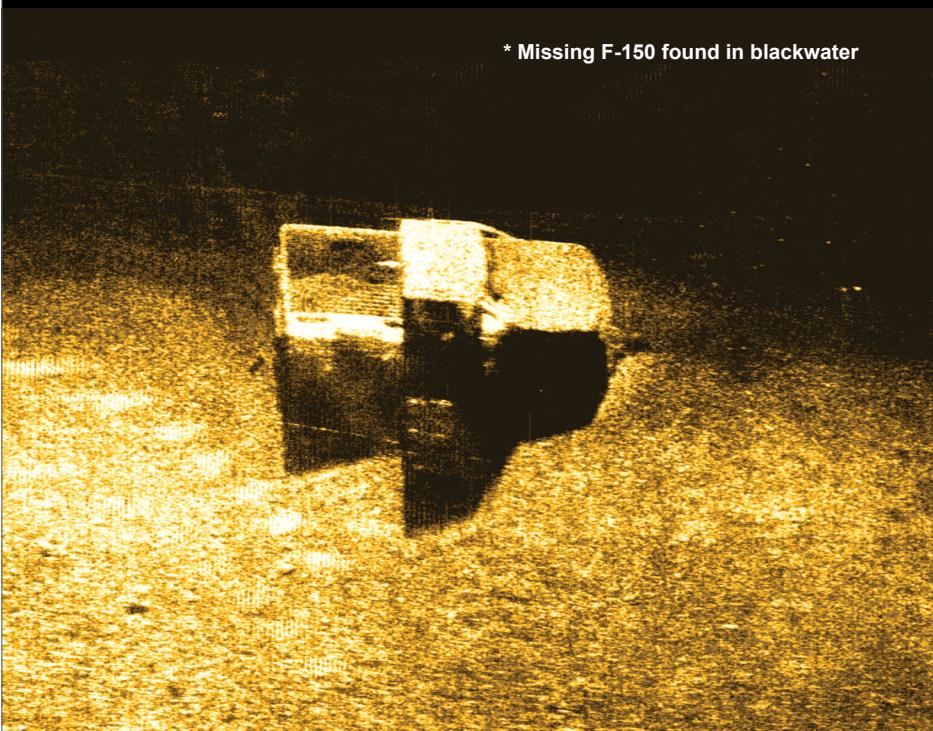
These projects all bring Total closer to the ambition of getting to net zero by 2050, together with society.

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\* Missing F-150 found in blackwater



The side scan sonar image shows a dark, rectangular object with a lighter-colored front section, likely a vehicle, resting on a textured seabed. The image is grainy and has a yellowish tint.

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# DEMOCRATIZING DATA BY SIMPLIFYING MULTIBEAM DEPLOYMENT AND OPERATION



**By Sören Themann**  
CEO, Subsea Europe Services GmbH

**C**reating a map of the seabed is a complex task, to say the least, and one that has traditionally relied on the data acquisition skills of professional hydrographers. While their experience and expertise will always be in demand, developments in marine survey workflow, technologies and multibeam (MBES) system integration and installation are coming together to create a simplified and more automated approach to marine survey.

The goal is to unlock data acquisition capabilities for companies and organizations that don't have the need or budget for a permanent in-house marine survey department staffed by hydrographers, but still require accurate marine data, albeit not regularly.

Consider a (theoretical) developer planning a wind farm installation project. Due to the

risk of not proceeding beyond the Final Investment Decision (FID) stage, developers often seek to minimize investment in the early phases, which could, for example, limit funding for essential transmission cable planning and routing and make it harder to access resources such as the services of a professional marine survey company. But could a simpler approach allow the developer to save money by collecting their own data—at least in the pre-FID stage?

Reducing the complexity of data acquisition is only possible when we look at the entire value chain. It starts with a) procuring, configuring and installing the survey system on the chosen vessel, then b) operating the MBES to produce quality results and c), processing data to create an accurate, user-friendly final product from the data collected. The work is diverse, but more effective and less complex ways of working already exist at all phases.

## (A) PROCURE, CONFIGURE AND INSTALL

After selecting a vessel, the first challenge is securing the required hydroacoustic technology. As turnkey equipment, MBES systems are not easy to acquire, especially if time is of the essence. It pays to plan your survey well in advance and give your provider as much notice as possible to minimize staff/ vessel downtime while waiting. New business models such as a subscription service offered by Subsea Europe Services are designed to ensure access to hydrographic equipment exactly when it's needed by allowing long-term pre-booking in a 'time-share' like fashion.

But it's the nature of the technology that causes the biggest need to simplify. The MBES is approximately 10% of the entire system needed onboard. Traditionally, a client needs a deep understanding of what systems are necessary to piece together their



» iHSS was designed to overcome mobilization and operational challenges of multibeam echosounders. (Image credit: Subsea Europe Services)

survey platform, but pre-integration of the relevant components by professionals can reduce the need for expertise down the line.

Approximately 90% of the work can be done before the system even leaves the office. All sensors can be integrated, correct cables selected, and software and firmware updated. Further, it's possible to set the MBES offset calculations for any mounting system and vessel size or motion at this stage, which massively simplifies commissioning of the MBES system on site at the vessel.

This pre-configuration and testing are key to a new MBES solution from Subsea Europe Services known as the 'integrated Hydrographic Survey System' (iHSS). Delivered as a 'plug and play' turnkey package, the iHSS is ready to mobilize with R2Sonic Sonic 2024 or 2020 MBES, sound velocity instruments, workstation and software, I2NS inertial navigation system and flexible mounting. As an integrated package, it is able to collect data to the new IHO S-44 Exclusive Order standards and regardless of which MBES is specified, the system can take less than 2 hours to install because everything is ready to go on delivery.

#### (B) HIGH PERFORMANCE, HIGH PRECISION

The iHSS all-in-one pole mount design places the MBES, Inertial Motion Unit and GNSS antennas in one reference frame with offsets already set prior to delivery, which simplifies installation and reduces potential errors from inconsistent or wrong offsets. This set-up also lowers the technical burden when moving a vessel to new survey areas by road or transport ship; if all systems remain on the same mounting pole, all offsets remain the same for the vessel, so there is no requirement for recalibration.

MBES manufacturers continue to develop easier methods of operation also, which is starting to let non-hydrographers access at least some of the functions required to collect precise data at sea. The R2Sonic ROBO™ mode for instance, is the only automatic MBES feature that relies on empirical data provided by advanced algorithms.

The ROBO™ mode works in conjunction with the Saturation Monitor to set the system gain, which is something that the hydrographer would usually take care of. Employing the complex calculations used to determine the degree of receiver saturation makes the ROBO™ mode intelligent and robust and of course, more experienced users can change the parameters for the auto gain adjustment.

#### (C) DATA PROCESSING, VESSEL AND OFFICE

The iHSS uses the BeamworX software suite, which provides automated functions to improve workflows and data processing on board. The AutoPatch system enables fully automated MBES patch test calculations, which would normally require the expertise and experience of a marine surveyor. Likewise, the AutoClean app cleans and validates bathymetric and LiDAR point clouds so that the data coming from the vessel to office is already clean without intervention from an expert.

At the post-processing stage, both hydrographers and users with less experience can take advantage of advances in cloud-based data storage and processing systems made by corporations or more specialist subsea industry developers. It's important to note that while advances made to support professionals in producing final products have certainly simplified data post-processing, hydrographers will always be needed to validate and ensure that output meets client expectations.

#### STEPS TO AUTONOMY

The Cloud paves the way to bring AI and machine learning to the acquisition and processing of MBES data. In combination with the



» Placing the MBES, IMU and satellite positioning on the same pole mount keeps them in the same reference frame, which reduces errors in collected data. (Photo credit: Subsea Europe Services)



» Installing an echosounder can be complex and time consuming but 90% of the work can be done prior to delivery. Here an IMU is pre-installed with a sound velocity probe instrument. (Image credit: Subsea Europe Services)

simplification of the hydrographic processes, technology and operations, we are seeing the first step towards autonomous marine surveying; though from a vessel and marine operations perspective, this is already a reality.

To some extent, autonomous echosounders are also a reality. To bring autonomy to live MBES seafloor surveys where hundreds of variables need to be calculated for every second is still quite challenging, but ongoing simplification and automation efforts will bring us closer and provide operational benefits in the meantime.

There will of course be detractors of what might be described as a 'dumbing down' of such a technical field of expertise, but it's important to understand that most companies and academic organizations engaged in developments that automate marine survey are primarily aiming to help professional surveyors optimize their work. But as more-user friendly technology and simplified workflows become mainstream, there will be more opportunity to 'democratize' marine data.

# CHECK THE TECH



## DFOG: THE FUTURE OF FIBER OPTIC GYROSCOPES

### A NEW GENERATION OF FOG

Fiber Optic Gyroscopes (FOG) have long been trusted by the Marine industry. The first generation of FOG made available in 1976 used analog signals. The second generation, developed in 1994 and still used to this day, improved upon this with a hybrid approach using an analog signal in the coil with digital signal processing.

In 2021, FOG evolved into DFOG (Digital Fiber Optic Gyroscope). This third generation of FOG sets itself apart by being fully digital. The DFOG technology provides significantly lower SWaP-C (size, weight, power and cost), while providing industry leading accuracy and reliability. DFOG sets a new standard for gyrocompassing, motion reference units and inertial navigation.

### DFOG, A DIGITAL REVOLUTION

DFOG is patent pending technology, which has been developed over 25 years across two research institutions together with Advanced Navigation. DFOG was created to meet the demand for smaller and more cost-effective FOGs while achieving maximum accuracy and improved reliability.

To achieve this, three different, yet complimentary, technologies were utilized to improve the capabilities of FOG:

- 1. Digital Modulation Techniques:** DFOG uses specially developed digital modulation techniques that pass spread spectrum signals through the optical coil. This allows in-run variable errors in the coil to be detected and corrected, increasing accuracy.
- 2. Revolutionary Optical Chip:** Five discrete components that are present in a traditional FOG are combined into a single chip. The optical chip decreases errors while significantly increasing DFOG's reliability since there are fewer sensitive components and fiber splices.
- 3. Specially Designed Optical Coil:** DFOG employs a specially designed closed-loop optical coil, developed to take full advantage of the digital modulation techniques. The optical coil offers a high level of protection for the optical components from shock and vibration, thus increasing reliability.

The resulting combination of these three technologies results in a final product that is 40% smaller, lighter and lower powered than comparable products with a 30% reduction in price. All this while increasing reliability and accuracy.



▲ The revolutionary DFOG technology. (Image credit: DFOG)



▲ Advanced Navigation's Boreas D90. (Image credit: DFOG)

The key technology that enabled a breakthrough came from gravitational research conducted by two universities. Advanced Navigation saw the potential of the technology and continued to develop it for commercial use, investing 100,000 hours into the development of the first DFOG, Boreas D90.

### BOREAS D90, THE WORLD'S FIRST DFOG

Boreas D90 is a GPS-aided Inertial Navigation System (INS) that provides ultra-high accuracy position, velocity and orientation under the most demanding conditions. It combines cutting edge DFOG technology with closed loop accelerometers and a dual antenna RTK GNSS receiver. These are coupled in a sophisticated fusion algorithm to deliver reliable navigation. The system features ultra-fast north seeking, acquiring and maintaining an accurate heading, even without GNSS.

The small form factor makes it perfectly suitable for ROV/AUV while the lower cost enables accurate dead reckoning for a greater number of vessels. Furthermore, applications that currently use unreliable magnetic heading or are heavily reliant on GPS, can now use gyro compassing. [www.advancednavigation.com](http://www.advancednavigation.com)

## MODUS SUBSEA SERVICES SECURES STATNETT SURVEY CONTRACT

Global subsea services company, Modus Subsea Services Ltd has been awarded a contract to perform survey services in connection with a new cable corridor requirement in Ofotfjorden, northern Norway. The campaign will use the Modus Hybrid AUV (HAUV) system which represents the very latest in merged ROV and AUV technology.

