

A high-angle aerial photograph of a large-scale aquaculture operation. The water is a dark, mottled brown. Numerous rectangular pens, each containing several fish, are arranged in a grid-like pattern across the surface. Some pens are more densely packed than others. The overall scene is industrial and repetitive.

February 2021

# ON&T

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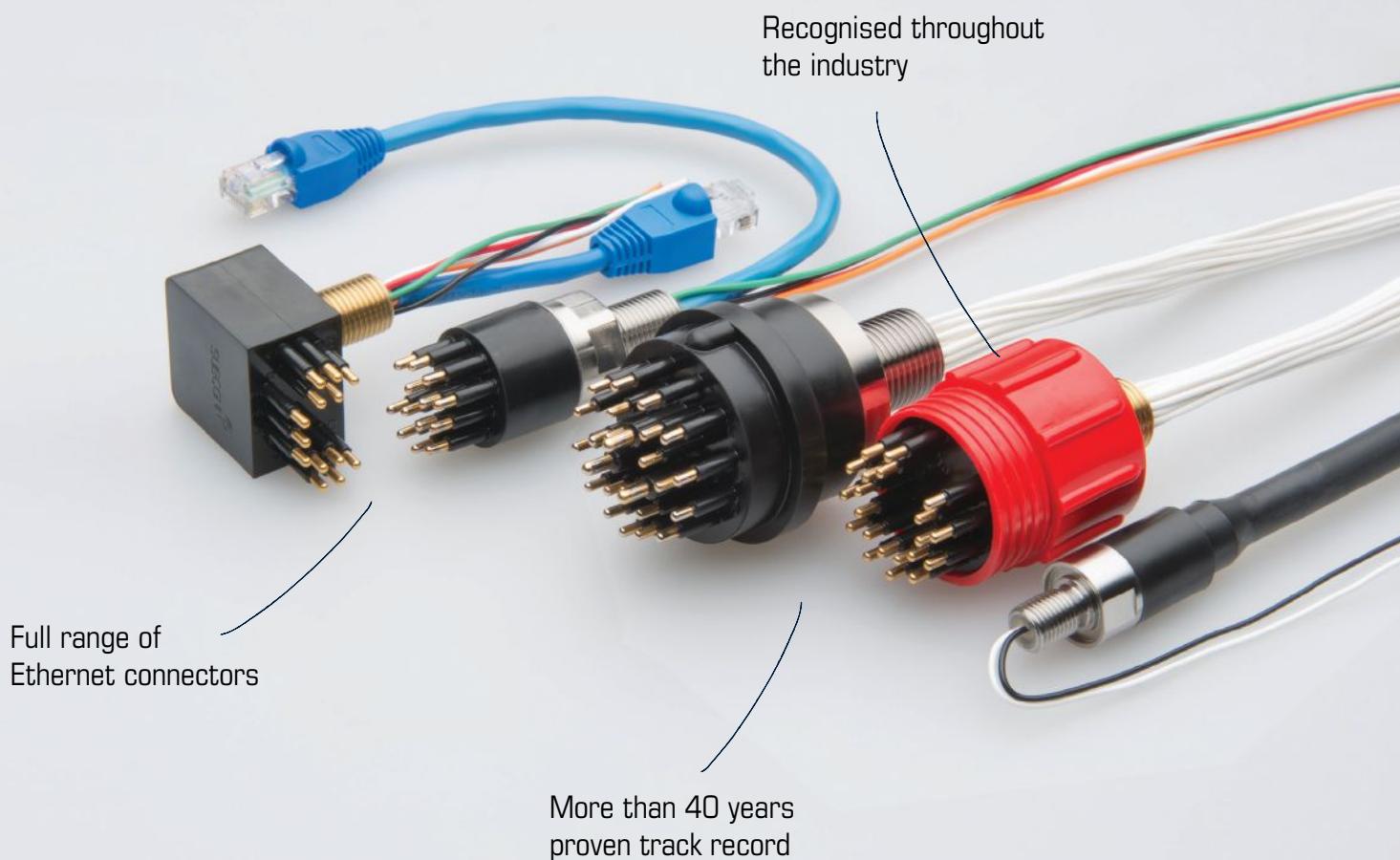
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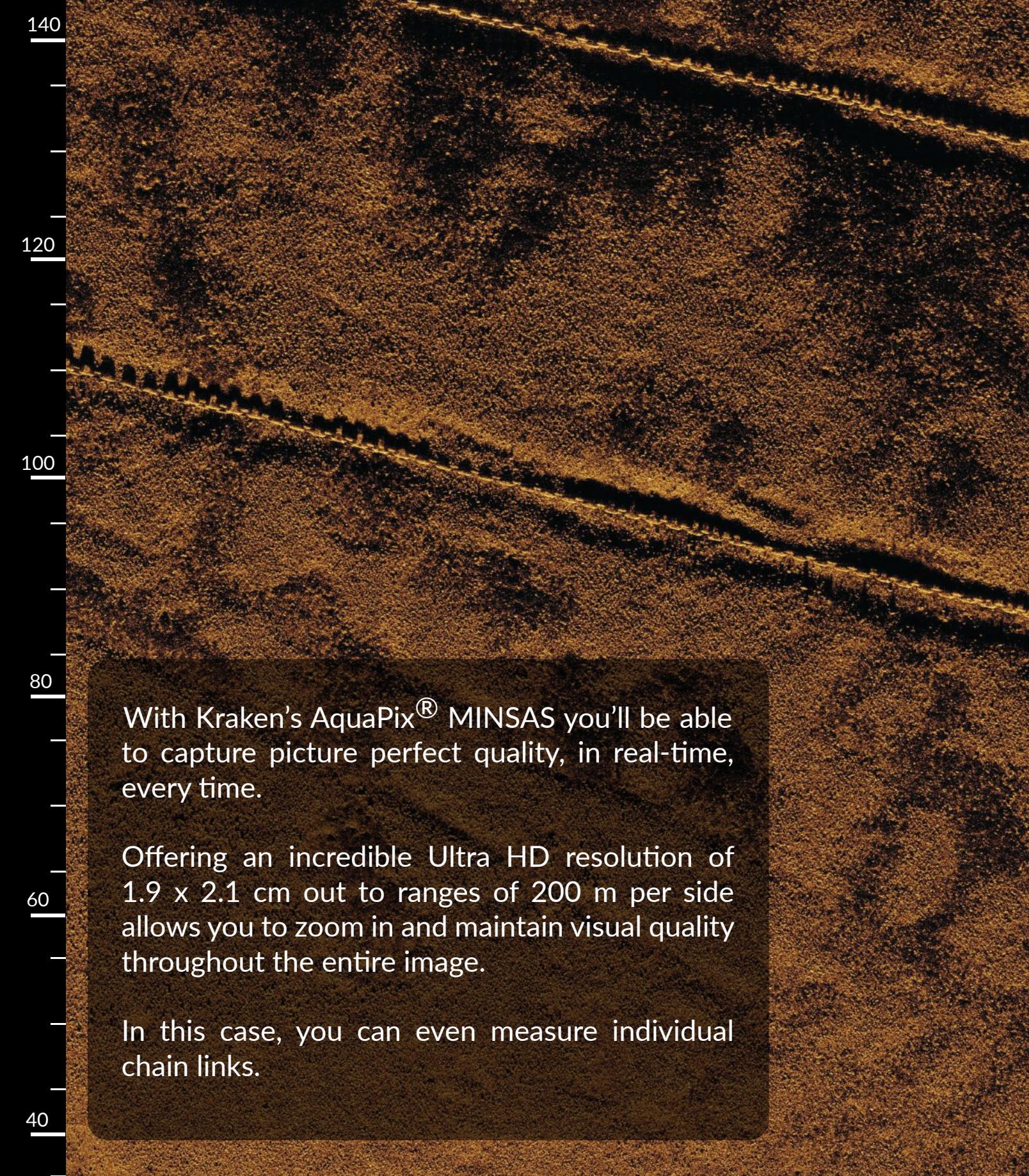
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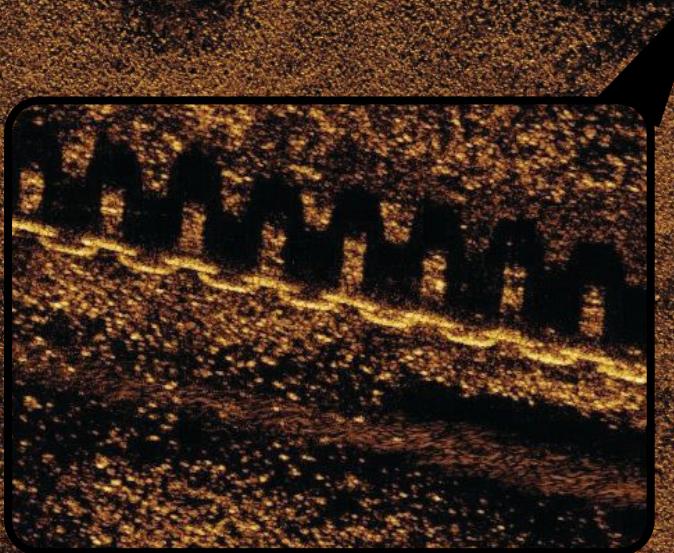




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In this case, you can even measure individual chain links.



OCEANVISION

By



10



16

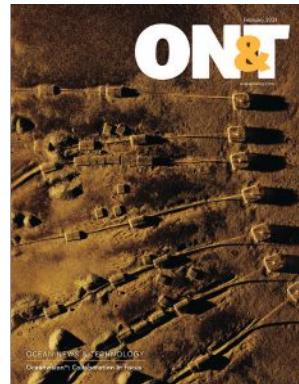


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**ON THE COVER:**  
Kraken's AquaPix® MINSAS  
image of offshore oil and gas  
flow lines and risers taken at  
15 m altitude at 6 knots.  
(Image credit: Kraken Robotics)

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## EDITOR'S NOTE

The team at ON&T would like to pay tribute to Suzi Short, who passed away unexpectedly in December 2020. Suzi was part of the CSA family from 1986 – 2017. She served as TSC Publishing's Art Director in her later years with the organization and her contribution to the organization's publications was immeasurable. She will be missed by all who knew her.



Suzi Short



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# PREPARING FOR THE UNIMAGINABLE

**BY DR. VICKI FERRINI***Head of the Atlantic and Indian Oceans Regional Center, Seabed 2030*

The Nippon Foundation-GEBCO Seabed 2030 Project is a collaborative project with the goals of inspiring the complete mapping of the world's ocean by 2030 and compiling all bathymetric data into the freely available GEBCO Ocean Map. Recognizing the importance of seabed mapping to a variety of applications, the project aspires to support scientific research and to empower the world to make informed policy decisions and use the ocean sustainably. Initiated in 2017, Seabed 2030 is a global call to action that seeks to promote capacity development, technical innovation, and data sharing to meet a grand challenge. The outcomes of this project will benefit the world in several predictable ways, but will also deliver technical innovation and ocean discovery that is yet unimaginable.

## STAKEHOLDER COLLABORATION

To achieve its ambitious goals, Seabed 2030 relies heavily on a global community of stakeholders that is committed to collaboration, coordination and data sharing. Establishing collaborations that are mutually beneficial and equitable for stakeholders will ensure that efforts to map the global ocean brings benefit to all. GEBCO (General Bathymetric Chart of the Ocean) operates under the auspices of the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO and provides an important foundation for this project, connecting it to an international network of government agencies and research institutions. Accelerating toward the goals of Seabed 2030 also necessitates the engagement of, and collaboration with, strong industry partners.

## TECHNICAL INNOVATIONS

We look to our industry partners not only as potential data contributors, but also as innovative players who can develop some of the technical solutions necessary for us to meet

our goals. Autonomous platforms and sensor technology are rapidly evolving, as are cloud computing and machine learning approaches. Coupled with emerging approaches such as crowdsourced bathymetry, these innovations will lower the costs of data acquisition and integration. Ensuring that emerging technical solutions are brought to bear will extend mapping capabilities to hard-to-reach areas, and help to ensure that all stakeholders are able to acquire and/or access the data they need to support their work. Emerging technology presents new challenges and opportunities, but it is clear that the contribution of the private sector coupled with public-private-academic partnership will be an important catalyst for helping us complete the map by 2030.

We are in truly a new era of seabed mapping, and a new era for ocean science as a whole. Data sharing is becoming more common, as is the sharing of knowledge and workflows. Technology and collaboration are core themes that can unify our efforts and will lead to acceleration and discovery. The establishment of the UN Decade of Ocean Science for Sustainable Development underscores the importance of understanding our global ocean as a vital aspect of securing a sustainable future for all of humanity. Seabed 2030 invites us to explore the infinite possibilities that building a complete map of the ocean floor will yield, both technologically and scientifically. It challenges us to unite in purpose to achieve something that was unthinkable just a few years ago—to produce a complete map of not only the ocean floor, but of the planet.

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# OCEANVISION™: COLLABORATION IN FOCUS



**By Karl Kenny**  
*President & CEO, Kraken Robotics*

## THE RISE OF THE KRAKEN

For centuries, ocean exploration was besieged by the legend of the Kraken, a merciless creature from the deep with an insatiable appetite for intrepid North Atlantic seafarers. In both lore and literature, the fabled sea monster would rise from the abyss to claim its bounty before retreating to its lair, a murky habitat found only at unfathomable depths.

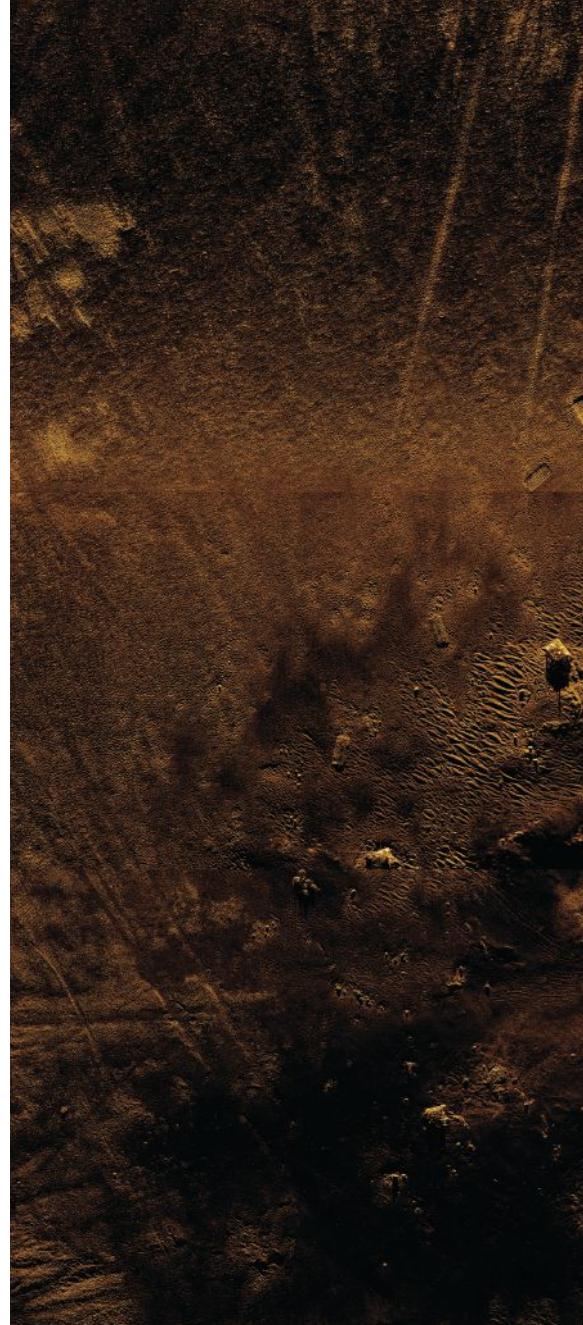
Unfathomable, that is, until relatively recently. Advances in ocean technology have revolutionized the way we explore underwater environments, and our mission at Kraken Robotics is to accelerate this progress by engineering a fully integrated suite of state-of-the-art technologies designed to analyze the seafloor. While we draw the line at terrorizing vessels, ever since our inception in 2012 we have been loyal to the disruptive instincts of our tentacled namesake by internalizing an "Innovate or Die" attitude to bringing innovation to market.

Kraken Robotics was created as an offshoot of Marport Deep Sea Technologies Inc. and we initially focused on developing our best-in-class Synthetic Aperture Sonar (SAS)—a pioneer sonar that renders superior ultra-high-resolution imagery to conventional sonars. Other advanced sensors and components soon followed, including pressure tolerant batteries and rim driven thrusters, before we opened our Unmanned Maritime Vehicles Facility in Nova Scotia, in 2016, to concentrate our efforts on producing fully integrated systems, software, and services for the global Unmanned Maritime Systems market.

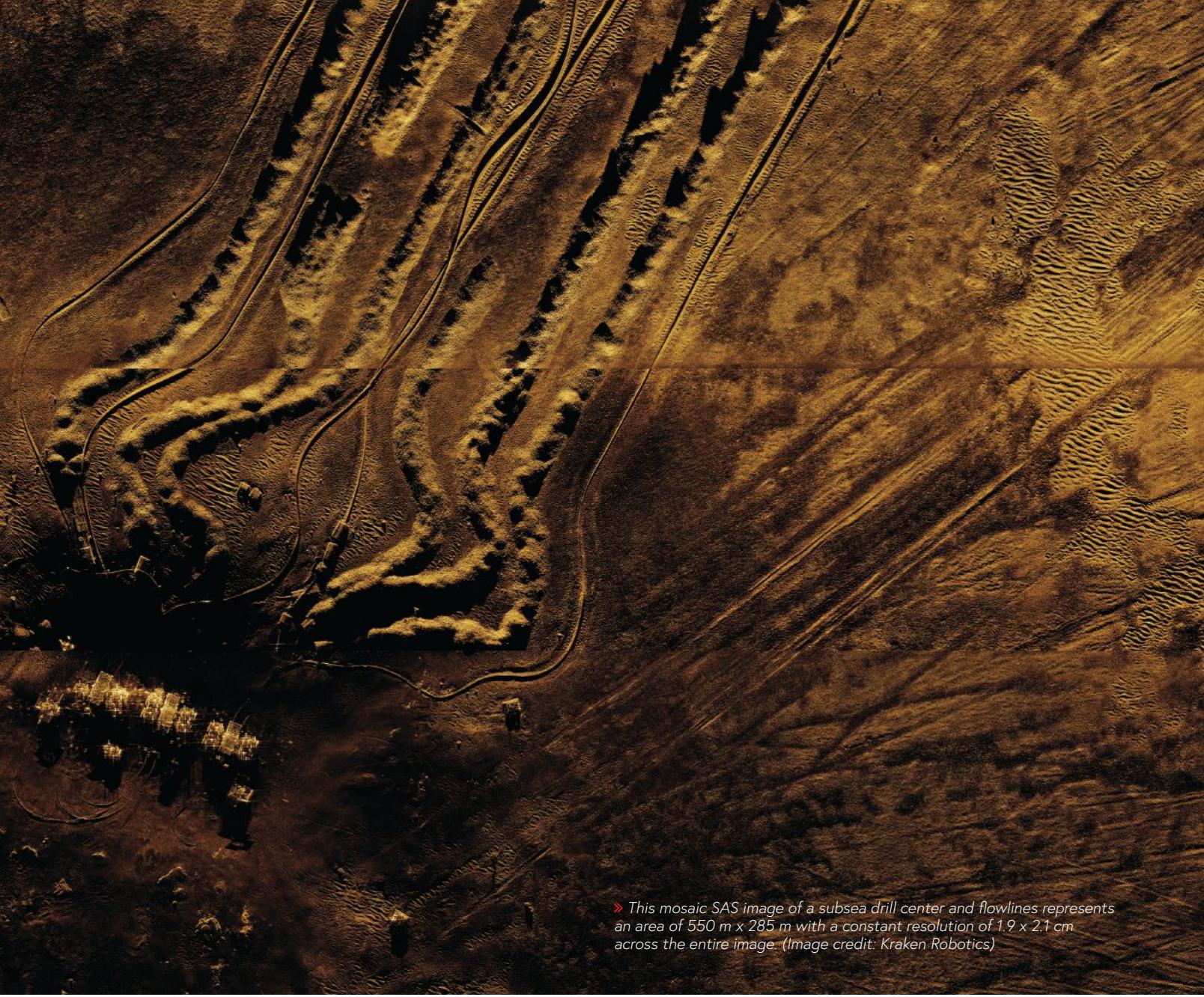
Today, working with our partners in the oil and gas, fishing, military, defense and ocean science sectors, Kraken is a recognized leader in advanced marine robotics and A.I., having launched a number of highly successful commercial platforms, including our KATFISH™ (high speed towed SAS), THUNDERFISH® (untethered AUV), TENTACLE™ (winch), ALARS (autonomous L&R) and SeaVision® (3D laser scanner).

## A FRESH PERSPECTIVE: OCEANVISION

As far the ocean community has come in embracing breakthrough technologies, a somewhat lackluster approach to industry collaboration is undeniable. At times,



▲ Kraken's SeaScout System—KATFISH towfish, Autonomous Launch and Recovery System (ALARS) and TENTACLE Winch—has proven instrumental to the OceanVision program. (Image credit: Kraken Robotics)



» This mosaic SAS image of a subsea drill center and flowlines represents an area of 550 m x 285 m with a constant resolution of 1.9 x 2.1 cm across the entire image. (Image credit: Kraken Robotics)

this has hindered the rate of progress and application of innovation, especially where marine robotics is concerned. In short, technology developers have generally preferred to work in guarded silos to devise custom platforms for very specific means or tasks.

In 2018, we saw this tendency as an opportunity to spearhead a more orchestrated approach to the marine survey industry by extending our service portfolio to include two cross-sectoral offerings; Robotics as a Service (RaaS) and Data as a Service (DaaS). This strategic move coincided with another pivotal market development, the announcement of the Canadian government's Ocean Supercluster initiative, a private sector-led partnership created to support local companies and resources to drive sustainable technology and innovation across the ocean industries.

In November 2018, a team from Kraken attended the Ocean Supercluster's kick-off event and pitched our idea to establish a long-term commercial offering that provides cross-sector industries with cost-effective data acquisition and analytics as a turnkey service. This would ultimately afford commercial entities, government agencies, and

academic researchers alike access to pertinent data and information that is usually publicly unavailable or prohibitively expensive to collect in the field. This concept evolved into OceanVision™, a cooperative scheme designed to foster industry collaboration, stimulate local supply chain opportunities, and nurture a fertile entrepreneurial ecosystem among Canadian stakeholders.

OceanVision, which was the first proposal to be approved under the Ocean Supercluster program (in July 2019), is a three-year ~\$20 million project that has helped enable the rapid scaling of the RaaS and DaaS models under the Kraken brand. The ongoing objective of OceanVision™ is straightforward: to leverage new and existing Kraken technologies to provide our partners—both from the private and public sectors—with significantly higher-quality data, more quickly and at a substantially lower cost when compared to traditional technologies.