As part of the scope, Modus shall perform a desk top study, to identify further site information and support the preparation of the project. In Q2 2021, Modus shall mobilize HAUV-2 to collect geophysical seabed survey data, perform target inspection and an environmental survey across a 6km x 1km area. The HAUV will be operated as a high-speed ROV in tethered

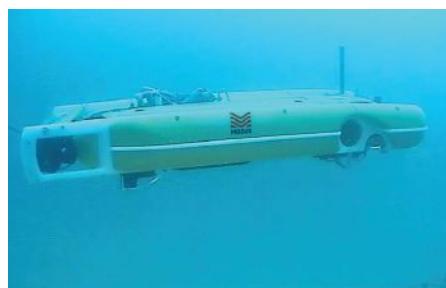
mode to provide real time data feedback and decision making. The scope will be performed from the M/V *Elektron* vessel in a water depth range of less than 10 meters to 500 meters.

To perform the scope of work the HAUV will house Multibeam Echosounder, Sidescan Sonar and Sub-Bottom Profiler. The speed in which the HAUV can collect data in high current and shallow water environments without compromising data quality, is expected to yield significant project efficiencies for Statnett.

"This is the first survey contract we have entered into with Modus and we are looking forward to the cooperation," says Karin Ryssdalsnes Project Manager at Statnett.

Guy Lainchbury, Commercial Manager for Modus said: "Working for Statnett, the system operator of the Norwegian grid, is a great opportunity for Modus to demonstrate this class leading Hybrid AUV

technology. The difficult environmental conditions that we will experience, along with the ability to collect multiple streams of data from varying sensor technology and at high speed, will be the defining factors of this project. Modus HAUV systems are now used globally, and we have achieved success in reducing overall project timelines and providing best in class reporting. Modus look forward to working with Statnett across their subsea network into the future with this disruptive technology."



» Modus Hybrid AUV will perform survey services in connection with a new cable corridor in Norway. (Photo credit: Modus)

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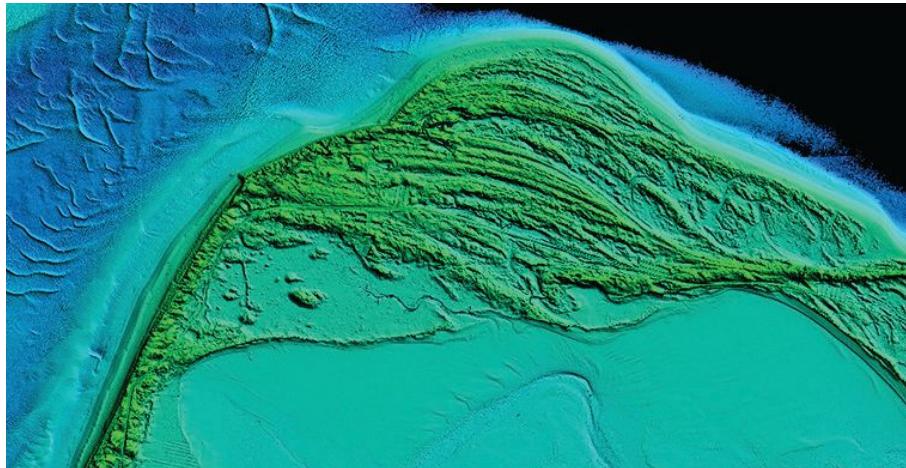
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# LEICA CHIROPTERA 4X: AIRBORNE LiDAR PROVES IDEAL FOR CHALLENGING COASTAL SURVEY



» Digital terrain model of the west coast of Sylt island, Germany, captured with the Leica Chiroptera 4X airborne bathymetric LiDAR. (Photo credit: Arctia-Meritaito)

**S**trong currents, frequent storms and high waves continuously reshape the German island of Sylt, despite attempts to reduce erosion along its sandy beaches. To help identify effective ways of preserving the coastline, the National Office for Coastal Protection, National Park and Marine Protection Schleswig-Holstein (LKN.SH) has experimented with various technologies to date, including the use of survey vessels to run bathymetric studies. However, approaches thus far have proven time-consuming and jeopardized by an underwater reef.

## TAKING TO THE SKIES

In 2020, the LKN.SH selected Arctia-Meritaito to survey Sylt with a Leica Chiroptera 4X airborne bathymetric LiDAR scanner. Deliverables included point clouds with classifications and orthophotos. The height accuracy had to be better than 20 cm and the positional accuracy better than 50 cm.

Initially, Arctia-Meritaito surveyed the shallower depths using a vessel-borne single beam echosounder, but the resulting depth profiles at defined interval distances had significant data gaps. Multibeam echosounders address that problem but are not always efficient in shallow waters. To



» Sylt Island, Germany, from the survey aircraft. (Photo credit: Arctia-Meritaito)

overcome these challenges, Arctia-Meritaito opted to use an airborne bathymetric LiDAR sensor instead.

"The Leica Chiroptera 4X provided the most promising results," according to Mikko Ojala, Arctia-Meritaito's head of airborne LiDAR bathymetry. "With airborne LiDAR, we get full coverage in shallow waters with depth penetration down to 25 m depending on the conditions, while minimizing the risk of losing sensors. And we can collect land and seabed data in one survey."

## AIRBORNE EFFICIENCY

Covering the entire project area as efficiently as possible is crucial. Weather and water conditions can change rapidly. Timing is essential for collecting clean airborne bathymetric data sets that are fast to process. Seabed material, especially fine sand, is always in flux. Overlapping data of the ever-changing seabed will not correspond if collected days apart, and processing will take longer. The Chiroptera 4X simultaneously captures 140,000 points per second in the bathymetric channel and up to 500,000 pps in the topographic channel. In two days, within five flight hours, Arctia-Meritaito collected 70 km<sup>2</sup>.

The elliptical scan pattern captures a forward and backward view, providing two data sets of the same point, which reduces noise caused by waves and increases depth penetration. In ideal conditions, the Chiroptera 4X can penetrate down 30 m. In addition, the oblique view of the laser beam captures data of vertical objects. Despite turbidity and waves, the Chiroptera 4X reached the seabed, meeting all project requirements.

## IMPRESSIVE RESULTS

Arctia-Meritaito's processing setup was based on recommendations from Leica Geosystems, part of Hexagon: Besides point-cloud-processing software Terrasolid and the QPS hydrographic software suite, it used Leica LiDAR Survey Studio (LSS) to process all waveform and position data and incorporate four-band camera data from the Chiroptera 4X.

Arctia-Meritaito delivered the results about eight weeks after data collection. "I am very satisfied with the results," said Lutz Christiansen, head of surveying, topography and morphology at the LKN.SH. "The data density, accuracy and type of processing met all of our requirements. This showcase project provided stakeholders with an up-to-date status of the west coast and shore area. Now we have a digital terrain model (DTM) from the steep coast of +20 m down to -10 m water depth." [www.leica-geosystems.com](http://www.leica-geosystems.com)

# SONARDYNE UNVEILS 'OPERATE-ANYWHERE' PORTABLE SHALLOW-WATER TRACKING SYSTEM

Energy, defense and science technology company Sonardyne has launched a new, entirely portable configuration of its shallow water Ultra-Short BaseLine (USBL) system Micro-Ranger 2.

Everything needed to start tracking divers, ROVs, AUVs, or any other subsea targets is contained in a single, IP67-rated ruggedized case small enough to operate-anywhere, from anything.

The one-box USBL solution is able to track up to 10 targets out to 995 m. Inside the case is a Micro-Ranger Transceiver (MRT) with 10 m of cable, a GNSS antenna with 5 m of cable, and two Nano transponders and command hub. A built-in battery provides more than 10 hours of continuous use, enough for a full day of activity out on the water. The case can also accept external power from a boat or shore supply.

To get started, users simply have to connect their laptop running the Ranger 2 software to the case via Wi-Fi, put the MRT in the water, connect the antenna, and fit a Nano to each target. Sonardyne says even first-time operators can expect to be up and running in around 30 minutes.

Nano transponders are the perfect size and weight for divers, small towfish and micro ROVs. The two that come in the case are Sonardyne's recently introduced second generation model, offering extended battery life and depth rating. A connector-equipped Nano is also available allowing it to operate continuously via an external power source. Customers can choose the type of Nano transponder that comes with their system at the time of ordering.

The needs of AUV developers who need to both track and communicate with targets have been addressed with the Micro-Ranger 2 integrator system kit. It comes complete with Sonardyne's add-on Marine Robotics software pack and AvTrak 6 Nanos, which support two-way messaging, vehicle control and tracking in one small instrument.

John Houlder, USBL product line manager at Sonardyne said: "Whether you're looking for flexibility, ease of use, or convenience, Micro-Ranger 2 is the ideal solution. It's a smaller, lighter and more complete portable system than anything else on market. And it's very competitively priced when you consider everything that's included in one box as standard. It's export-license free and is engineered to be safely carried on passenger aircraft. Then, when you get to where you're working; a quayside to track an ROV, a RIB for tracking divers or a small boat to track and control your AUV, just turn it on, connect to the control hub with your laptop and away you go."



» Sonardyne's updated Micro-Ranger 2 USBL system contains everything you need to track divers, ROVs and AUVs. (Photo credit: Tom Acton/Sonardyne)

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## BRINGING INNOVATION TO COASTAL SURVEY

**M**organ & Eklund, Inc. (M&E) is a Florida-based hydrographic and geophysical survey services company with over 36 years' experience of supporting engineering firms, construction contractors and federal, state, and local government entities on marine and coastal infrastructure, beach restoration, and large-scale water management projects.

### SURVEYING PIONEERS

Incorporated in 1985, M&E was the vision of co-founders John Morgan and Ron Eklund. Along with David Coggin—still an active member of the team today—M&E soon gained a reputation as the go-to provider of specialized services for the collection, processing and analysis of high-quality, reliable coastal survey data.

Both M&E's agility and appetite for innovation have been key drivers for growth over the past four decades, and this ability to seize new opportunities is amply evidenced by the organization's adoption of industry-leading technology and field methodologies. Today, M&E is fully equipped with an expanding portfolio of cutting-edge equipment to run multifaceted hydrographic and topographic surveys—including port inspections, digital terrain modeling, canal

cross-sections, and beach profiling. In addition, the highly qualified team at M&E includes experts in GPS data collection, processing and management, and Computer Aided Drafting.

### AUTONOMOUS MARINE SURVEYS

However, recent advances in marine engineering pose something of a paradox to the survey community; while breakthroughs in sensor technology continue to expand the horizon for coastal and marine data, the topside process of collecting it is often arduous and time-consuming. This restriction has given way to the advent of commercially viable uncrewed systems, such as Autonomous Surface Vehicles (ASVs). M&E sees the ongoing integration of ASVs into standard coastal survey practices as instrumental to bringing down the overall cost of operations and placing an increased emphasis on safety.

"These days, the surveyor's toolkit—which includes multibeam echo sounders, side scan sonar, LiDAR, and RTK GPS—can be incorporated into tightly integrated ASVs, perfectly suited to running repetitive survey lines and standard sampling," explains M&E Vice President, David Coggin. "ASVs can operate a suite of sensors simultaneously without the need for topside intervention,

and so represent a game-changing approach to executing routine surveys with unmatched efficiency."

### RAPID TURNKEY RESULTS

Further, ASVs help measurably streamline the data delivery process. That is, they maximize the speed at which data can be collected, processed, and interpreted. Depending on the survey in question, ASVs allow surveyors to manage data in real time from a shore-based command or workboat. A preset survey plan allows hydrographers to focus on other important aspects of operations, like survey processing and QAQC, meaning clients ultimately receive validated results sooner.

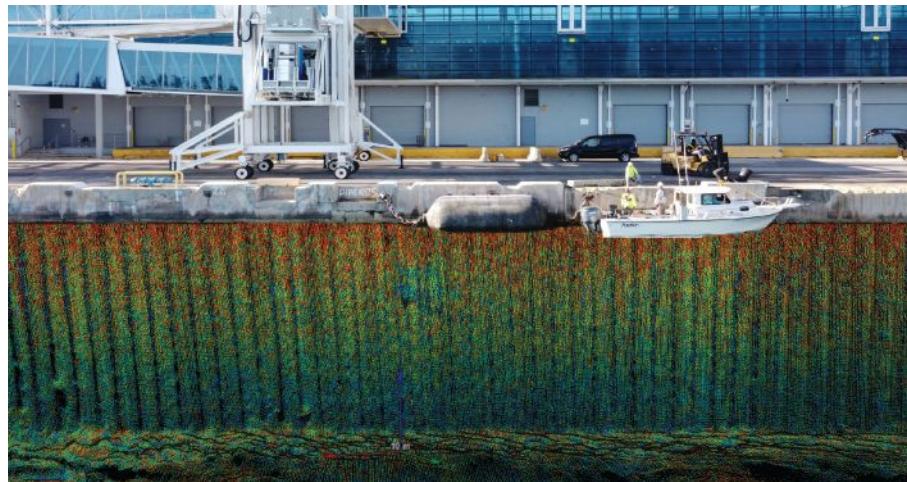
M&E also uses compact ASVs to navigate hard-to-reach and potentially hazardous waters—areas inaccessible to crews on larger survey boats. In recent years, Coggin and his team have leveraged their fleet of ASVs to run several high-profile survey projects, from the coastal damage assessment of hurricane-torn islands to the business-critical inspection of offshore utility infrastructure.

### CHARTING THE FUTURE

M&E plans to further expand its ASV line in 2021 with models that share a common uni-cab architecture. This compatibility is critical for enabling plug-and-play, multi-unit deployment for a wide range of environmental, geophysical, and ocean sound survey tasks.

For a company that was created to bring industry-defining innovation and service excellence to market, it is little wonder that M&E sees the world of advanced robotics as a linchpin to the future of coastal survey operations. Perhaps Coggin puts it best: "ASVs represent an undeniable win-win for both surveyor and customer in terms of the cost effectiveness, efficiency, and safety of daily operations—the future of coastal survey is now available."

[www.morganeklund.com](http://www.morganeklund.com)



» M&E uses cutting-edge sensor technology to run multifaceted hydrographic and topographic surveys, including port inspection surveys. (Image credit: M&E)

## BRAZILIAN RENTAL AND SERVICES COMPANY INVESTS IN IXBLUE DRIX USV

A recently formed Brazilian rental and services company, WAMS, has added an iXblue DriX USV to its existing pool of equipment. Offering the most cutting-edge technology for subsea services and research, this new investment marks an important milestone for the company. Available to WAMS customers in Brazil, the DriX USV will increase operational performance for shallow water hydrographic and geophysical surveys as well as LBL array box-in operations, and ROV/AUV tracking for deep water projects.

"We are fully confident that the marine data collection and subsea operations industries are undergoing a profound change due to the rising technologies of USVs and AUVs," said Elijah Egorov, Survey Operations Supervisor at WAMS.

"We were fast to recognize iXblue DriX as a versatile and force-multiplying autonomous platform that will allow WAMS to perform bathymetric surveys up to 10 times faster than traditional vessels and survey launches when using multiple DriX. iXblue USV will furthermore be a great asset in supporting our customers' deep-water operations. DriX will radically reduce the time required to perform box-in operations, and significantly improve the accuracy of ROVs and AUVs subsea positioning and communication in challenging acoustic environments. By investing in unmanned technologies such as DriX, WAMS is now expanding the capabilities of traditional survey equipment and leading the way towards more cost-efficient, safer and environmentally conscious offshore operations. This will be a great opportunity for companies that operate in the offshore market in Brazil, as they will get the highest technology equipment along with greatly reduced operating costs."



» DriX surveying the waters of Tonga. (Photo credit: iXblue)

iXblue DriX USV, along with its efficient launch and recovery system, is a seasoned asset in supervised autonomy. A true force-multiplier, DriX is able to conduct both remote-controlled and supervised autonomous operations (within visual range or Over The Horizon), and offers outstanding seakeeping and speed capabilities. Versatile and efficient, the unmanned platform performs extremely well in severe weather conditions and



» DriX being deployed from NOAA's Thomas Jefferson hydrographic survey vessel. (Photo credit: iXblue)

keeps downtime to a minimum compared to traditional survey vessels. Capable of hosting a wide range of payloads, DriX offers optimum conditions for high quality data acquisition and subsea positioning in both shallow and deep waters.

"By choosing to add our DriX USV to their service offering, WAMS is truly stepping up as an avantgarde company that will increase the productivity, efficiency and safety of their operations, while also lowering their overall HSE and environmental impact," stated Thiago Montanari, Sales Manager at iXblue.

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## JAN DE NUL EXECUTES CABLE REPAIR WORK FOR TENNET

Jan De Nul Group has successfully repaired TenneT's AC108 cable connecting the Trianel Borkum offshore substation with TenneT's DolWin alpha convertor station. The repair job is part of the Service Level Agreement for cable repairs that Jan De Nul Group and TenneT entered into in 2019.

TenneT engaged Jan De Nul Group for the repair of a cable fault located within the 500-meter zone around the DolWin alpha platform, 75 kilometers off the German coast north of the island of Borkum. This offshore platform connects three wind farms in the German North Sea to the German extra-high voltage grid, and is therefore vital for these wind farms to get the green energy ashore.

Within less than 50 days, Jan De Nul performed the specific detailed engineering, the vessel mobilization, the replacement of the damaged cable section, as well as the burial of the new cable and joint.

Benjamin Foubert, Manager Offshore Cables at Jan De Nul Group, said: "We are very proud of this very well organized and swift repair. The extensive pre-engineering efforts we performed in view of this repair framework agreement clearly paid off. Achieving the full repair in such a short notice resulted in a minimal disruption of the offshore grid connection. Thanks to the close and pro-active cooperation between all parties involved we were able to complete this campaign successfully, which included our two vessels working simultaneously in close proximity of the offshore platform."

For this repair job, Jan De Nul mobilized its Cable-Laying Vessel *Isaac Newton* and Multi-Purpose Vessel *Adhémar de Saint-Venant*. First, the *Adhémar de Saint-Venant* deburied the damaged cable section, including its cable protection system which was buried under large armor rock.

The *Isaac Newton* loaded the spare cable and repair joint in Emden, recovered the damaged cable section offshore and subsequently installed the new cable and joint with success. Jan De Nul's jet-trenching vehicle PT1, installed on-board the *Isaac Newton*, completed the repair campaign by burying the new cable section 1.5 meters below the seabed.



» Jan De Nul repaired a cable fault located within the 500-meter zone around the DolWin alpha platform, 75 kilometers off the German coast. (Photo credit: Jan De Nul)



» The collaboration seeks to capitalize on the growing global demand for high-voltage, next generation power cables with dynamic capabilities for near-shore and floating wind farms. (Photo credit: DNV)

## DNV, LS CABLE TO TARGET FLOATING OFFSHORE WIND CABLING

DNV, the independent energy expert and assurance provider, has signed a non-exclusive Memorandum of Understanding (MOU) with leading global cable manufacturer LS Cable & System to target emerging cabling opportunities in the offshore wind industry.

The MOU comes in response to growing global demand for high-voltage, next generation power cables with state of the art dynamic capabilities for near-shore and floating wind farms.

The collaboration represents a new opportunity for DNV to extend its market-leading Dynamic Power Cables Assurance service offering to the cabling industry and to leverage the group's longstanding technological expertise in the oil and gas industry for the rapidly expanding offshore wind market.

For LS Cable & System, this initiative with DNV represents one of the early collaborations between a cable-focused Original Equipment Manufacturer (OEM) and an energy expert and assurance provider.

The MOU will assist LS Cable & System in identifying and reducing risk early on in the cable manufacturing process, improving overall decision-making and helping secure pre-approval for floating power cabling products for offshore wind farm developers.

The MOU will see DNV and LS Cable & System leverage their collective resources, individual strengths and distinctive capabilities in the following areas:

- **Geotechnics:** cable protection and burial assessments
- **Installation:** environmental screening and cable-laying optimization and scheduling
- **Materials technology:** cable corrosion protection and mechanical testing
- **Structural design:** dynamic analysis and cross-sectional analysis of cables subjected to floating loads and installation loads
- **Forensics:** rapid-response investigation into power failures and root cause analysis of third-party cabling.

As part of the MOU, DNV and LS Cable & System will develop specific framework agreements to jointly determine their commercial and working arrangements in relation to these various work areas.

## OFFSHORE WIND CABLE STABILITY SYSTEM PREVENTS DAMAGE

With recent publicity surrounding offshore wind cable failures, Aberdeen-based Balmoral Comtec says its integrated cable protection stability system offers up to 75% reduction in subsea cable movement helping prevent irreversible damage.

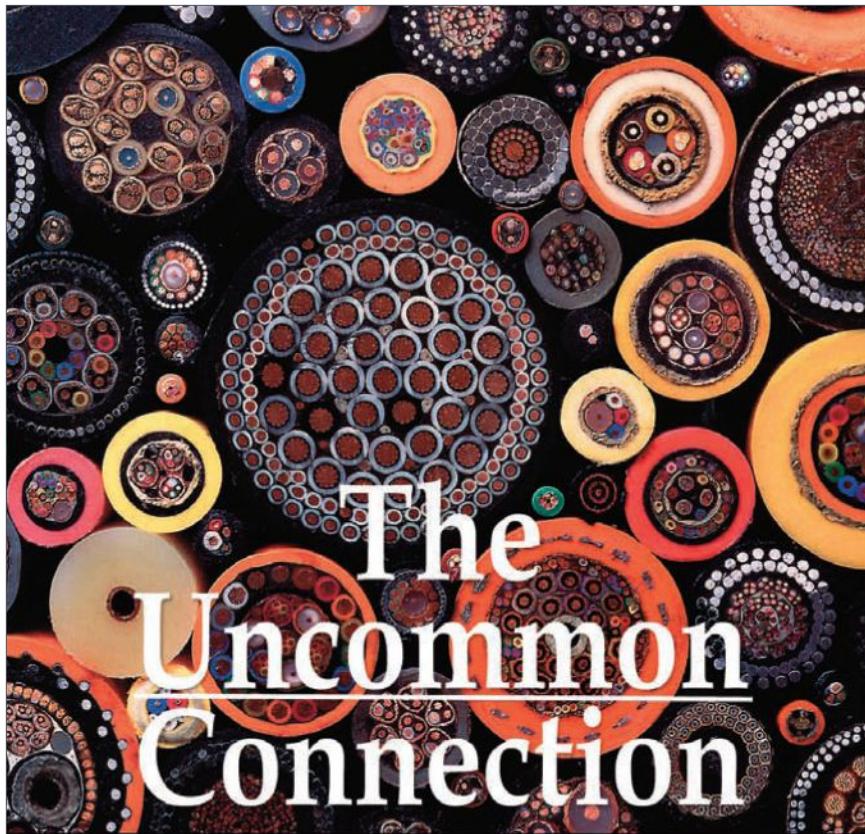
The stability solution, which complements Balmoral FibreFlex™, the company's patented cable protection system, offers enhanced tensile and creep performance by using weighted modules to improve cable curvature response while maintaining system geometry over life.

The proprietary system has been proved to offer up to a 75% movement reduction in subsea environments with a corresponding trebling of cable life subject to seabed topology and metocean data.

Even in the most extreme environments a 50% reduction in subsea movement is achieved that more than doubles cable lifetime performance.