It's not simply about gathering endless swathes of data for data's sake; this is about optimizing the relevance and usefulness of subsea data to inform ever smarter operational decisions. The caliber and reliability of this information allows Kraken to assist fishing companies

to fish smarter (not harder), oil and gas operators to run maintenance and inspection surveys with never-before-seen forensics, and defense contractors to pinpoint UXO exposure. This culture of collaboration is what underpins the OceanVision program and allows stakeholders to learn and grow together.

In just 18 months we have welcomed a formidable group of entities to the OceanVision program, including: Petroleum Research Newfoundland and Labrador (PRNL) Members, Ocean Choice International, Nunavut Fisheries Association and Emera. In addition, we are working with several academic and research collaborators from the Marine Institute in Newfoundland, Memorial University, Dalhousie University and the National Research Council of Canada. True to our roots, we are also actively partnering with numerous startups, tying in specialisms such as software and data management companies, upcoming sensor manufacturers, and other emerging names in the blue economy.

The Ocean Supercluster's support has enabled us to roll what we originally considered a seven-to-eight-year project into a tight 36-month program, a timeline that has resulted in the creation of 50 new jobs at Kraken Robotics.

## PROGRESS IN THE FIELD

To date, our team has completed three OceanVision data collection campaigns. Central to operations has been the successful deployment of our SeaScout System, which incorporates our intelligent KATFISH towed SAS system, Autonomous Launch and Recovery System (ALARS) and our TENTACLE Winch. Each outing gives us an opportunity to build upon lessons learned in previous campaigns and showcase seabed imagery in and around Atlantic Canada at unprecedented resolutions.

Further, it allows us to demonstrate updated versions of our cutting-edge technologies in the most challenging environments. Winter in the North Atlantic Ocean typically presents some of the harshest marine conditions on the planet, and our latest campaign, from September 21 to October 18, 2020, was no exception. Despite the threat of a major hurricane, we were able to integrate and operate Kraken's KATFISH system onboard Atlantic Towing Limited's Atlantic Kingfisher offshore supply vessel. This highlights the flexibility and adaptability of our systems; we have now deployed our KATFISH from eight different vessel types, both manned and unmanned, ranging from 39 feet to 262 feet in length.

OceanVision stakeholders understand that to spark innovation you must disrupt and challenge long-established ways of doing things. We are not trying to displace other marine survey companies, but rather seek to help our partners rethink the efficiency of their operations and the ongoing usefulness of the data collected. Many surveys tend to be ad hoc in nature and project specific, often covering previously explored areas. We recognize that the value of subsea data goes beyond any one job, industry, or sector, and feel uniquely positioned as a vertically integrated one-stop-shop for RaaS and DaaS to promote a progressive business model for subsea survey and inspection.

## PICTURE-PERFECT PINGS

The image resolution possible with our kit speaks for itself. We find that most offshore operators have come to expect a standard 15 – 20 cm resolution associated with a hull mounted multibeam or side scan sonar. AquaPix® MINSAS (Miniature Interferometric Synthetic Aperture Sonar) sensors, mounted to our KATFISH, offer an industry-leading 1.9 x 2.1 cm constant Ultra HD resolution across the entire swath out to ranges of 200 meters per side, along with simultaneously collecting



» Each OceanVision campaign is a new opportunity to demonstrate updated versions of the SeaScout System in the North Atlantic, which typically presents some of the harshest marine conditions on the planet. (Image credit: Kraken Robotics)



» AquaPix MINSAS: industry-leading Ultra HD resolution that offers offshore developers an entirely new perspective. (Image credit: Kraken Robotics)

co-registered 6 cm x 6 cm bathymetry. We are confident that Kraken's SAS technology, as well as offering the industry's best Area Coverage Rates (ACR), delivers the highest resolution seabed pixel at the lowest cost in the industry.

In practical terms, the data allows us to create precise 3D models of seafloor environments and assets, from which operators can ascertain critical operational information (e.g., determine hard-to-distinguish flowline shifting). Many of our offshore energy customers find it hard to believe how this degree of visual detail is produced by sound, millions of acoustic pings stitched together to render the picture-perfect clarity—a resolution that enables users to count individual chain links on mooring lines!

## THE FUTURE

Despite the challenges of 2020, we adapted operations to keep OceanVision on track, and 2021 is set to be a game-changing year, with two further OceanVision campaigns slated for May and September. The R&D team are busy refining a number of key hardware enhancements, and we look forward to running future sea trials using our *RV Ocean Seeker*, equipped with our upgraded SeaScout System and stationed at our Dartmouth office at the Centre for Ocean Ventures and Entrepreneurship (COVE), in Nova Scotia. Having the *RV Ocean Seeker* on hand allows our onsite engineers to constantly test and modify the SeaScout's functionality as the project progresses.

We are also in the process of building a new 6,000-meter depth rated AUV to augment our fleet. The ThunderFish XL AUV®—supported in part by advisory services and research and development funding from the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP) and tested at the National Research Council of Canada Ocean, Coastal and River Engineering Research Centre—is being designed to function as a permanent subsea resident inspection and survey vehicle, supported by a seafloor charging/docking station. Engineered to eclipse the payload capacity, endurance, and versatility of other "long endurance" vehicles on the market today, the ThunderFish XL AUV will support an array of sensors and custom payload modules, including Kraken's AquaPix® SAS, SeaVision® 3D laser profiler, SeaThrust™ rim-driven thrusters and SeaPower™ pressure tolerant batteries. All of these will be integrated with advanced onboard A.I. algorithms and available for deployment 24/7/365. The AUV will be programable from anywhere—rig, vessel or shore—and capable of transmitting and processing data in real time. We are seeing increasing interest from the Inspection, Repair, and Maintenance (IRM) segments for offshore energy (oil & gas and wind). In-water testing should begin later this year, which will include demonstrations as part of the OceanVision project, with a view to being commercially available by Q4 2022.

Suffice to say, if there is a dormant Kraken in waiting down there, our ThunderFish XL AUV will find it.



» Kraken's SAS technology delivers the highest resolution seabed pixel at the lowest cost in the industry. (Image credit: Kraken Robotics)



» The *RV Ocean Seeker*, stationed at Kraken's Dartmouth office at the Centre for Ocean Ventures and Entrepreneurship (COVE), in Nova Scotia. (Image credit: Kraken Robotics)



» Kraken's R&D team get set to run sea trials of new hardware enhancements to the SeaScout system. (Image credit: Kraken Robotics)

For more information, visit:  
[WWW.KRAKENROBOTICS.COM](http://WWW.KRAKENROBOTICS.COM)

## NOAA PARTNERS WITH UNIVERSITY OF SOUTHERN MISSISSIPPI ON UNCREWED SYSTEMS

NOAA and the University of Southern Mississippi (USM) have signed a 10-year agreement to partner on ways to improve how uncrewed systems (UxS) are used to collect important ocean observation data and augment NOAA's operational capabilities. The agreement provides a framework for collaborating with NOAA scientists and UxS operators on projects to further UxS research, development and operations.

"Mississippi is poised to become a major hub for ocean research and innovation, and NOAA plans to help drive that innovation," said Rear Adm. Nancy Hann, deputy director for operations for NOAA's Office of Marine and Aviation Operations (OMAO) and deputy director of the NOAA Commissioned Officer Corps. "This new partnership with the University of Southern Mississippi will greatly enhance our ability to transition these technologies into operational platforms that will gather critical environmental data for the nation."

UxS are sensor-equipped vehicles that operate autonomously or are remotely piloted. NOAA currently uses UxS for seafloor and habitat mapping, ocean exploration, marine mammal and fishery stock assessments, emergency response, and at-sea observations that improve forecasting of extreme events,

such as hurricanes, harmful algal blooms and hypoxia.

UxS have the potential to transform how NOAA meets its mission to better understand our oceans and their ecosystems. While the use of UxS is not new to NOAA—agency scientists have been experimenting with and using uncrewed systems for research for decades—the recent increase in the availability of highly capable UxS has brought a corresponding increase in their innovative use as a force multiplier for many NOAA programs. Advancing partnerships with academia will be essential to the development and use of these technologies.

"We are excited to expand our collaboration with NOAA for research, development, testing and evaluating uncrewed systems," said Kelly Lucas, associate vice president for research, coastal operations at USM. "The use of uncrewed systems increases safety and productivity and allows us to expand coverage and access of ocean space, especially in remote, hazardous or extreme environments. Coupled with sensor development, artificial intelligence and machine learning, uncrewed systems will transform data collection and processes to help users make informed decisions."



» University of Southern Mississippi Vice President for Research Gordon Cannon, Ph.D., and Rear Adm. Nancy Hann, deputy director for operations for NOAA's Office of Marine and Aviation Operations, sign an agreement to partner on using uncrewed systems to collect ocean data. (Photo credit: NOAA)

The new agreement helps NOAA meet the objectives of the Commercial Engagement Through Ocean Technology Act of 2018, which requires the agency to coordinate research, assess, and acquire uncrewed systems with the U.S. Navy, other federal agencies, industry and academia. In Fiscal Year 2021, NOAA received \$13.7 million from Congress to improve and expand UxS operations across the agency, including the creation of the OMAO Uncrewed Systems Operations Center—a key goal of NOAA's Uncrewed Systems Strategy.

## SONARDYNE'S SPRINT-NAV HIGH ALTITUDE VARIANT REACHES NEW HEIGHTS OF CAPABILITY

Marine technology specialist Sonardyne has released a new high altitude variant of its market leading hybrid navigator SPRINT-Nav to allow uncrewed surface vessels (USVs) and underwater vehicles to extend their operational envelope.

SPRINT-Nav tightly integrates a Sonardyne SPRINT INS, Syrinx DVL and a highly accurate pressure sensor into a single high-performance solution providing navigation and optional acoustic Doppler current profile (ADCP) functionality.

Sonardyne's new variant takes this capability to an even higher

level; increasing the altitude at which vehicle platforms can work when they don't have an external position reference, without compromising accuracy.

Operating at 400 kHz, the high altitude variant achieves reliable bottom lock at up to 230 m altitude above the seabed, providing USVs with a highly accurate and robust navigation source, which is critical for, as an example, station keeping applications in coastal surveys where GNSS could be denied or subject to interference.

Installation of the new SPRINT-Nav variant on autonomous



» SPRINT-Nav allows AUVs and ROVs to perform inspection surveys at even higher altitudes than previously possible. (Photo credit: Sonardyne)

underwater vehicles (AUVs) and remotely operated vehicles (ROVs) allows inspections and surveys to be performed at even higher altitudes than previously possible.

In addition, the instrument's optional ADCP functionality has been extended to 120 m, adding oceanographic

data gathering and increased operational capability. This can be especially beneficial in highly dynamic environments and/or where remote vehicles are being deployed from a USV and robust current profile data is required.

The new SPRINT-Nav high altitude variant has already been delivered into the USV market, including as part of a package of Sonardyne technologies being installed on the first wave of Ocean Infinity's new Armada fleet of robotic vessels.

In addition to releasing the SPRINT-Nav high altitude variant, the 400 kHz capability it contains is also now available as a standalone 400 kHz variant of Sonardyne's Syrinx DVL, which also comes with optional ADCP functionality.

## WAVE PREDICTION BECOMES A REALITY

WaveSignal™ is the latest addition to the *sigma S6* line of advanced radar processing systems.

WaveSignal™ uses x-band radar and predictive analytics to determine when quiet periods in wave action will occur. This information will improve mariner safety while conducting on-deck operations, carrying out cargo or personnel transfers, and a host of other offshore activities.