Fraser Milne, engineering and projects director at Balmoral, says: "The integrated stability system delivers these important improvements without the requirement for expensive secondary activities such as placement of concrete mattresses or rock dumping which can involve the chartering of further vessels. This innovative development was inspired by engagement and recognition of client requirements and considers the commercial aspect of not just field development but the longevity of the product, improving overall field reliability and therefore directly affecting the Level Cost of Energy."

Balmoral is globally recognised for its experience in extreme subsea environments and the company has adapted its polyurethane design engineering and manufacturing capabilities to develop high performing cost-efficient solutions for the offshore wind sector.



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» Balmoral FibreFlex cable protection system offers up to 75% reduction in damaging subsea cable movement.  
(Photo credit: Balmoral Comtec)

## OFFSHORE WIND INDUSTRY LOOKS TO RAISE ARRAY VOLTAGE

A new project to build industry consensus on setting the future standard array voltage for offshore wind farms has been launched.

The High Voltage Array Systems (Hi-VAS) project is the latest joint industry initiative led by the Carbon Trust as part of the Offshore Wind Accelerator (OWA) program. It aims to understand the costs, benefits and technology challenges associated with raising the array voltage.

The wider consortium of the Hi-VAS project consists of seven wind farm developers: EnBW, Equinor, Ørsted, RWE, ScottishPower Renewables, Shell and Vattenfall. The half-million pound project is set to run until January 2022 and is being delivered by the Carbon Trust, TNEI and Petrofac. It builds on the success of previous OWA work in raising the array voltage from 33kV to 66kV, where similar industry consensus was reached five years ago.

As offshore wind turbines are set to grow beyond 15 MW, it is widely agreed within the industry that the current standard array voltage of 66kV will be insufficient. A higher array voltage will be necessary to enable cost-effective string lengths and layout designs; reduce electrical losses; and ultimately enable the deployment of larger turbines. However, uncertainty remains as to what the optimum next

array voltage is; the appropriate timing for making the change to the next array voltage; and the most efficient path to the next array voltage in terms of technology and regulatory development.

Whilst, in time, the array system supply chain could gradually accommodate the next generation of turbines and regulators would progressively move to accommodate changes in array system technology, a collaborative approach will accelerate this transition to ensure the industry can continue to reduce costs and increase capacity.



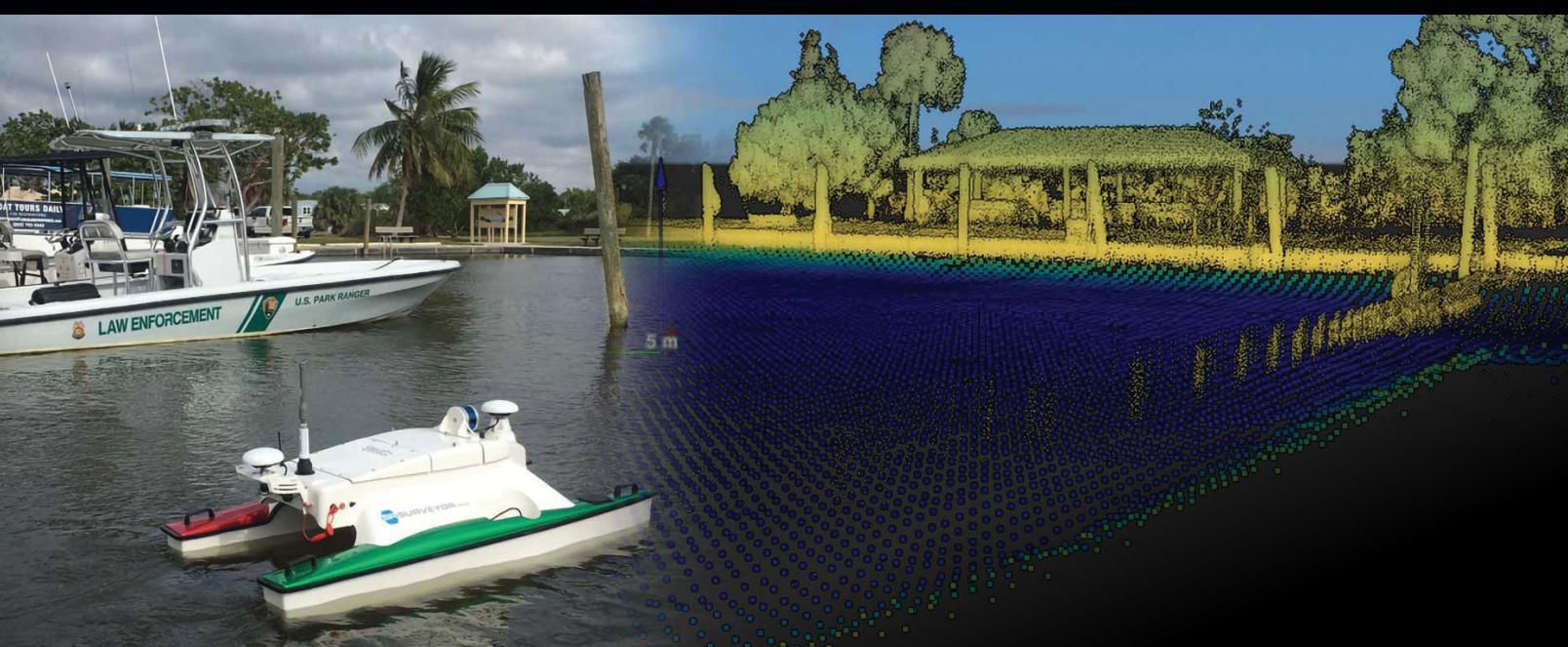
To achieve this, supply chain and regulatory stakeholders will be engaged throughout the project to provide insights into the practical challenges faced in raising the voltage; to provide constructive criticism and to ensure the project's findings are supported and acted on by the industry.

The technical and regulatory changes required when raising the array voltage will be examined. Detailed cost-benefit analysis, risk analysis and preliminary design studies will be performed for a range of possible future array voltages and a range of future turbine sizes (14-20 MW) to identify the next optimum array voltage.

A series of engineering design studies will examine how each component, standard, method, or regulation associated with the array system may need to adapt. Recommendations on how to address barriers identified through the project will be included in an industry roadmap to ensure the recommendations are taken up by the supply chain and regulators.

Jan Matthiesen, Director Offshore Wind at the Carbon Trust, commented: "Offshore wind is a leading solution to tackle climate change globally and we must continue to innovate to accelerate and optimize deployment. The OWA High Voltage Array Systems project is the latest collaborative industry project to join the significant portfolio of offshore wind research and development programs run by the Carbon Trust. By demonstrating a strong alignment among developers a clear and consistent message can be sent to the supply chain, which will ultimately accelerate the introduction of high voltage array systems and hence the next generation of wind turbines."





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# REDISCOVERING USS NEVADA

**By James Delgado,**  
Senior Vice President, SEARCH Inc.

**Michael Brennan,**  
Maritime Archaeologist, SEARCH Inc.  
**and Josh Broussard,**  
Chief Technology Officer, Ocean Infinity

## MAPPING AN UNDERSEA MUSEUM

As bathymetric mapping and hydrographic surveys tackle the goal of a complete mapping of the global seabed in the next decades, an increasing number of highly significant shipwrecks and lost aircraft will be found. In some cases, this will resolve mysteries past and present, like Amelia Earhart's plane and flight MH370, or long forgotten missing ships that never reached port. Recently, Ocean Infinity and SEARCH, Inc. worked together to maximize mapping opportunities and more efficiently do just that. The wreck in question was not lost, but sunk after a storied career, which included as a target for two atomic bombs. Lying at roughly defined coordinates three miles deep and sixty miles off Oahu, the wreck of the battleship USS Nevada was located with autonomous HUGIN vehicles that covered a hundred square miles of uncharted seabed in a matter of hours.

Over the course of a 24-hour period, the wreck site was mapped, revealing a scattered debris field that included the intact, overturned hull of the veteran battleship. Among the debris field lay the superstructure, turrets, and portions of the ship that had fallen from the surface during five days of prolonged naval gunfire and torpedoes to sink Nevada—a ship that already had a reputation of being "too tough to die." A prolonged ROV dive completed a comprehensive documentation of the wreck site, which now rests in the great museum of the deep. The key to success in this mission was the unique capabilities of AUVs, their instrumentation, and the concept of utilizing a suite of robotic vehicles in a cost and time effective manner, while also using best practices for mapping and detailed characterization of what rests in a hitherto uncharted, unknown deep ocean environment.

ROV: KD31  
Dive No: 134

Easting :  
Northing:

HDG: 304.93  
Depth: 4678.01m  
Alt: 1.10m

Date: 29/04/2020  
Time: 19:39:51 UTC

USS NEVADA GVI

ROV: KD31  
Dive No: 134

Easting :  
Northing:

HDG: 83.84  
Depth: 4676.54m  
Alt: 1.73m



Date: 29/04/2020  
Time: 19:29:04 UTC

USS NEVADA GVI

ROV: KD31  
Dive No: 134

Easting :  
Northing:

HDG: 334.11  
Depth: 4677.07m  
Alt: 1.67m



Date: 29/04/2020  
Time: 19:43:47 UTC

USS NEVADA GVI

ROV: KD31  
Dive No: 134

Easting :  
Northing:

HDG: 144.05  
Depth: 4673.67m  
Alt: 3.41m



Date: 29/04/2020  
Time: 18:38:04 UTC

USS NEVADA GVI

ROV: KD31  
Dive No: 134

Easting :  
Northing:

HDG: 304.93  
Depth: 4678.01m  
Alt: 1.10m



» Lying over 4,500 m deep, sixty miles off Oahu, hi-res images of the USS Nevada. From top to bottom: USS Nevada's mast that once towered over 300 ft; one of four tanks onboard; one of Nevada's thirty-two 40 mm Bofors antiaircraft guns; the ship's stern. (Image credits: Ocean Infinity/SEARCH, Inc.)



» *USS Nevada (BB-36) underway off the Atlantic coast of the United States, September 17, 1944. (Photo credit: Official U.S. Navy Photograph, Naval History and Heritage Command)*

The mission was not planned, but came as a sudden opportunity in April 2020, at the start of the COVID-19 pandemic. Both of our companies had been discussing the potential for working together given our mutual interests, backgrounds and different assets and skills. Ocean Infinity, both U.K. and U.S. based, was then operating a small fleet on the world's oceans. Their smaller fleet of fourteen HUGIN autonomous underwater vehicles, and their remotely operated vehicles, which are especially significant for deep sea survey and discovery. This was tested and proved with Ocean Infinity's successful searches for and surveys of the wrecks of the Argentine submarine ARA San Juan, the bulk carrier *Stellar Daisy*, the Ro-Ro *Grande America* and the French submarine *Minerve* from 2018 to 2019.

#### **TECHNOLOGY NARROWS THE SEARCH**

The technology, while field-tested and known in the industry, is a game-changer when multiple vehicles can be deployed simultaneously, all equipped with multiple sonars and digital imaging systems, including high resolution synthetic aperture sonar, and capable of detailed, centimeter-level resolution survey at depths up to 6,000 meters. While this mission again demonstrated the ability of the tech and the team to find a deep-sea shipwreck quickly, it also demonstrated how much more efficient the systems and approach are when assessing the needs for high-resolution deep-sea survey and mapping.

SEARCH and its team have been in the forefront of deep-sea archaeology for two decades. As the two companies discussed partnership on projects, the realization of a repositioning cruise and *Pacific Constructor*'s imminent arrival at Honolulu meant that we could partner on a quick mission of opportunity to find

USS Nevada when *Pacific Constructor* passed within miles of the rough position for the wreck. Despite being sunk in modern times in a highly publicized target practice exercise that lasted for five days with battleships and destroyers shelling, onboard explosives and at last aerial torpedoes, the exact location of USS Nevada was a rough position noted in classified logbooks of the ships that participated in the exercise in 1948. Those now declassified logbooks had been studied by Pam Orlando of NOAA's Maritime Heritage Program as part of an assessment of ships subjected to atomic testing and subsequently scuttled. Three different positions from the logs, when plotted on a chart, yielded a hundred square mile search "box" in those three-mile-deep waters.