High-definition visual representations of approaching wave fields, combined with a timer to the next light change, keep operators well-informed when assessing risk and identifying safe operational windows. WaveSignal™ forecasts quiet periods in wave activity, when it is safer to conduct on-deck operations. This includes predicting if, and when, a larger wave will impact the vessel.

The operator can input specific wave height thresholds, as determined by the nature of the work and acceptable conditions. When these thresholds are exceeded, a red signal light is activated—or conversely, quiet periods are identified with a green signal light, indicating it is safe to proceed. Like a traditional traffic light signal, a red or green light is displayed on the bridge system, and on an on-deck signal panel, indicating when it's safe to begin and continue operations, or necessary to suspend operations.

The origins of the technology within WaveSignal™ began in 2008 at OceanWaveS GmbH in Lüneburg, Germany, later acquired by Rutter. The research, which was spearheaded at the OceanWaveS office through collaboration with several governmental and educational research groups, quickly demonstrated the real-world application for this technology. Since then, Rutter R&D teams in Germany and Canada have worked to develop and commercialize WaveSignal™.

"It has been very exciting, and challenging, bringing this breakthrough product to market. Because only now, some twelve years after the idea first germinated, has computing power and high-definition imaging been up to the task of dealing with the complexities of real-time wave prediction," said Blair Wheaton, Rutter CEO.

"Our fabulous R&D team has come up with a simple, elegant, highly intuitive interface and user experience that belies the complexity of the underlying technology," said Rutter President, Fraser Edison. "This technology will provide a new layer of safety for mariners. In concert with the range of products under the *sigma S6* banner, we are confident that WaveSignal™ will quickly become an essential tool in the technology kit of mariners and oil & gas production professionals around the world."

"We gratefully acknowledge the participation of the Provincial Department of Industry, Energy and Technology as well as National Research Council (NRC) in helping us bring this innovation to market."



## TENDEKA AND NORTHERN SOLUTIONS SIGN ALASKAN SERVICES AGREEMENT

A new collaborative agreement has been signed that will see Northern Solutions Alaska LLC represent global completions specialist Tendeka in actively promoting sales, installation, and services of its completion products and technologies in the region.

The two companies have previously worked together on several projects in Alaska which contributed to the introduction and ongoing success of Tendeka's FloSure Autonomous Inflow Control Devices (AICD) and most recently its new PulseEight Electronic Ambient Valve (EAV) technology in Prudhoe Bay.

Northern Solutions have machining, fabrication and workshop facilities in Anchorage and Prudhoe Bay that are already qualified to manufacture, assemble and test a range of Tendeka technologies. With wellsite and classroom-based training already underway we have already made an impact with Alaskan operators recognizing the benefits that this agreement brings. To find out more, please visit:

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# EcoCTD: A NOVEL UNDERWAY PROFILER FOR HIGH-RESOLUTION OCEAN RESEARCH

By Liz Kerrigan, RBR

**T**here has been a growing interest in observing the vertical dynamics of the ocean. Numerical modeling has uncovered important processes that could be responsible for vertical mixing, but they have only started to be observed in situ. With operationally challenging spatio-temporal scales of 0.1 – 10 km horizontally, 1 – 100 m vertically, and timescales of hours to days, these processes have been traditionally difficult to sample. In order to characterize the variability associated with submesoscale eddies and fronts, researchers are looking for ways to provide evidence of water exchanges between the upper ocean layer and ocean interior.

In 2018, this led RBR Research Scientist Dr. Mathieu Dever—who at the time was a post-doctoral researcher at Woods Hole Oceanographic Institution with Dr. Amala Mahadevan—to begin investigating submesoscale instabilities at ocean fronts. To identify these instabilities, they began looking at biophysical properties of water masses. At submesoscales, biological and physical properties occupy similar timescales. As a water mass is subducted it will maintain the same biological profile, meaning that biological properties—such as chlorophyll, backscatter, and oxygen—can be used as semi-conservative tracers to identify vertical mixing.

So, they knew what needed to be measured but were stuck on how. At sea, CTD rosettes take discrete samples of the water column, but stations are often far apart and cast times are slow, meaning that submesoscale features are often missed. A profiler that could take high resolution measurements at these difficult to sample spatio-temporal scales was the answer.

To meet the observational needs for submesoscale motions, Drs. Mahadevan and Dever determined that a profiler would need to be able to (1) profile the upper 500 m of the ocean, (2) provide vertical profiles at sub-kilometer lateral resolutions within a few minutes, and (3) measure both bio-optical and physical properties simultaneously. With these requirements



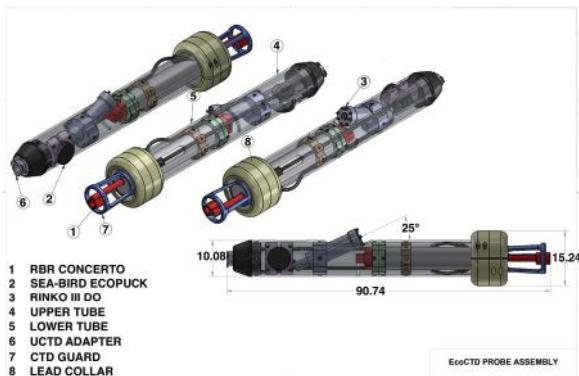
» Figure 1: RBR Research Scientist, Dr. Mathieu Dever, deploying the EcoCTD onboard the R/V Neil Armstrong. (Photo credit: J. Doucette© Woods Hole Oceanographic Institute)

in mind, they developed the EcoCTD, a fast, biophysical underway profiler to observe submesoscale features.

The profiler was built to offer a lighter weight and cheaper alternative to similar profilers on the market. The objective was to take advantage of the typically underutilized steaming time between stations, thus creating a profiler that could be used underway with little to no impact on other science operations onboard.

### WHAT IS THE EcoCTD?

The EcoCTD is a lightweight profiler that connects a CTD with bio-optical sensors (Figure 2). Built around an RBRconcerto<sup>3</sup> CTD, the EcoCTD accommodates one of two potential oxygen sensors, both featuring a fast time constant (~1 s): the RBRcoda TODO or the JFE RINKO. Additionally, to the oxygen, a WetLabs ECOPuck is used to measure chlorophyll, backscatter, and fluorescence.



» Figure 2: Design of the EcoCTD. (Image credit: Dr. Mathieu Dever)

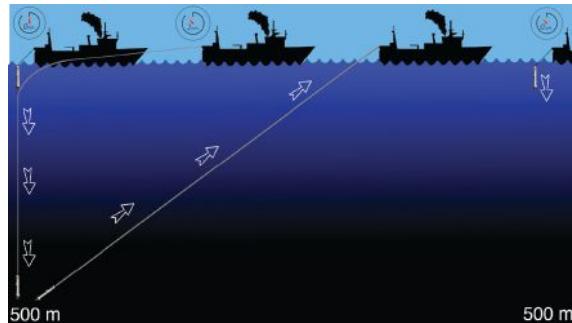
The EcoCTD also includes two lead collars to increase the weight of the probe. While a lightweight sensor was an important design consideration, Dr. Dever also needed the sensor to be rapidly free-falling to flush the inductive conductivity cell, enabling high-quality measurements of the water column. With line drag impacting free-falling velocity, the profiler needed to be heavy enough to maintain its speed as it went deeper in the water column. With the lead collars, the EcoCTD weighs 13 kg in air, heavy enough to overcome line drag, but light enough to be handled by one person. However, these weights are also customizable to adjust fall rate to the sampling's objectives.

The RBRconcerto<sup>3</sup> CTD was an attractive base for a number of reasons. With falling rate a key consideration, its cylindrical shape was appealing. The fast thermistor and accuracy of the profiler were also important given the speed at which it falls through the water column—up to 3 to 4 m/s. The logger provides data from all sensors synchronously, thus streamlining post-processing of the data. Finally, the low power consumption of the CTD, which runs on 8 AA batteries, simplifies shipping, handling, and battery replacement.

### HOW DOES IT WORK?

The EcoCTD was designed to take full advantage of ship time. First, the profiler is attached to a lightweight winch and thrown over the side of the boat (Figure 3), free-falling to the desired depth as the ship is underway. It is then reeled back up and once the profiler reaches the surface it can be dropped again, beginning the next profile. While a typical profile to 500 m takes approximately 12 minutes, the speed of the ship can change the temporal and lateral resolution depending on a researcher's needs.

One early requirement for Dr. Dever was to ensure that the movement of the ship, in particular heaving, was not impacting the downcast. Dr. Dever

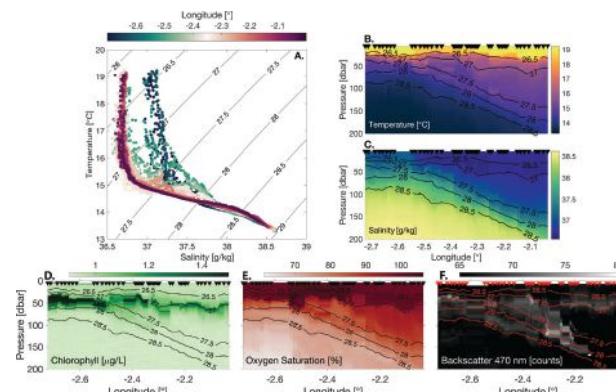


» Figure 3: Illustration of the EcoCTD's sampling method while underway. (Image credit: Dr. Mathieu Dever)

confirmed this separation onboard the *R/V Neil Armstrong*, attaching motion sensors to both the ship and the profiler to ensure that their respective motions did not correlate. No significant cross-variance was found, meaning that the EcoCTD was indeed decoupled from the ship's motion and therefore free-falling.

### PROMISING RESULTS

In 2018 and 2019, Dr. Dever tested the EcoCTD as part of an ONR-funded project (CALYPSO), in an area of the Mediterranean Sea where the inflow of colder, fresher water from the Atlantic Ocean meets warmer, saltier water from the Mediterranean. These two different water masses were found to have distinct signatures through temperature and salinity data; however, considering these data alone makes identifying submesoscale mixing challenging. Oxygen, chlorophyll, and backscatter all illustrate mixing, with the backscatter data in particular highlighting a subduction event, with a "tongue" of water being brought down, ventilating the ocean interior. Using the additional bio-optical measurements provided by the EcoCTD, Dr. Dever was able to see this submesoscale mixing take place.



» Figure 4: Results from the EcoCTD along the Almeria-Oran front, illustrating two distinct water masses through salinity and temperature data. Oxygen, chlorophyll, and backscatter data also provide evidence for subducted water and vertical, submesoscale mixing. (Image credit: Dr. Mathieu Dever)

### WHERE DO WE GO FROM HERE?

Future work includes modifying the profiler to allow for even more measurements; adding or removing sensors to sample different parameters or modifying the weight of the profiler—by removing its lead collars—to account for different water column depths or lateral resolutions.

The EcoCTD is currently an open-source project, meaning that you can make one yourself. Learn more about how you can build your own EcoCTD—and even tailor it to your specific needs—at the EcoCTD Open Project website. <https://matdever.github.io/ecoCTD-open-project/getone.html>

M. Dever, M. Freilich, J. T. Farrar, B. Hodges, T. Lanagan, A. J. Baron, and A. Mahadevan. EcoCTD for Profiling Oceanic Physical-Biological Properties from an Underway Ship. *Journal of Atmospheric and Oceanic Technology*, 37(5):825-840, 2020. doi: 10.1175/JTECH-D-19-0145.1

## GÜRALP TO SUPPLY 120 BROAD-BAND OCEAN BOTTOM SEISMOMETERS TO NFSI

Guralp Systems Ltd, a leading global provider of seismic monitoring instrumentation and solutions, has been awarded a contract to supply 120 free-fall, Aquarius broad-band ocean bottom seismometer ("BBOBS") systems and associated topside equipment to form the instrument pool of Canada's National Facility for Seismic Imaging ("NFSI") based at Dalhousie University in Halifax.

The Aquarius is a compact unit with a low profile that minimizes flow noise on the seabed and features unique capabilities specifically suited to free-fall deployment in the deep ocean. As a result of a partnering agreement between Guralp and Sonardyne in 2019, Aquarius is equipped with Sonardyne's 6G Wideband low-mid frequency (LMF) acoustics, making it the most compact telemetry-enabled OBS available in the market.

- The sensor is operational at acute angles of up to  $\pm 180^\circ$  without mechanical levelling
- The on-board tri-axial, broadband seismometer has a 120s-100Hz response with a configurable long-period corner, making it ideal for instrument pools where response requirements may vary between projects
- The Sonardyne omnidirectional transducer enables cable-free data transfer through the water column—this is used at deployment by the OBS team to view 'State of Health' parameters, noise performance data and to confirm commencement of seismic recording once the system reaches the seabed. This is also compatible with a Sonardyne Gyro USBL acoustic transceiver, which can be used on a vessel of opportunity for underwater positioning during deployment and recovery
- The recovery system once activated is supported by a satellite tracking system that locates the instrument on the sea surface for retrieval prior to data download, battery re-charge and re-deployment
- Each of the re-usable Aquarius units will be engineered for a maximum depth of 6000 m and has a battery life of at least 12 months



With this program, the NFSI aims to rebuild Canada's OBS capability following the end of life decommissioning of the previous Canadian short period OBS pool [in 2015]. The NFSI is a partnership of ten major universities from across Canada including Dalhousie University, University of Victoria, University of British Columbia, Simon Fraser University, University of Manitoba, University of Toronto, University of Ottawa, Université du Québec à Montréal, McGill University and Memorial University.

The BBOBS contract was awarded following a public tender process that commenced in 2019. Guralp will also supply deck units and battery chargers and will assist the NFSI in establishing a BBOBS service center based at Dalhousie with accredited staff trained in operating and managing the Aquarius systems. Guralp will work in close cooperation with the NFSI project team, to ensure that the BBOBS pool meets the specific Instrument requirements. The expectation is that the entire pool of 120 Instruments will be completed and delivered within a two-year period.



For more information, visit:  
[WWW.GURALP.COM](http://WWW.GURALP.COM)



» Aquarius OBS during test deployment in 2019. (Photo credit: Guralp)

» The NFSI 'BBOBS' laboratory.  
(Photo credit: Guralp)

# EVOLOGICS RELEASES SiNAPS 2 UPGRADED ACOUSTIC POSITIONING SOFTWARE

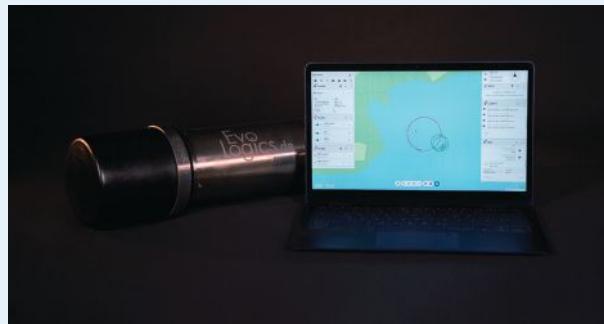
EvoLogics team recently announced the release of SiNAPS 2, the newly upgraded underwater acoustic positioning software.

Rebuilt from scratch, it comes with a more powerful and efficient data engine with improved positioning accuracy. The updated user interface and intuitive workflows allow for easier onboarding and system integration.

SiNAPS 2 is both powerful and flexible—it supports USBL, LBL, and advanced hybrid positioning methods. The software is intuitive and fast to configure even for complex scenarios and comes with built-in system calibration tools. With SiNAPS, it is possible to manage multiple databases and maintain separate data sets. Automation options and advanced data fusion strategies are available for demanding application tasks.

Real-time multiple target tracking is combined with data input from multiple sensors. SiNAPS is capable of real-time output of positioning and sensor data for custom forwarding and processing.

Its web-based user interface allows using SiNAPS on any device in the local computer network; the extensive display tools include the new option to visualize acoustic communication, as well as adding online and offline background maps.



» EvoLogics SiNAPS 2 Software. (Photo credit: EvoLogics)

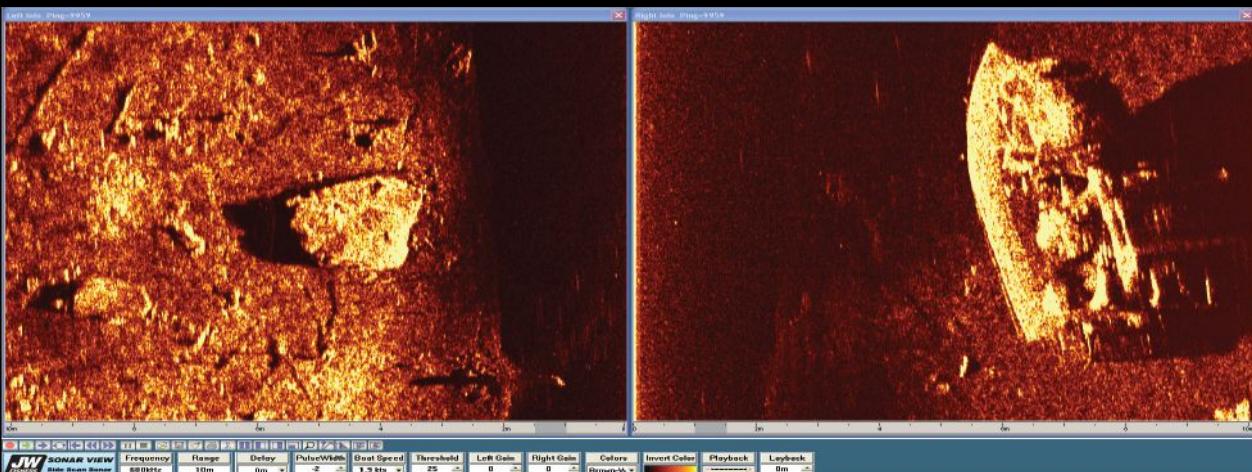


» SiNAPS 2 allows for real-time multiple target tracking and data input from multiple sensors. (Photo caption: EvoLogics)

SiNAPS 2 is fully compatible with the whole range of EvoLogics underwater acoustic modems and USBL devices that support simultaneous tracking and bidirectional communication. The software is available from EvoLogics starting February 1, 2021.

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# HOST: INSTRUMENT DATA DELIVERY FROM SUB-SURFACE MOORINGS



**By James A. Cappellini**  
CEO, Mooring Systems, Inc.

**T**ransmitting instrument data files via satellite directly from anchored sub-surface moorings has just become a reality. The ability to capture data prior to mooring recovery allows traditional subsea remote sensing installations to become near real-time observation systems. GHOST, which stands for Global Hidden Ocean Satellite Telemetry, is a newly developed data delivery tool designed to advance the capability of sub-surface moorings by providing a means to automatically and periodically extend a satellite antenna above the ocean surface to transmit instrument data and then lower itself back to a hidden and safe depth below. This tool is easily adaptable to existing moored data collection applications and new monitoring applications previously thought not possible.

▼ (Left) GHOST consists of two primary components, the motorized vessel referred to as TRANSPORTER, and a tethered TRANSMITTER BUOY. (Right) The transmitter buoy is the only component of the GHOST system that breaches the ocean surface, spending less than 5 minutes to transmit data files. (Photo credit: Mooring Systems)



## BENEFITS TO EARLY DATA CAPTURE

Near real-time observation capability is only one benefit of many that early project data reporting provides. Knowing that valuable data would not be entirely lost if an instrument fails prematurely or the mooring recovery operation is not successful provides added assurance of data recovery. Unanticipated events caused by water ingress, internal battery leakage, or housing impact damage during recovery operations can result in complete data loss. In some circumstances the entire mooring may not be recoverable due to equipment failure, difficult sea conditions or the mooring is missing. Data files can be captured prior to the time of instrument failure and transmitted safely upon the next programmed transmission cycle. In the event a mooring prematurely separates from its anchor with no ability to send a vessel to the site, the instrument data will automatically be transmitted when GHOST reaches the ocean surface and obtains a satellite link. Another benefit to collecting data remotely includes reducing ship time for remote sites that require frequent visits to physically link instruments to download data.

## R&D EVOLUTION

Real-time transmission of underwater oceanographic instrument data using moored surface buoys is common practice with several standardized methods used to achieve acceptable survival life. Typical methods include electro-mechanical cables with bend relief devices for protecting the integrity of cables or the simpler approach of inductively coupling instruments using inductive modems and jacketed wire rope. Despite these successes, designing for survival against surface buoy motion under harsh environmental conditions can still lead to premature mooring failure and vandalism to surface buoys remains a problem in many regions around the globe.

GHOST evolved from an earlier design effort by Mooring Systems, Inc. named (ARROW), which began back in 2011. Arrow was an innovative Tsunami detection system aimed at deployment in areas prone to surface buoy vandalism. This system included the use of expendable pop-up buoys to transmit Tsunami alert data and thus eliminate the need for a moored surface buoy altogether. Unfortunately, a limitation in the number of pop-up buoys per system was insufficient in meeting the number of possible alert events that could occur within one year along with the number of routine status reports desired (also via pop-up buoys) to confirm the system is operational and system ready.



The development of GHOST was a self-funded effort to not only satisfy the continued and very important need for a Tsunami detection system not prone to vandalism but to expand the technical capability of sub-surface moorings by providing near real-time data capture for many other moored instrument applications.

## DESIGN HURDLES

Tackling this problem included applying fundamental oceanic mooring design principles, adapting a data signal carrying method, and designing a motorized self-powered vessel programmed to automatically travel up and down through the water column.

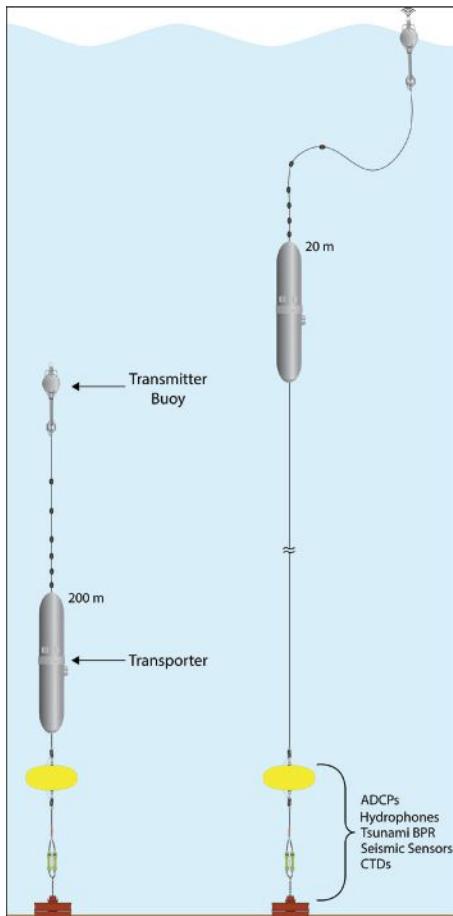
Our extensive experience with the use of jacketed wire rope as a component to carry inductive data signals on moorings was an easy choice for the system. Mechanical challenges included the requirement for a seawater grounded signal loop through the jacketed wire rope that also rotated on a drum. The use of our standard Hammerhead wire rope terminations provided a robust and proven method to secure and link the system inductively to the top of any sub-surface mooring buoy. A jumper from the termination would provide a connection point for the instrument's inductive signal to link to. The jumper would also attach to another Hammerhead termination on the mooring to continue the inductive link downward along the mooring to instruments mounted further below.