#### **RECAPTURING HISTORY**

Other than having rough coordinates and a historical and archaeological interest, why Nevada? USS Nevada was an iconic prewar dreadnought style battleship that was state-of-the-art when launched in time for World War I. *Nevada* gained fame and its iconic status at Pearl Harbor on December 7, 1941. Strafed, bombed and torpedoed, *Nevada* was the only battleship to get under way that day, a brave sortie that inspired all who watched it steam out, guns blazing at attacking aircraft. While run ashore to avoid sinking, *Nevada* was refloated and repaired and went on to fight in the Atlantic and Pacific theaters of war. It was at D-Day, and off Okinawa and Iwo Jima, surviving a kamikaze attack that hit it and killed or wounded sixty of the crew. At the end of the war, *Nevada* was known as the toughest ship in the U.S. Navy. It was a ship that would not die. The discovery of *Nevada* in April 2020 was a perfect reminder to a nation and a world ravaged by COVID-19 that the human spirit is resilient and indomitable.



» AUV launch: Capable of working in the deepest, darkest, and coldest reaches of the ocean, AUVs return to the surface with data that provides a detailed sense of what sonar and other sensors have revealed. (Photo credit: Ocean Infinity)

Selected for the first atomic bomb tests in 1946 at Bikini Atoll, Nevada was the aiming point for the first test, but survived that and the next test. Irradiated and battered, but still afloat, Nevada was towed to Pearl Harbor for detailed examination before being scuttled in 1948. Seventy-two years later, our focused deep-sea survey rediscovered and mapped Nevada and the surrounding seabed in just under twenty-four hours. As the data from the initial AUV deployment was quickly processed, the ROV started its drop to the sea floor. An eight-hour dive followed, revealing the ship as we joined via satellite to work remotely and COVID-19 safely with the onboard team to characterize and assess history once hidden in the deep sea.

The mission was a successful test of the systems, technology and teams. It underscored the cost-efficiency of ocean survey with these tools and approach. The future is here, as demonstrated with this powerful reminder from our past. Let's get out there and efficiently survey, discover and better understand our planet's final frontier.



» The hatch leading into a shell handling compartment for one of USS Nevada's 5-inch/38 caliber guns. This remarkable level of preservation is occasionally found on deep-ocean shipwrecks due to the lack of light, oxygen, and the extreme cold at 15,400 feet down. (Photo credit: Ocean Infinity/SEARCH, Inc.)

# NAVY FORECASTING PROVIDES 45-DAY ADVANCED ENVIRONMENTAL PREDICTIONS

Earth's ocean-navigating environment just got a little less mysterious thanks to the U.S. Naval Research Laboratory (NRL) developed Navy Earth System Prediction Capability (ESPC) global forecasting system that went live in late August.

Navy ESPC V1 provides the Navy with the first ever high-resolution ensemble capability for the ocean and sea ice that delivers both ensemble mean forecasts as well as a measure of uncertainty up to 45 days out.

"Atmosphere, ocean and sea-ice conditions affect naval operations," said Carolyn Reynolds, a meteorologist at NRL's Marine Meteorology Division in Monterey, California. "The transition of this new system provides, for the first time, environmental forecast information that fills the gap between weather and climate timescales to advise decision makers."

Fleet Numerical Meteorological and Oceanography Center (FNMOC) released the new forecast system to provide these important program elements and provide users a range of forecasts and an understanding of the accuracy of the forecast.

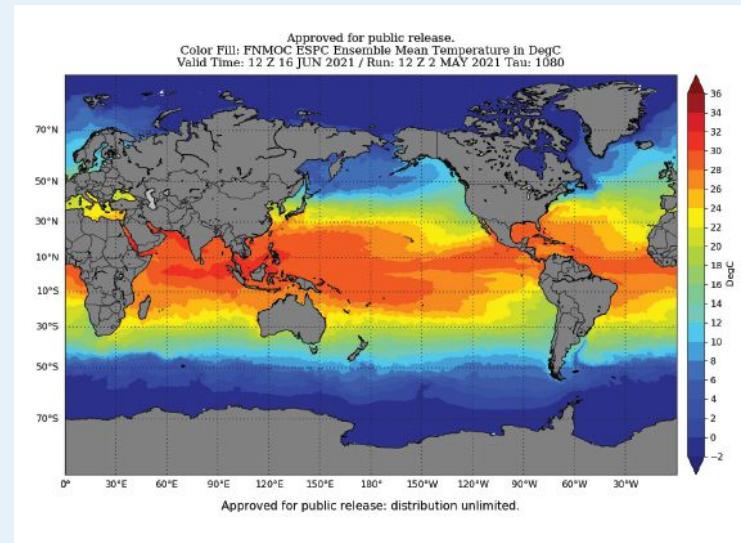
"Previously, global ocean and sea ice forecasts consisted of a single deterministic forecast out to seven days, but now Navy ESPC V1 provides an extended high resolution capability out to 45 days and the ensemble mean is typically more accurate than a single forecast," said Joe Metzger, a meteorologist at NRL's Ocean Sciences Division and project collaborator.

With Naval forces operating in dynamic environments around the world, having an accurate global long-range forecast provided by the Joint Typhoon Warning Center, Naval Oceanographic Office, and National Ice Center is critical to the safety of service members and for operational planning.

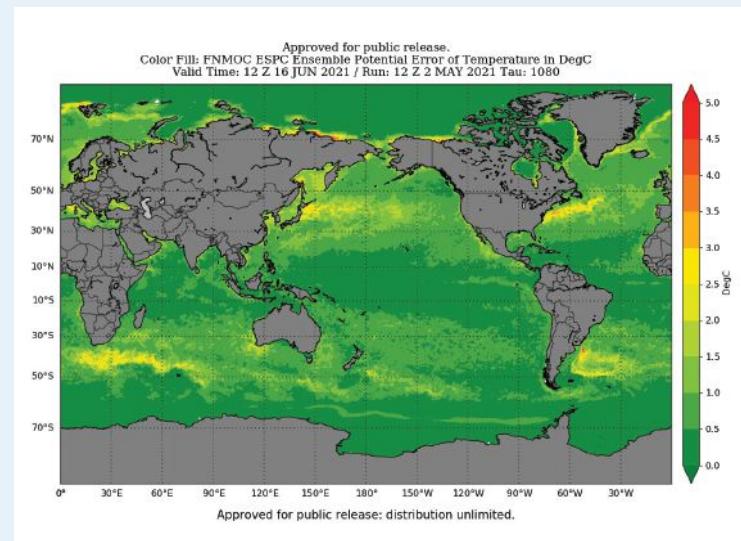
"ESPC is enabling higher-level Navy preparation for subseasonal-to-seasonal prediction," said Bill Kerr, the technical director at FNMOC. "For instance, knowing ahead of time the typhoon season in the Western Pacific will be particularly light or particularly heavy allows better force protection preparation and application of resources."

Kerr believes this initial implementation is just the tip of the iceberg for how ESPC will revolutionize environmental forecasting.

"The real payoff for this technology is still in the future, when ESPC becomes a rapidly evolving testbed for Navy R&D, and the same systems provide dynamically reconfigurable modeling capabilities in one coupled system for operations," Kerr said. "It's good now, but it's going to be game-changer for environmental forecasting."



» Fleet Numerical Meteorological and Oceanography Center (FNMOC) Earth System Prediction Capability (ESPC) ensembles potential error of temperature in degrees Celsius. (Image credit: U.S. NRL)



» Fleet Numerical Meteorological and Oceanography Center (FNMOC) Earth System Prediction Capability (ESPC) ensemble potential error of temperature in degrees Centigrade. (Image credit: U.S. NRL)

## TETHYS ROBOTICS INTEGRATES REACH ALPHA GRABBER FOR MILITARY EOD AND SEARCH & RESCUE

Tethys Robotics is an Unmanned Underwater Vehicle (UUV) developer founded by Christian Engler and fellow pioneering ETH Zurich students in 2019. Tethys aims to push boundaries for underwater exploration in Switzerland, where large waterways including lakes and rivers are abundant, as well as contribute to the country's hydroelectric industry. Since Tethys launched their



» Proteus UUV testing in Switzerland. (Photo credit: Tethys Robotics)

flagship vehicle, the SCUBA 2.0 they have found further success with the recent release of Proteus, an omnidirectional ROV appointed with a stereo camera, depth sensor, IMU, SBL and sonar, certified to a depth of 300 m.

Alongside their research partners 'Armasuisse,' an armament procurement agency affiliated with Switzerland's Federal Department of Defense, Tethys aims to produce UUVs for local authorities including the Swiss Explosive Ordnance Disposal (EOD) team. The vehicle applications will include rescue diver assistance through robotic interaction, 3D mapping of the seabed, ammunition recovery and search and recovery of underwater targets. Their technology will ultimately minimize risk to rescue divers conducting recovery missions by operating in harsh conditions unsafe for humans, including high currents, turbulence, long dive durations and extreme temperatures.

To assist in achieving these goals, Tethys has integrated Blueprint Lab's Reach Alpha Grabber to their Proteus UUV. Featuring adjustable grip force, active compliance for safe lifting of heavy, unbalanced objects and quick-change end effectors for mission specificity, the Alpha Grabber is a tough, versatile and proven solution for intervention in harsh subsea environments. In their own words, Tethys describes their success with the manipulator:

"With the Reach Alpha Grabber, we are now able to interact with the environment and the divers underwater. The combination of reliability and robustness of the grabber with the precision and maneuverability of the UUV pushes the frontiers of underwater operations. Furthermore, due to the depth rating of the Reach Alpha, we have no restrictions to operate in any lake or river of Switzerland."

## ISRAEL SHIPYARDS TO SUPPLY EAST ASIAN NAVY WITH SHALDAG MK V VESSEL

Israel Shipyards Ltd., a leading shipbuilding and repair company in the Eastern Mediterranean serving naval and commercial marine markets, has won a tender to supply an East Asian Navy with its SHALDAG MK V vessel. The Agreement, which was signed between Israel Shipyards, the Israeli Ministry of Defense, and the customer, includes the transfer of knowledge regarding the construction of the vessel, as well as the preparation of the customer's shipyard for vessel construction through an upgrade of the shipyard. Israel Shipyards will also conduct training at the customer's facility regarding construction of the SHALDAG MK V sections as well as maintenance of the vessel.

SHALDAG MK V, the largest member of the SHALDAG Class, is a combat-proven, all-aluminum, light and fast vessel with high payload capacity, providing exceptional maneuverability and seakeeping. Delivering a high firepower-to-displacement ratio, it

is designed to operate in naval security missions and is a recognized leader in the protection of Exclusive Economic Zones (EEZ) and littoral waters.

Remarking on the award of the tender, the company's CEO, Eitan Zucker, said, "At Israel Shipyards we work tirelessly to enable our customers to receive a

comprehensive and long-term solution for their various needs in securing their maritime borders—from the construction of vessels suitable for missions in the region, to knowledge transfer services that enable long-term savings for the customer. We are thankful for the fruitful cooperation with the Ministry of Defense and the customer."



» SHALDAG MK V is a high payload capacity vessel that provides exceptional maneuverability and seakeeping. (Photo credit: Israel Shipyards)

# SPECIALIZED OCEAN TECHNOLOGY AND MARINE OPERATIONS

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## OIL & GAS CORPORATE EVENTS HAVE NO IMPACT ON COMMODITY PRICES

BY G. ALLEN BROOKS | Author, *Musings From the Oil Patch* | [www.energymusings.com](http://www.energymusings.com)

### Crude Oil:

Since mid-February, except for a few days in early April, crude oil futures prices have been at or above \$60 per barrel. The longer prices trade in this range, the greater the confidence that \$60 has become the new price floor, meaning falling oil prices will reach that point and then rally higher. Price floors and caps are important technical levels for commodity traders figuring out when to buy and/or sell oil futures contracts. From the energy market's viewpoint, the price floor is a signal we have reached a global oil supply/demand balance and are beginning to trend toward a shortage condition.