Developing a motorized vessel required balancing its power system payload weight and size with the required volume of buoyancy needed to meet acceptable mooring performance. Designing for good mooring performance requires sufficient buoyancy and the use of low drag shapes to meet anticipated current velocities for typical deployment sites. With these fundamental goals we were able to package the components needed for a self-powered payout and retrieval system that met a minimum power consumption amount to provide multiple cycles up and down through the water column for its intended deployment period. Our design team included a highly experienced controls engineer with many years of experience in both system automation and underwater inductive modem use on buoy observation systems. The automation built into the system provided the motor control linked with the instrument download and satellite telemetry to produce a programmable system to carry out the desired missions.

The result of this engineering effort produced a commercially available tool for aiding in ocean research, observation, and Tsunami detection.

GHOST easily attaches to the top of any sub-surface mooring's upper most buoy with the use of standard shackles and rings. The Hammerhead wire rope termination provides the necessary isolation from the mooring hardware and makes the inductive-ready link.

GHOST consists of two primary components, the motorized vessel referred to as TRANSPORTER, and a tethered TRANSMITTER BUOY. Transporter is self-powered and travels up and down through the water column to transport the transmitter buoy to the ocean surface multiple times throughout its pre-defined mission. The transmitter buoy is



» The transmitter buoy is connected to Transporter via a fixed length of electro-mechanical cable and houses the satellite antenna. (Image credit: Mooring Systems)

connected to Transporter via a fixed length of electro-mechanical cable and houses the satellite antenna. Only the transmitter buoy will breach the ocean surface spending less than 5 minutes to transmit collected instrument data files. Transporter will remain just below the sea surface during the transmission then retract to a safe and hidden park depth.

The brain of the system is an intelligent controller that requires no user interaction during deployment operations. The controller is pre-programmed to collect data from multiple instruments installed on the sub-surface mooring and transport the antenna to the surface for the satellite transmission at pre-defined time intervals. Smart features built into the system provide assurance the system will never exceed its pre-programmed depth for the selected mission. Proprietary components and automated control systems have been uniquely designed into the pay-out and retrieval system to provide a robust and seawater resistant design. Sea trials were conducted to test all functions of the system including the failsafe conditions designed for safe and reliable operation. Recommended deployment and recovery methods of the system components were determined based on actual field use.

This new TAU (tethered AUV) product entry opens new possibilities in ocean observation systems. The ability to remotely capture subsea instrument data files and deliver those files to a host computer from any water depth in any ocean and virtually without ever being visible is a game changer for ocean science, marine conservation, Tsunami detection, and security.

Our focus on making data recovery a priority goes hand in hand with our track record in building robust moorings designed to meet a required survival life. This product is patent pending.



» GHOST Deployment: Successful sea trials were conducted to test all functions of the system. (Photo credit: Mooring Systems)

For more information, visit:  
[WWW.MOORINGSYSTEMS.COM](http://WWW.MOORINGSYSTEMS.COM)

## JW FISHERS' SEALION-2 ROV OFFERS ECO-FRIENDLY BUSINESS SOLUTION

Seashells are the exoskeletons of mollusks such as snails, clams, oysters and many others. They have a critical role in coastal ecosystems such as providing nesting materials, a home or attachment surface for algae, sea grass, sponges, and a host of other microorganisms. Fish also use seashells to hide from predators while hermit crabs use them as temporary shelters.

ScubaCom has the only specimen seashell permit (EP0002) in South Australia which is closely managed by the SA Fisheries Department. Founder Steve Robinson commented, "it is my aim to offer seashells to the world with a guarantee that all specimens have been responsibly collected ensuring species sustainability. We currently have a database of every seashell taken by us (with photos and unique number) and will be able to verify all shells sold by us. You will see this section slowly grow as this business moves forward."

How did this adventure start? According to ScubaCom's website, Steve was looking for a semi-retirement plan and the opportunity to apply for a specimen seashell permit appeared. It was a tough decision considering his commitment to environmental responsibility and the sustainability of any species collected.

Steve carefully analyzed the environmental implications before starting this type of endeavor. "At this stage I considered very carefully the impact a specimen seashell license would have on the environment."

These considerations included (1) "this would be the only specimen seashell license in South Australia, so overfishing seemed impossible," (2) "the weather would only allow me to fish a small number of days a year," (3) "with specimen seashells, only the best shells have value so I would expect to only take about one quality shell out of thirty or more seen," (4) "South Australia also has many sanctuary zones protecting many seashell populations and marine parks ensuring minimal impact on species."

Most seashell collection will be done with a JW Fishers' Sealion-2 ROV to allow for individual seashell collection at a depth of 300 m. The ROV has a modified manipulator arm with docking station so that seashells can be scooped up effortlessly. The umbilical from the surface is attached to the docking station and 25 m of cable are coiled on the top shelf which come out when the ROV leaves the station. This eliminates the umbilical drag from the surface. This method of operation results in zero damage to the marine environment while searching. Utilizing a JW Fishers' ROV also significantly expands the search area to include locations that divers cannot reach.

Any seashells that ScubaCom has for sale on the website will show the fisherman's license number, processors license number, export exemption details, where the shell was caught, identification photo and data base number, and other information. All of these details are available on a database, which the South Australian Fisheries Department can



» JW Fishers' Sealion-2 ROV. (Photo credit: JW Fishers)



» Utilizing a JW Fishers' ROV to help collect seashells expands the search area to include areas that divers cannot reach. (Photo credit: JW Fishers)

fully access. Also, a certificate will be issued with details, photos, and unique number. This certificate ensures all shells purchased have been collected under strict environmental management.

It is the aim of Steve's company to ensure every seashell sold has been collected under strict environmental management. JW Fishers applauds Steve's efforts to operate a successful business, while also taking environmental factors very seriously for our ocean waters.

## DAMEN AND SEA MACHINES FORM ALLIANCE

Sea Machines Robotics has announced a new strategic alliance with Damen Shipyards Group, of the Netherlands, to incorporate the company's autonomous and wireless-helm systems as standard features in Damen's global vessel build catalogue. This partnership increases the accessibility of Sea Machines systems in marine and maritime markets and further propels Sea Machines into mainstream use aboard commercial vessels.

Now, with Sea Machines technology on board, Damen's customers can take advantage of new operational methodologies that deliver additional efficiencies, increases in productivity and predictability, and opportunities to increase at-sea safety throughout the life of the vessel.

In addition to installing the autonomous-command and wireless-helm systems, Damen will train users to operate Sea Machines systems via the company's in-house simulator. Fully integrated with Sea Machines' technology, the simulator will generate a realistic

marine domain in which employees and the company's clients can learn to use Sea Machines' intuitive user interface and become familiar with modern autonomous-command capabilities.

Damen's Toine Cleophas, manager programs, said: "The collaboration forms a part of Damen's R&D program Smart Ship and will increase customer value by supporting a more digitalized Damen portfolio."



» A rendering of a "smart bridge," in which a mariner takes a remote supervisor role. (Image credit: Damen)

## TELEDYNE RESON TO DELIVER SONARS FOR MINE COUNTER MEASURE PROGRAM

Teledyne RESON has been awarded a significant order for the supply of SeaBat 7123-MkII forward-looking sonar systems for obstacle identification and avoidance for two new build naval mine hunting vessels.

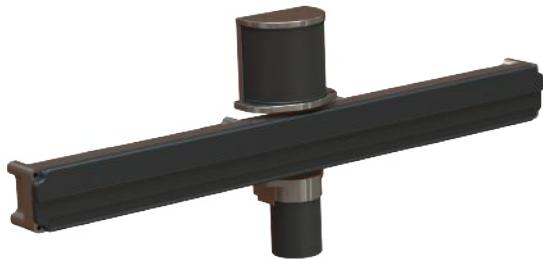
Teledyne RESON's SeaBat 7123-MkII is an advanced dual-use high resolution forward-looking sonar suitable for use in a wide range of applications and platforms, including both surface vessels and underwater vehicles.

In commercial use, the SeaBat 7123-MkII can deliver super high-resolution imaging for underwater inspection related tasks, such as long-range detection of objects in the water column or on the seabed, and the sonar can be used as a platform for scientific and oceanographic research applications. The SeaBat 7123-MkII can be integrated on many platforms, such as AUVs, ROVs, PVDS and surface vessels, and is especially useful for unmanned drone vessels for detecting and classifying objects on the seabed in real time.

In Naval use, the sonar is a vital component in Mine Counter Measure (MCM) systems for detection of Mine Like Objects (MLOs) at long distances. The high-resolution image enhancement solution of the SeaBat 7123-MkII not only provides a clearer image, but combined

with machine learning algorithms, provides unprecedented real time computer aided detection (CAD) and tracking supporting the operator to classify objects.

"We are pleased to be awarded this order and being able to deliver solutions that keep the oceans safe." said Ole Søe-Pedersen, VP of Teledyne Marine Europe. "Teledyne Marine innovation continuously focuses on developing market leading sonars with state-of-the-art image enhancement features. The sonars for this order will be delivered with the newest features that include machine learning and AI."



» Teledyne RESON's SeaBat 7123-MkII. (Photo credit: Teledyne RESON)

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# USING GLIDERS FOR LONG-TERM OCEAN OBSERVATIONS



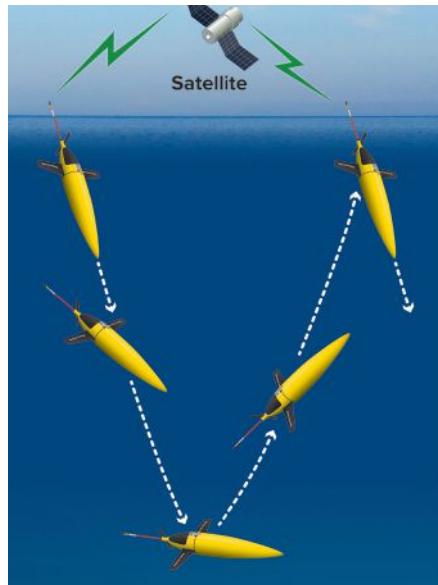
**By Duane Fotheringham**

President, Unmanned Systems business group,  
Huntington Ingalls Industries, Technical Solutions

Long-term ocean observations can be extremely costly and time-consuming. Typical data collection methods include large, manned platforms on or above the water that drive sensors to areas of interest. The operation and maintenance of a research vessel, with equipment and crew, traditionally have been a massive endeavor. As unmanned maritime systems have evolved, they have emerged as cost-efficient methods for collecting ocean data. In the early 2000s, underwater gliders were introduced to the oceanographic community as an addition to the suite of tools used in oceanographic research. Today, gliders are an integral part of ocean observations, collecting physical, biological, optical and acoustic data sets with high temporal and spatial resolution at a fraction of the cost of ship-based data collections.