Another sign of the market's balance and tightening environment on the horizon is that OPEC is adding more oil to the market. Importantly, the supply additions have not weakened oil prices as demand is growing despite COVID-19 outbreaks. The reopening of the global economy is key. Driving in North America has returned to 2019 levels and continues increasing. Air traffic grows and airlines are reporting leisure bookings are back to 2019 levels, although business traffic continues to lag. Shopping traffic is up sharply, although it is about 4.3% below 2019 levels. Companies, schools, and universities are announcing plans to return to in-person operations starting this summer and fall. All these demand increases are coming faster than predicted.

Geopolitics will continue to shape world oil supply. Will the Israel-Palestine violence, currently on hold, erupt and spread throughout the Middle East? Will the United States reenter the nuclear agreement with Iran, freeing it to ramp up its oil exports? Will the U.S. aid Venezuela in restoring some of its lost productive capacity? The answers to these questions, and others, could signal a greater increase in global oil supply. The offset is that

additional consumption is shrinking the global oil glut from 2020 that overhung the market and depressed oil prices.

Rather than geopolitical events, global economic demand remains the key driver for oil prices. Will demand growth and limited supply expansion lead to an \$80-per-barrel price by year-end, as Goldman Sachs predicts? While the loss of at least two directors from ExxonMobil's board in a proxy contest suggests the end of Big Oil as we know it, the market knows we will need oil and its products for decades. That is why the shocking annual meeting outcome did not move oil prices. The market is smarter than the pundits.

### Natural Gas:

Hurricane season begins June 1. The National Oceanic and Atmospheric Administration (NOAA) has predicted this year will see "above normal" activity—more total storms, hurricanes, and extreme hurricanes than usual. NOAA's forecast is consistent with forecasts from other storm researchers. Colorado State University's hurricane forecasters not only predict storm activity, they also have been developing models to predict where storms may go, including whether and where they might make landfall along the U.S. coastline and in the Caribbean. With an above-normal season predicted, it is not surprising that the likelihood of hurricane landfalls on the U.S. coast is higher than the historical average.

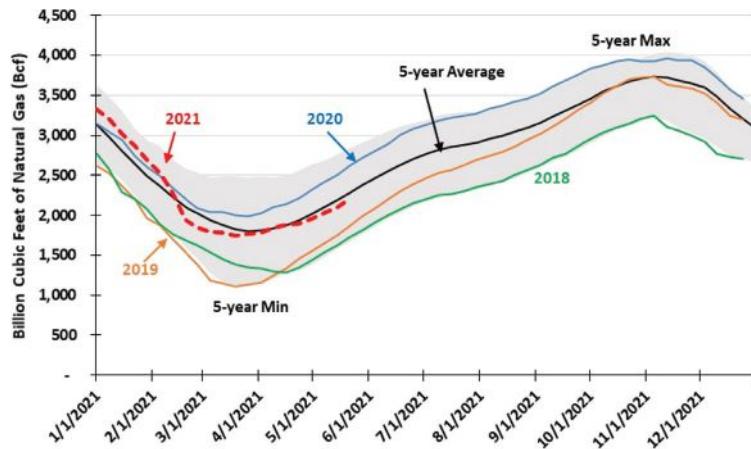
Weekly gas storage injections during May were higher than predicted. This is not necessarily a surprise, as we are in the shoulder months of weaker demand as we transition between winter and summer demand. Strong LNG demand is being met at the same time storage injections are overshooting estimates. This suggests consumption may be slightly weaker, while supply could be greater.

A healthy natural gas industry will be important in a recovering economy, but any spike in gas prices could jeopardize LNG's global competitiveness. The completion of the Nord Stream 2 gas pipeline between Russia and Germany may make Europe a much more competitive market for U.S. LNG starting this fall, which is a longer-term development that needs to be monitored this summer. We also need to watch tropical storm activity for supply and demand disruptions.

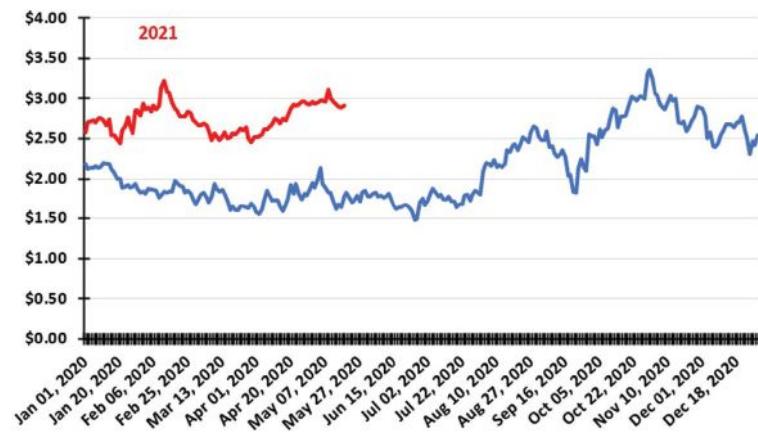
Another potential disruptive development is the effort by politicians and courts to ban fossil fuels in fighting climate change. The recent ruling in The Netherlands by a Dutch court that Royal Dutch Shell must cut its carbon emissions by 45% from 2019 levels by 2030 is a sign of how market dynamics can be upset by events outside of the energy market. The ruling did not detail how Shell's emissions were to be measured and monitored, let alone how the court would enforce its order or even what penalties might be assessed. The energy market sensed the ruling was another example of "virtue signaling" rather than a serious threat to gas demand, thus gas prices never reacted. This development is a warning that non-market events have the potential to disrupt gas prices by altering market participants' expectations for supply and demand trends.

If natural gas supply is not disrupted by tropical storms and demand is not disrupted by non-market factors, gas prices will probably trade around their current levels. Extreme heat waves this summer will boost demand and could spike gas prices, but once the heat moderates, we would expect prices to return to their prior levels. A dull gas market is not such a bad situation.

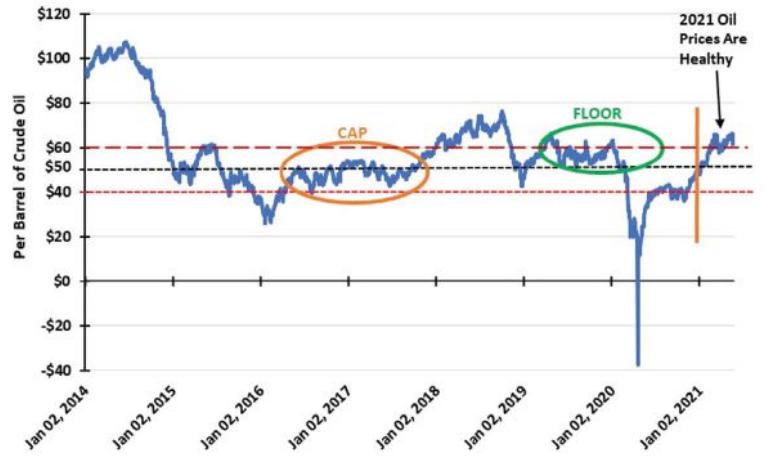
**Gas Storage, After Winter Cold Boosted Consumption, Now Close to 5-Year Average**



**2021 Gas Prices,**  
- Better Than Last  
Year; Are Now  
Tracking \$3/Mcf  
Level



**As \$60 Is New Price Floor - Might Oil Prices Go Higher?**





## AMERICAS

### **Marine Tech Expo**

Virtual » July 12-13  
[www.marinetechexpo.co.uk](http://www.marinetechexpo.co.uk)

### **AUVSI XPONENTIAL Atlanta**

Atlanta, GA » August 16-19  
[www.xponential.org/xponential2021](http://www.xponential.org/xponential2021)

### **Offshore Technology Conference (OTC)**

Houston, TX » August 16-19  
<http://2021.otcnet.org/>

### **International Partnering Forum (IPF)**

Richmond, VA » August 24-26  
[www.offshorewindus.org/2021ipf](http://www.offshorewindus.org/2021ipf)

### **International Telecoms Week**

Washington D.C. » August 29 - September 1  
[www.internationaltelecomsweek.com](http://www.internationaltelecomsweek.com)

### **Offshore Well Intervention LATAM**

Rio de Janeiro, Brazil » September 8-9  
[www.offsetnet.com/latam](http://www.offsetnet.com/latam)

### **US Hydro**

Virtual » September 13-16  
<http://ushydro2021.org>

### **Global OCEANS**

San Diego, CA » September 20-23  
[www.global21.oceansconference.org](http://www.global21.oceansconference.org)

### **SIPEX**

Virtual » October 5-7  
<https://surinameoilexpo.com>

### **ACP Offshore Windpower**

Boston, MA » October 13-15  
<https://cleanpower.org/events/offshore-windpower-2021-conference-exhibition/>

## EUROPE

### **All-Energy**

Glasgow, UK » August 18-19  
[www.all-energy.co.uk](http://www.all-energy.co.uk)

### **Deep Sea Mining Summit**

London, UK » August 25-26  
[www.deepsea-mining-summit.com/](http://www.deepsea-mining-summit.com/)

### **Submarine Networks EMEA**

London, UK » September 1-3  
<https://www.terrapinn.com/conference/submarine-networks-world-europe>

### **SPE Offshore Europe**

Aberdeen, UK » September 7-10  
[www.offshore-europe.co.uk](http://www.offshore-europe.co.uk)

### **Seanergy**

Nantes, France » September 21-24  
<https://www.seanergy-forum.com/en/seanergyforum>

### **Ocean Business**

Southampton, UK » October 12-14  
[www.oceanbusiness.com](http://www.oceanbusiness.com)

### **Offshore Energy**

Amsterdam, The Netherlands » October 26-27  
<https://www.offshore-energy.biz/offshore-energy-2021/>

### **EEGR Southern North Sea**

Norfolk, UK » October 27-28  
[www.eegr.com/events/sns2021](http://www.eegr.com/events/sns2021)

### **Ocean Energy Europe**

Brussels, Belgium » December 6-7  
[www.oceanenergy-europe.eu/annual-event/oee2021](http://www.oceanenergy-europe.eu/annual-event/oee2021)

### **Undersea Defence Technology (UDT)**

Rostock, Germany » December 14-16  
[www.udt-global.com](http://www.udt-global.com)

## OTHER REGIONS

### **Telecoms World Africa**

Virtual » August 31  
[/www.terrapinn.com/conference/telecoms-world-africa](http://www.terrapinn.com/conference/telecoms-world-africa)

### **Gastech**

Dubai » September 21-23  
[www.gastechevent.com](http://www.gastechevent.com)

### **Submarine Networks World**

Singapore » September 29-30  
[www.terrapinn.com/conference/submarine-networks-world/](http://www.terrapinn.com/conference/submarine-networks-world/)

### **Mediterranean Offshore Conference**

Alexandria, Egypt » October 12-14  
[www.moc-egypt.com](http://www.moc-egypt.com)

### **Offshore Well Intervention West Africa**

Virtual » October 12-15  
[www.offsetnet.com/owi-wa](http://www.offsetnet.com/owi-wa)

### **ADIPEC**

Abu Dhabi » November 15-18  
[www.adipec.com](http://www.adipec.com)

### **Telecoms World Asia**

Bangkok » November 16-17  
[www.terrapinn.com/conference/telecoms-world-asia/index.stm](http://www.terrapinn.com/conference/telecoms-world-asia/index.stm)

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	TECHNOLOGY & INDUSTRY FOCUS	2021 EDITORIAL CALENDAR
JANUARY Editorial: Dec. 28 Ad: Jan. 14	» <b>The Essential 2021 Offshore Toolkit</b>	<b>Technologies:</b> ROV tooling & control, Subsea cables, Remote inspection, Supply vessels, turbines, tethers, and more. <b>Industry Focus:</b> Offshore Energy & Renewables, Marine Survey, Scientific, Defense	
FEBRUARY Editorial: Jan. 25 Ad: Feb. 11	» <b>Ocean Observation</b>	<b>Technologies:</b> Buoys, ADCP, Data Software, Sensors, Drifters, Gliders, and more. <b>Industry Focus:</b> Marine Survey, Scientific, Offshore Energy & Renewables	
MARCH Editorial: Feb. 22 Ad: Mar. 11	» <b>Unmanned Vehicles &amp; Marine Robotics</b> » <b>Distribution:</b> GIPEX ☰ / June 28-30	<b>Technologies:</b> USVs, AUVs, ROVs, Aerial drones, Control systems, Seafloor residency, and more. <b>Industry Focus:</b> Offshore Energy, Marine Survey, Defense, Academic, Subsea Infrastructure	
APRIL Editorial: Mar. 22 Ad: Apr. 08	» <b>Defense &amp; Security</b>	<b>Technologies:</b> Autonomous Navigation, Comms & Telemetry, Magnetometers, GIS, Sonar, and more. <b>Industry Focus:</b> Subsea Defense, Government, Offshore Energy, Subsea Infrastructure	
MAY Editorial: Apr. 19 Ad: May 06	» <b>Marine Renewables</b> » <b>Distribution:</b> SIPEX ☰ / June 1-3 Floating Wind Solutions / June 28-29 Int'l Partnering Forum / Aug. 24-26 H2O Conference ☰ / June 7-10	<b>Technologies:</b> Turbines, Subsea Cables, Inspection Drones, Subsea Batteries, Grid Integration, Connectors, and more. <b>Industry Focus:</b> Offshore Wind, Wave Energy, Tidal Energy, Alternative Offshore Energy	
JUNE Editorial: May 17 Ad: June 03	» <b>Bathymetric Mapping &amp; Hydrographic Survey</b>	<b>Technologies:</b> Oceanographic Equipment & Instrumentation, Sensor Suites, ADCP, Buoys, ROVs, and more. <b>Industry Focus:</b> Marine Survey, Academic, Geotechnical Services	
JULY Editorial: July 01 Ad: July 15	» <b>Unmanned Vehicles Buyers' Guide ☰</b>	<b>Technologies:</b> ROVs, AUVs, USVs, Towed & Bottom Crawling Vehicles, and Gliders. <b>Company Focus:</b> Exclusive company/product spotlights and editorial features available	
AUGUST Editorial: July. 26 Ad: Aug. 12	» <b>Deep-Sea Exploration</b> » <b>Distribution:</b> Global OCEANS / Sept. 20-23 Seanergy / Sept. 21-24 ☰	<b>Technologies:</b> Seabed samplers, Mining machines, Geotechnical tooling, Seafloor imaging equipment, and more. <b>Industry Focus:</b> Offshore Energy, Marine Mining, Scientific	
SEPTEMBER Editorial: Aug. 23 Ad: Sep. 09	» <b>Offshore Build, Inspection &amp; Maintenance</b> » <b>Distribution:</b> Ocean Business / Oct. 12-14 Offshore Energy / Oct. 26-27 ACP Offshore Windpower / Oct. 13-15	<b>Technologies:</b> Inspection drones, Turbines, Subsea cables, Power substations, Battery technology, Grid integration, Connectors, and more. <b>Industry Focus:</b> Offshore Operations & Maintenance, Offshore Energy & Renewables	
OCTOBER Editorial: Sep. 20 Ad: Oct. 07	» <b>Submersibles</b> » <b>Distribution:</b> Ocean Energy Europe / Dec. 6-7 UDT / Dec. 14-16	<b>Technologies:</b> Manned submersibles, Navigation systems, ROVs, Submarines, Resident Subsea Vehicles, and more. <b>Industry Focus:</b> Offshore Energy, Defense, Academic, Marine Mining	
NOV./DEC. Editorial: Oct. 18 Ad: Nov. 11	» <b>Subsea Engineering &amp; Infrastructure</b>	<b>Technologies:</b> Subsea drills, Prospecting tools, Deck handling equipment, and more. <b>Industry Focus:</b> Offshore Energy, Defense, Marine Mining, Government	
SPECIAL ISSUE Editorial: Nov. 18 Ad: Dec. 1	» <b>The Future of Ocean Technology</b>	<b>Tech and Industry Focus:</b> Our Special Edition unites an exclusive roll call of industry thought leaders to discuss the innovative breakthroughs set to redefine how we work in marine environments over the coming decade.	

# ØRSTED APPOINTS RICHARD HUNTER AS CHIEF OPERATING OFFICER

Ørsted has appointed Richard Hunter Chief Operating Officer (COO) and new member of the Executive Committee of Ørsted as of June 1, 2021. Richard Hunter comes from a position as President of Rail Control Solutions and Wayside in Bombardier Transportation.

The position is new, following a decision announced earlier this year to reorganize Ørsted to position for future growth. As COO, Richard Hunter will head Ørsted's EPC & Operations for all of Ørsted except the Onshore business, which is organized in a separate business unit.

EPC & Operations is Ørsted's EPC (Engineering, Procurement, and Construction) provider and operator of offshore wind farms as well as combined heat and power plants. The EPC organization manages multiple large-scale offshore construction projects in parallel across the globe, while the Operations organization manages 28 offshore wind farms in operation that supply carbon-free power to more than 18 million people worldwide as well as combined heat and power plants delivering green power and district heating in Denmark.



Richard Hunter has had a long career as executive leader within engineering, manufacturing, and operations in the global and UK-based railway industry, and, until recently, he was President of Bombardier Transportation's global Rail Control Solutions and Wayside business. During his 17 years with Bombardier, Richard Hunter has held executive positions within engineering, manufacturing, and operations in Europe and Asia-Pacific, and he has led projects and product supply in more than 50 countries.

Mads Nipper, CEO and Group President, said: "I'm truly excited to see Richard join the Executive Committee as our COO. Richard

is a world-class executive and has the right set of skills to continue the development of EPC & Operations as a crucial part of our actions to create a world that runs entirely on green energy. Richard has a strong technical foundation in engineering, he has impressive international experience leading manufacturing, operations, and development across the globe, and last but not least, Richard has proven himself to have a strong commercial mindset delivering high value to the business and customers."

Richard Hunter will be based in Gentofte in Denmark and work on a regular basis from Ørsted's London office as well as from other locations worldwide.

Mr. Hunter commented: "I really look forward to joining the team at Ørsted. Having worked for many years in businesses delivering the most environmentally friendly and sustainable forms of transportation, I'm honored to take this role with one of the largest renewable energy companies in the world with a clear ambition to be a leader in the global energy transformation."

## CLASSNK GRANTS AiP TO "AQUARIUS MARINE RENEWABLE ENERGY WITH ENERGYSAIL"

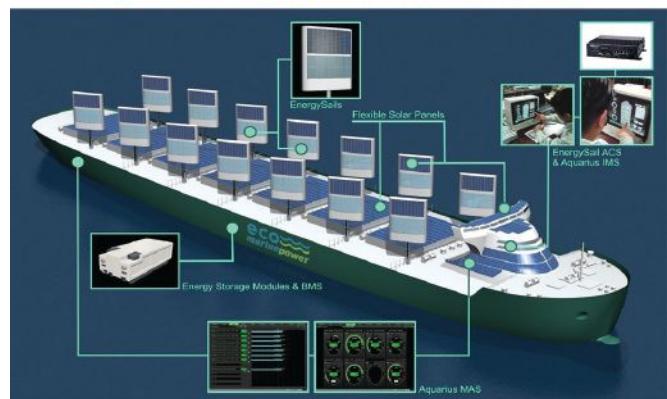
Environmental technology is being actively developed in the maritime industry for the realization of a decarbonized society, as the IMO has set out a vision which confirms its commitment to reducing GHG emissions from international shipping and to phasing them out as soon as possible. To contribute to the swift and safe social implementation of these initiatives, ClassNK has been providing safety standards applicable to a variety of new technologies based on knowledge obtained by collaborating with front runners.

"Aquarius Marine Renewable Energy with EnergySail" is a system that utilizes a combination of renewable energy (wind and solar) obtained by a rigid sail and solar panel deployed on the deck. Having received an application from Eco Marine Power, ClassNK confirmed the design's feasibility based on its Rules for the Survey and Construction of Steel Ships and guidelines for "Wind-Assisted Propulsion Systems for Ships" and "Large-capacity Storage Batteries," and granted the AiP upon completion.

Aquarius Marine Renewable Energy (MRE) is an advanced integrated system of rigid sails, marine-grade solar panels, energy storage modules, charging system and marine computers that enables ships to tap into renewable energy by harnessing the power provided by the wind and sun. The array of rigid sails is automatically positioned by a computer system to best suit the prevailing weather conditions and can be lowered and stored when not in use or during bad weather.

The rigid sails are based on EMP's EnergySail technology and these renewable energy devices can even be used when a ship is at anchor or in harbor. Each EnergySail can be configured with a mix of sensors, photovoltaic panels or other power generation devices.

**Aquarius MRE® – Zero Emission Power and Propulsion**



**eco marine power** **TERAMOTO IRON WORKS** **FURUKAWA BATTERY** **KEI system**

» Aquarius MRE is an integrated system of rigid sails, marine-grade solar panels, energy storage modules that enables ships harness renewable energy. (Image credit: EMP)

## UNMANNED SYSTEMS FOR DISASTER OPERATIONS

By Ronda Moniz, Host of SeaState

Robots are frequently used to gather information when disasters strike. Their ability to either fly, tunnel, swim, or crawl through potentially hazardous environments makes them a vital tool for search and rescue teams.

In our latest episode of SeaState, we talk with Dr. Robin R. Murphy about the use of robotics in disaster response.

Dr. Murphy is the Raytheon Professor of Computer Science and Engineering at Texas A&M University, where she is also Director of the Center for Robot-Assisted Search and Rescue. She is also an IEEE and ACM Fellow. Murphy helped create the fields of disaster robotics and human-robot interaction, deploying robots to 29 disasters in five countries including the 9/11 World Trade Center, Fukushima, the Syrian boat refugee crisis, Hurricane Harvey, and the Kilauea volcanic eruption.

Murphy's contributions to robotics have been recognized with the ACM Eugene L. Lawler Award for Humanitarian Contributions, a US Air Force Exemplary Civilian Service Award medal, the AUVSI Foundation's Al Aube Award, and the Motohiro Kisoi Award for Rescue Engineering Education (Japan).

She is the author of the best-selling textbook *Introduction to AI Robotics* (2nd edition 2019) and the award-winning *Disaster Robotics* (2014), plus serves as an editor for the science fiction/science fact focus series for the journal *Science Robotics*. She also co-chaired the White House OSTP and NSF workshops on robotics for infectious diseases and recently co-chaired the National Academy of Engineering/Computing Community Consortium workshop on robots for COVID-19.

Visit [oceannews.com/seastate](http://oceannews.com/seastate) to listen to the full episode.

After a short summer break, SeaState will return in August when we will be discussing "NASA & Ocean Exploration" before moving on to "Cephalopods and their Possible Applications for Technology" in September.



» SeaState's guest in June,  
Dr. Robin Murphy.



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## YARA MARINE TECHNOLOGIES OPENS SHOP IN POLAND

The new site will serve turnkey deliveries as part of the company's green tech expansion, such as shore power and WindWings, as well as onboard repairs and upgrades. This marks a milestone for Yara Marine Technologies as they move into installation.