## THE SEAGLIDER

The Seaglider® Autonomous Underwater Vehicle (AUV) was developed by the University of Washington in 1995 and is manufactured and sold commercially by Huntington Ingalls Industries' (HII) Technical Solutions division. More than 150 Seagliders have been sold to 16 countries worldwide for various applications, including climate research, intelligence,



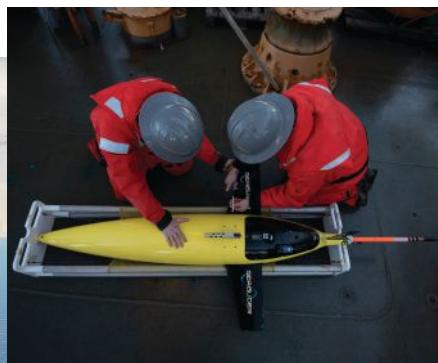
▲ (Top) The Seaglider uses changes in buoyancy to move through the ocean in a sawtooth pattern while collecting data. (Image credit: HII)

surveillance and reconnaissance (ISR), and marine research. They are reliable and robust, and can replace manned platforms to autonomously collect data for long-endurance missions.

There are two variants for littoral and deep-water missions: The new Seaglider C2, which is 200-meter-rated, and the Seaglider M1, which is 1000-meter-rated. They are two-man portable and use changes in buoyancy to move through the ocean in a sawtooth pattern. Internal sensors monitor vehicle heading, depth and attitude during dives. Buoyancy changes are achieved through the inflation and deflation of an oil-filled bladder and allows diving through water with up to a 10‰ density differential without adjustment of the ballast.

Because there are no external moving parts, the vehicles are quiet, durable and energy efficient. The C2 achieves endurance up to three months, and the M1 achieves endurance up to 10 months, dependent on active sensors and sampling rate. The Seaglider takes measurements from different levels in a water column, providing temporal and spatial scales not possible with research vessels.

Seagliders can be equipped with a variety of sensors, including conductivity/temperature/



» A Seaglider being prepared for deployment aboard the U.S. Coast Guard Cutter Healy off the coast of Alaska in September 2018. (Photo credit: Senior Chief Petty Officer NyxoLyno Cangemi, U.S. Coast Guard) (Left) A Seaglider deployed in Antarctica. (Photo credit: Dr. Vernon Asper)

depth (CTD); dissolved oxygen; backscatter and fluorescence; microturbulence; passive acoustics; acoustic doppler current profilers (ADCPs); and echosounders. Data is transferred anywhere in the world via satellite communications in near real-time based on user-defined intervals. When surfaced, the Seaglider also obtains a GPS fix to aid in navigation and can receive new commands or updated missions via satellite.

## CLIMATE RESEARCH

Climate change has echoing effects throughout the world, especially with the ocean. The Seaglider allows for measurement and calculation of factors like salinity and temperature, which aid in climate change studies. Because they are untethered, Seagliders can access remote or hazardous locations and have been used everywhere from the Caribbean Sea, monitoring hurricanes, to polar ice regions, investigating the thinning of ice shelves. They have made multiple passes of the Drake Passage, studying air-sea-ice flux and have tracked eddies across the Pacific Ocean for more than nine months at a time. Since the Seaglider is underwater most of the time, sea state and storm conditions are not a high risk to missions or equipment.

## INTELLIGENCE, SURVEILLANCE & RECONNAISSANCE (ISR)

The Seaglider has participated in military exercises, including TASWEX 04, RIMPAC 06 and REP14. The robustness and reliability make it a stable, covert platform for ISR missions. Without the need for a propeller or external moving parts, the vehicle is extremely quiet. It can also be programmed to surface infrequently to minimize surface expression. The Seaglider has been outfitted with multiple ISR sensors, including passive acoustic sensors.

## MARINE RESEARCH

The study of marine life can be aided by Seagliders, which are used by researchers around the world to collect data needed to better understand marine processes and concerns. Seagliders carrying a passive acoustic sensor payload are used to meet environmental monitoring regulations regarding the proximity of marine mammals to events such as oil and gas operations and naval exercises and to better understand the habits of marine mammals. When outfitted with echosounders, it generates biomass estimates without the need to catch specimens. Measurements of dissolved oxygen, salinity and temperature give insight into water quality and the health of the ecosystem.

## THE FUTURE OF SEAGLIDERS

As technology continues to progress and evolve, our Seagliders must do the same. At HII, we are always looking for ways to increase endurance by optimizing SWaP: size, weight and power. We are investigating new, higher-density power sources to increase endurance and our partners help customize sensors and payloads to minimize weight and size to increase vehicle capabilities. Modifications to the variable buoyancy system can increase the density range of operations, allowing Seaglider to easily transition from fresh water to salt water without the need to reballast.

## CASE STUDY: NOAA AOML SEAGLIDERS FOR HURRICANE MONITORING

The National Oceanic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratory (AOML) has been using a fleet of Seaglider AUVs since 2014 for hurricane monitoring. The data collected by the program is used to improve the operational hurricane models and their prediction of the track, intensity, structure and amount of



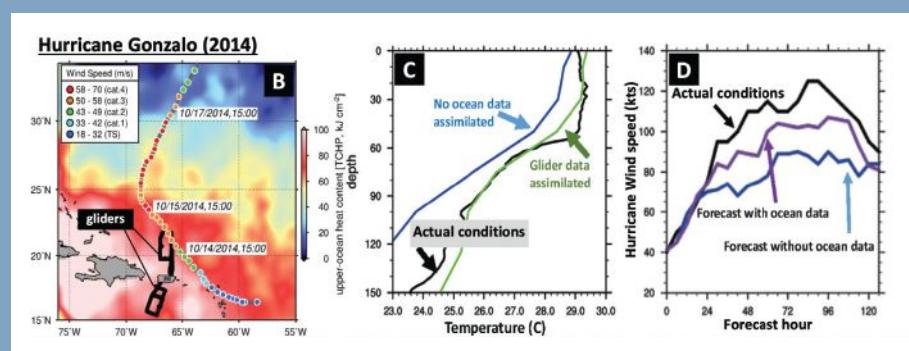
» Two Seagliders being prepared to deploy for hurricane monitoring in July 2014. (Photo credit: NOAA AOML)

rainfall throughout the life-cycle of a storm. NOAA AOML Seagliders measure temperature, dissolved oxygen, chlorophyll concentration and chromophoric dissolved organic matter (CDOM) and collect data needed to derive salinity.

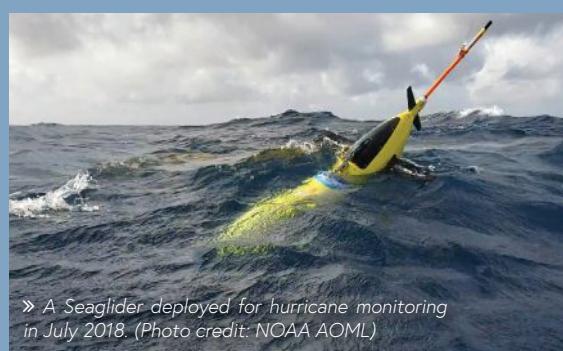
NOAA AOML and partners deploy Seagliders during hurricane season to the Caribbean Sea and tropical North Atlantic Ocean. Missions last about four months from mid-July to mid-November, and Seagliders collect data on temperature and salinity profiles around tropical storms and hurricanes. In 2020, NOAA AOML and partners completed a total of nine four-month missions with Seagliders, collecting more than 13,000 individual temperature and salinity profiles without loss of a single vehicle.

Since 2014, Seagliders have gathered more than 40,000 data profiles. They have operated around hurricanes up to Category 5, collecting and transmitting sustained and targeted ocean observations. NOAA AOML has found that high heat and low salinity may create conditions that are appropriate for hurricane intensification. By feeding the data into NOAA's hurricane forecast model, they help improve the five-day intensity forecast.

For more information about the Seaglider AUV, visit [www.tsd.huntingtongalls.com/unmanned](http://www.tsd.huntingtongalls.com/unmanned).



Figures B, C and D show the track of Hurricane Gonzalo in 2014 and the coupled model predictions for the intensity of this hurricane with and without inclusion of ocean data, including that collected by the Seagliders. [B] Seagliders currently collect approximately 10,000 ocean observations per hurricane season, including during hurricane conditions. Hurricane Gonzalo came within 85 km of the northern glider. [C] Seaglider data helps reduce errors of simulated ocean conditions used to initialize the ocean-atmosphere forecast models. [D] Ocean observations helped to significantly reduce the error of the Hurricane Gonzalo intensity forecast. NOAA AOML estimates that the assimilation of ocean observations and underwater glider data reduced intensity forecasts errors by as much as 50%. Underwater glider data provided by NOAA/AOML as part of the NOAA-funded "Sustained and Targeted Ocean Observations for Improving Tropical Cyclone Intensity and Hurricane Seasonal Forecasts" project.



» A Seaglider deployed for hurricane monitoring in July 2018. (Photo credit: NOAA AOML)

## SEA MACHINES' AUTONOMY SYSTEM TO SURVEY GALVESTON BAY FOR NOAA

DEA Marine Services, a division of David Evans and Associates, Inc. (DEA), in Vancouver, Wash., is leveraging a Sea Machines Robotics SM300 autonomous-command and remote-helm control system to fulfill a National Oceanic and Atmospheric Administration (NOAA) contract that is now surveying more than 3,500 nautical miles of the Western Galveston Bay, near the Houston Ship Channel.

The SM300 has been installed aboard the DEA survey boat *Sigsbee*, which is serving as an autonomous daughter craft for the project. *Sigsbee* is effectively doubling coverage by operating without an onboard crew, while collaboratively following another DEA-staffed hydrographic survey vessel, which serves as the mothership. The goal is to cover the Bay's large and shallow survey areas more efficiently than traditional, crewed survey vessel operations. DEA operators located aboard the mothership are commanding the autonomous *Sigsbee* as it conducts survey missions seven days per week, effectively doubling the conventional productivity of this type of survey.

Sea Machines' technology and DEA's technical advancements enhance the value of vessel operations by:

- Increasing productivity with collaborative autonomy for force-multiplication;
- Shifting recurring and repetitive operations from manual to autonomous, which enables personnel to focus on higher-level tasks;
- Interfacing autonomous navigation systems with survey software, including Hypack, enabling direct communication and optimizing the combined capabilities of both platforms;
- Improving vessel-tracking precision over planned lines to reduce cross-track error and excessive data overlap.

"Deploying the SM300 system for this mission is allowing DEA to conduct marine surveys with improved predictability, speed of data collection and at-sea safety," said Sea Machines' Sales Director Phil Bourque. "The integration with systems like Hypack are streamlining operations for surveyors and demonstrating our commitment to



» DEA operators located aboard the mothership are commanding the autonomous *Sigsbee* as it conducts survey missions. (Photo credit: DEA)

being a best-in-class technology provider. Sea Machines is pleased to support DEA and NOAA during this critical mission and others like it in the future."

"DEA is committed to the advancement of technology and being on the leading edge," said DEA Marine Services' Jon Dasler, PE, PLS, CH; senior vice president and director. "We see autonomy as the future of hydrography and have enjoyed working with Sea Machines and additional software vendors for continued improvements in autonomous operations and the use of artificial intelligence in data processing."

In May 2020, Sea Machines announced that Deep BV, of the Netherlands, would upgrade operations with the SM300 to conduct unmanned hydrographic surveys. Deep's vessel, operating in multiple areas of the Wadden Sea, has been regularly commanded and controlled by personnel situated in the Amsterdam office.



» The SM300 has been installed aboard the DEA survey boat *Sigsbee*. (Photo credit: DEA)

## THAYERMAHAN-UCONN TEAM BEGINS HIGH-RESOLUTION SEABED SURVEYS OF THAMES RIVER, CT

ThayerMahan, Inc. recently completed an underwater survey using its SeaScout system to capture high-quality hydrographic imagery of Connecticut's Thames River. The survey is being conducted under a National Institute for Undersea Vehicle Technology (NIUVT) project in conjunction with the University of Connecticut (UConn)'s Department of Marine Sciences.