"When introducing new and unfamiliar technologies to the maritime industry, we experience that we need to be able to supervise and cover some of the installations ourselves, if only to get local installation and commissioning teams on the right track. We often send our engineers to help on particularly difficult tasks, and now we can send our installation team as well," said



Aleksander Askeland, CSO at Yara Marine Technologies.

To start with, the installation team will focus on conversions, assembly, welding and repairs.

"Especially with smaller upgrades on existing equipment, we find that a small and lean in-house installation team adds a lot of value for our customers," added Askeland.

### IMPROVING SERVICE AND AFTERSALES

The new site will also function as a complementary addition to Yara Marine's suppliers in the after-sales part of the business. This enables the company to further strengthen its service capabilities and add value to its long-term service agreements.

"We keep track of repairs and maintenance, and to continue our service improvements we decided to do some of the critical repairs—like welding—ourselves, as a complement to our preferred subcontractors. The goal is to increase our capacity for supervision and control," said Clas Roth, Head of Customer Service Operations at Yara Marine Technologies.

### TURNKEY SOLUTIONS

Ship-owners and operators expect turnkey solutions for new technologies that are unfamiliar to workers, and the Poland branch is a valuable extension of Yara Marine's ability to meet this expectation. Yara Marine finds that having an installation team to support, supervise and inspect leads to reduced risk and increased value.

"We know how to introduce and implement green maritime technologies. This is our core competence, which we developed throughout our scrubber business journey. We are able to do conversions with several of our new products, like shore power, out of dry dock. In these cases, we experience that ship owners prefer turnkey solutions with a single point of contact and responsibility. Our new Poland site—and the capacity for supervision and control it provides us with—enables us to take full responsibility for these installations," continued Roth.

The new Yara Marine shop is located at Budowlanych no 17L, 80-298 Gdańsk.

## DELMAR SYSTEMS ACQUIRES VRYHOF

Delmar Systems, Inc. Recently announced the acquisition of Vryhof, which includes Deep Sea Mooring and Vryhof Anchors. The combined company, with its global footprint and enhanced asset portfolio, will continue operating as Delmar Systems and as Vryhof.

"We are excited to welcome Vryhof to the Delmar family. Vryhof's Team has built a world-class organization and we look forward to continuing that tradition," said Nick Patterson, Delmar's CEO. "With over a century

of combined company experience, Delmar and Vryhof will offer unrivalled personnel, equipment, engineering, mooring solutions and comprehensive project management to the global offshore energy industry."

"We are pleased to have reached this agreement with Delmar. This transaction is in line with our strategy to divest capital-intensive businesses to allow us to focus our energy on transition and growth plans," commented Jan Erik Rugland, Moreld's CEO, the former owner of Vryhof.

"Delmar is a great home for our companies. The combination of the individual strengths and complementary offerings of the companies will be a key benefit to our mutual and new customers," explained Wolfgang Wandl, Vryhof's CEO. "Our dedicated professionals look forward to

continuing the tradition of providing the very best service and quality that has led to our global success. Together we will pursue the same objectives and ambitions to foster a collective sense of pride in a successful Delmar Systems and Vryhof."



## DOLPHIN DRILLING SECURES ISO 50001 CERTIFICATION

Dolphin Drilling, a leading harsh environment drilling contractor, is the first company of its kind to successfully secure Energy Management System ISO 50001:2018 certification.

ISO 50001 was awarded to Dolphin Drilling following a seamless audit which also covered ISO 9001, ISO 14001, and International Safety Management (ISM) Code requirements for onshore and mobile offshore units. The seamless auditing approach allowed auditors, DNV, to assess the overall effectiveness of the Dolphin Drilling Management System in a holistic manner.

Undertaking a seamless audit approach also reflects Dolphin Drilling's environmental credentials by reducing the total time (onshore and offshore) required to complete the audits and number of offshore audits required.

Henning Carlsen, Key Account Manager at DNV commented: "DNV would like to congratulate Dolphin Drilling in achieving ISO 50001 Energy Management Certification, ensuring that the company has a healthy energy management system, reducing energy consumption, environmental impact and increasing profitability. The certification, obtained through Seamless™, proves that Dolphin Drilling is working strategically to reduce

the environmental footprint of their operations."

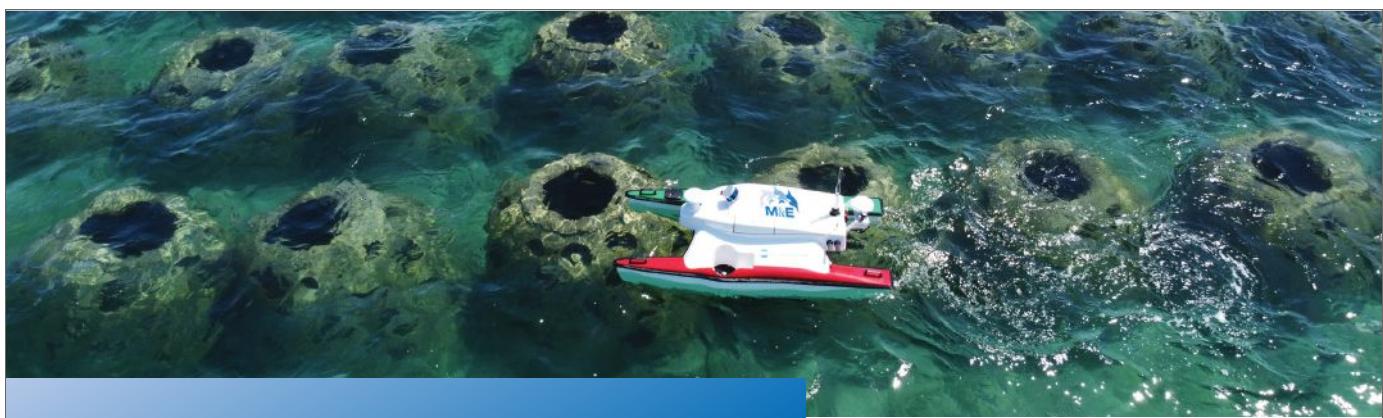
Bjørnar Iversen, CEO at Dolphin Drilling said: "This has been a massive team effort by all of our staff, and it is thanks to their hard work that we have gained the ISO 50001 certification and updated our existing certifications.

"This award is a huge step towards reaching our energy management goals. Having undertaken drilling operations since the mid-1960s we have been responsible for a number of 'firsts' within the oil and gas industry, and we are delighted to be leading the way today by placing our green credentials at the forefront of our operations."

Dolphin Drilling has committed to a climate roadmap, which outlines the company's contribution to a sustainable future by establishing the work processes and continual improvement initiatives necessary to help reduce emissions and meet the overall industry targets.



» Bjørnar Iversen, Chief Executive Officer at Dolphin Drilling



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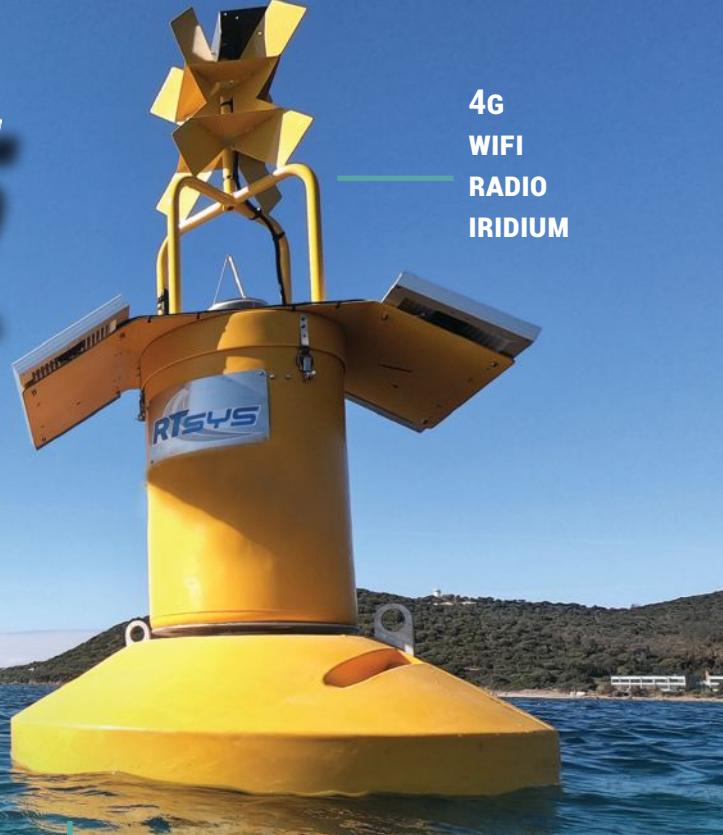


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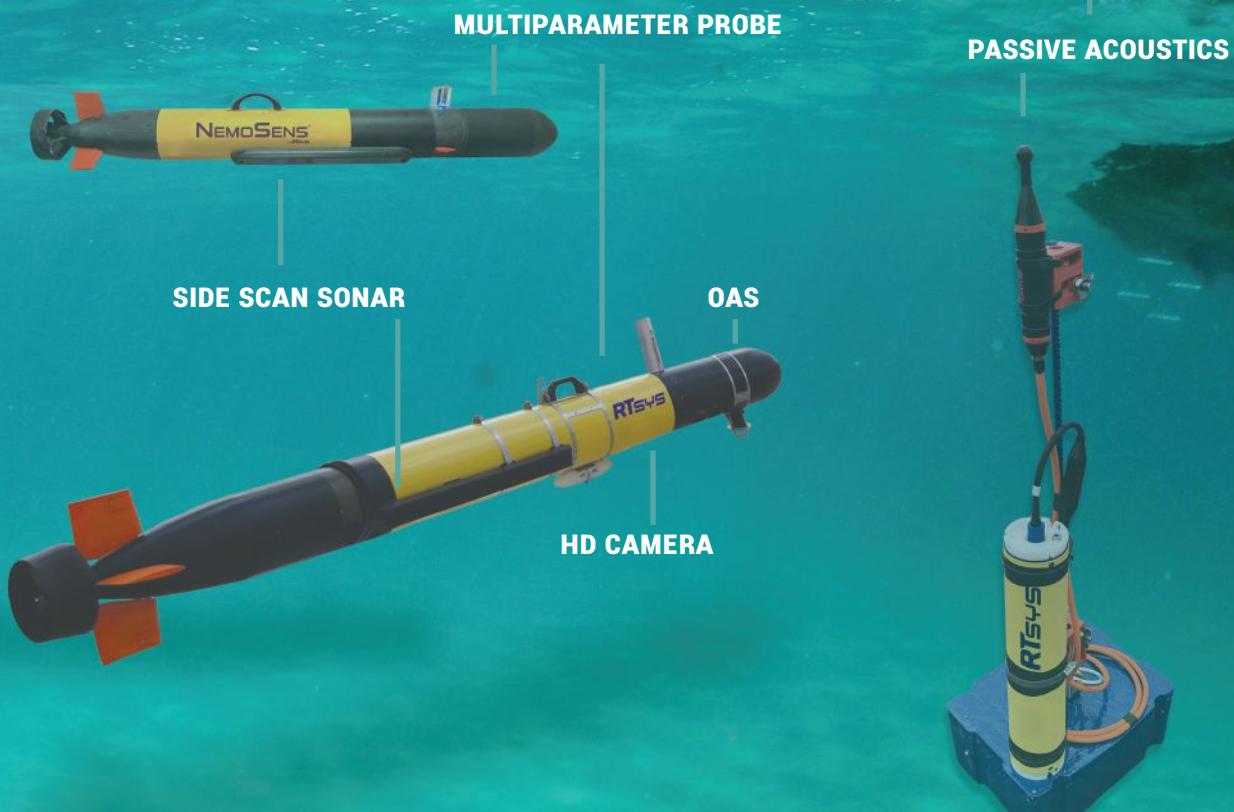
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