ThayerMahan's SeaScout system is an actively stabilized towed vehicle with synthetic aperture sonar and multibeam echosounder payloads. The system generates ultra-fine resolution (3 cm x 3 cm) beamformed imagery and interferometric bathymetry of undersea cables, boulders, rocks, and seafloor characteristics in real-time.

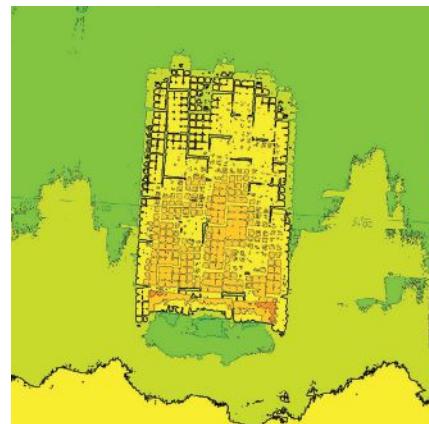
The two-year project will locate and monitor the shifting boundaries of key biological habitats and short-term, small-scale changes in bathymetry important to the health of the Thames River and Long Island Sound ecosystems. Baseline data will be re-evaluated to identify changes in the region and enhance security within the New London port area.



## HELPING MAKE SHORE

From major coastal restoration projects to beach monitoring, Morgan & Eklund has been providing government and commercial partners with multi-disciplinary surveys for over 35 years. Whether for artificial reef construction or ongoing dune nourishment, Morgan & Eklund is equipped to manage the pre-, during, and post-implementation survey and monitoring program using the latest breakthrough technology and software.

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# GLOBAL INSTALLED OFFSHORE WIND CAPACITY TO SEE 37% GROWTH IN 2021

Despite the COVID-19 pandemic, the world's installed offshore wind capacity rose by 15% in 2020, reaching 31.9 gigawatts (GW) at year-end, from 27.7 GW at the end of 2019, Rystad Energy estimates. China was the main contributor in 2020, accounting for 39% of last year's additions, followed by the Netherlands (18%) and the UK (17%).

Rystad Energy expects the global installed offshore wind capacity to further increase by 11.8 GW in 2021, a monumental 37% step-up compared to 2020's 31.9 GW. China will continue to lead the new capacity additions, contributing 63% of the expected growth.

As COVID-19 hit the Chinese market first, fears over supply chain disruptions emerged, with offshore wind developers worried about delays to projects down the line. And as the pandemic spread throughout the world, risks of a severe slump in construction activity grew. More countries closed their borders and went into lockdown and several manufacturing sites for turbines and other components temporarily shut down operations.

However, with the first wave of the virus settling, the offshore wind market returned to a growth trajectory, supported by increased capacity targets from several nations. While staying resilient in an uncertain market was key in 2020, this year the industry finds itself positioned for record growth, especially as commissioning activities pick up pace in Asia and around the world.

After 2021, China will begin phasing out feed-in-tariffs and many developers are therefore pushing to complete projects during the coming period. As such, this year is expected to see high capacity additions in the country.

"China had a construction backlog of more than 10 GW going into 2020, and Chinese developers are racing to reach maximum commissioning by the end of the year in order to claim full feed-in-tariffs. This means 2021 is going to see major capacity additions, particularly since some projects initially scheduled for commissioning in 2020 ended up slipping into 2021," according to Alexander Fløtre, Rystad Energy's Product Manager for Offshore Wind.

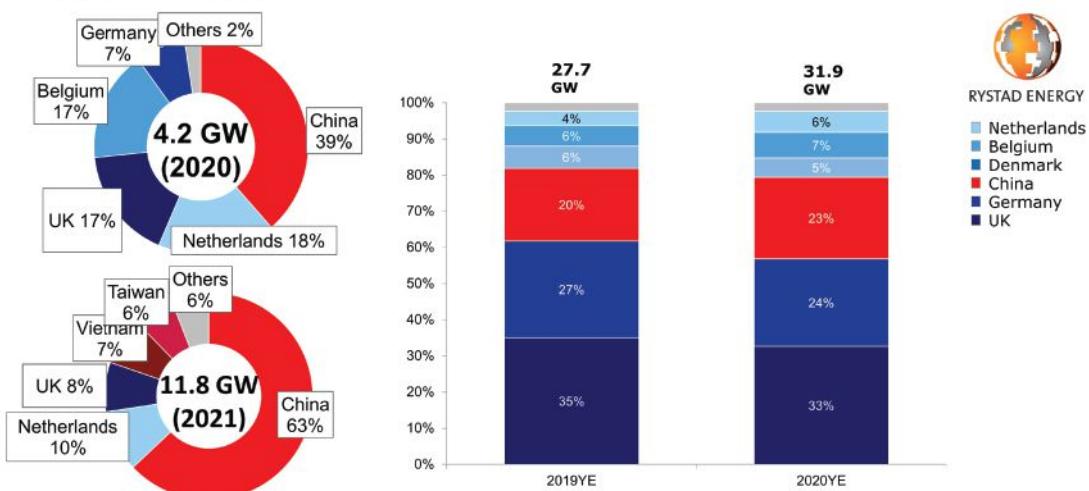
Europe and the US also saw some delays due to the pandemic. The developers of the second phase of the 50 MW Kincardine floating offshore wind project in Scotland and the Kriegers Flak combined grid solution in Denmark had to delay start-up. In the US, Danish player Ørsted announced in October delays of at least one year for five projects due to permitting issues.

Nevertheless, offshore wind developers stayed committed to their ambitions and continued to make final investment decisions for projects in 2020. The UK sanctioned more than 4.7 GW of offshore wind and the Netherlands followed with over 2.2 GW. As a result, major projects such as Triton Knoll in the UK, Borssele 3 & 4 in the Netherlands and Kriegers Flak in Denmark are expected to be completed during 2021.

In the second half of last year, almost 25 GW of capacity was added to the global backlog. Currently, Brazil has no operational offshore wind capacity, but its backlog grew significantly during 2020 as the country added more than 15 GW to the drawing board. In addition, other regions in Asia outside China are preparing for a ground-breaking year, Taiwan and Vietnam have finally started to add significant volumes to their project pipelines—making 2021 a year to look forward to in the offshore wind market.

*\*NOTE: The report's numbers are based on full commissioning of the wind farms to an operating level, which may diverge from grid-connected or just installed figures.*

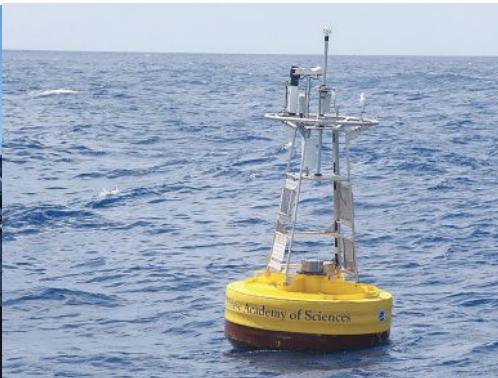
**Offshore wind capacity additions forecast, installed capacity at year end (2020-2021)**  
Share per country in percentage



Source: Rystad Energy OffshoreWindCube



# A UNIQUE APPROACH TO METOCEAN FROM DESIGN CONCEPT TO DATA STREAMING



» (Left) RDSEA Coastal MetOcean Buoy System Testing, Bayboro Harbor, St Petersburg, FL. (Center) RDSEA Deep-Water Ocean Climate Monitoring Buoy System, Real-Time Data, Sea Surface to 500 m, Western Pacific Ocean. (Right) NOAA TAO Program, Pacific Ocean, 170W/0, ADCP Deployment, Longest Running ADCP Dataset in the Community (34-years), NOAA Ship Ka'imimoana (The KA), RDSEA Assisted NOAA-NDBC in the Transition from Initial ADCP Technology (narrow-band) to Updated Long-Range Systems (broad-band).

**R**DSEA International is an experience-based and performance-driven oceanographic consulting company that prides itself on being a leading provider of ocean technologies. The company was founded in 2002 as a direct response to the growing demand for oceanographic subject matter expertise offshore and within the blue-water and coastal regions of our oceans, bays, and estuaries. RDSEA's initial projects included working on a number of federal and state oceanographic programs and observing systems that focused on studying air-sea interaction and ocean circulation.

## AN OCEAN OF INFORMATION

Today, RDSEA's experience spans three-decades of ocean measurements and technology evolution. Knowledge about the planet's marine environments is no longer limited to science and scientists; on the contrary, there is now a growing list of contributors and stakeholders to this ocean of information, which includes representatives from coastline emergency management, U.S. Coast Guard search and rescue operations, the U.S. IOOS, social health, recreational and commercial fishing, diving, energy solutions, oil-spill and algal-bloom response, management, and mitigation. This vast—

and ever expanding—knowledge base is now readily available to an industry that provides the technologies, methodologies, and services designed to collect critical data using observation platforms, systems, and programs. The role of this information has never been more critical, especially amid the emerging trends associated with certain natural phenomena, such as the increasing frequency and intensity of hurricanes, tsunamis and sea-level rise.

## TURNKEY SOLUTIONS

RDSEA is highly allied within the ocean community across the federal and state government, private and academic sectors in all corners of the U.S. and beyond. We offer the capability to measure and monitor environmental events with supporting time series using state-of-the-art, mostly off-the-shelf new technologies, instrumentation, and telemetry. From initial concept and design, to build out, testing, commissioning, deployment, data transmission, reception and dissemination to recovery and maintenance when needed, RDSEA delivers a partnership defined by end-to-end support.

We also aid in setting up protocol to keep critical data flowing and maintain an array offshore on a monthly to yearly basis, whether surface mounted or receiving subsurface data from the water-column to the seafloor.

Desktop studies for decision making and the permitting process in the energy sector and seafloor mining communities as well as providing *in-situ* site monitoring (in real-time if required), modeling, and reporting are company core offerings.

## OUR GOAL IS YOUR SUCCESS

Engaging emerging "Blue Tech" platforms and services, such as the importation of offshore datasets for machine learning via Artificial Neural Networks (ANN) or the collection of environmental DNA (eDNA) samples and subsurface data transfer using Subsea WiFi modem technologies, keeps RDSEA up to speed in this new era of ocean observation and collaboration and able to tailor solutions to the very complex and complicated task of working in the offshore environment of our world. We have learned from the challenges that working at sea presents and have grown through the genuine collaboration and team effort needed to stay innovative. Safety is always first and Our Goal is Your Success.

## RDSEA International, Inc.

📍 St Pete Beach, FL 33706  
📞 1.727.385.3834  
✉️ info@rdsea.com, rickcole@rdsea.com  
🌐 www.rdsea.com  
👤 Founder and President: Rick Cole  
DUNS #: 80-150-1110

## SUSTAINABLE MARINE UNVEils 'NEXT-GEN FLOATING TIDAL ENERGY PLATFORM'

Sustainable Marine is forging ahead with plans to deliver the world's first floating tidal energy array after unveiling its next-generation platform in Nova Scotia, Canada.

Construction of the pioneering new 420 KW PLAT-I 6.40 floating tidal energy platform was recently completed at A.F. Theriault & Son Ltd. in Meteghan, Nova Scotia and launched in the Bay of Fundy, which experiences the highest tides on the planet.

It will undergo commissioning and testing in Grand Passage and will then be moved to the

FORCE (Fundy Ocean Research Centre for Energy) site as part of the first phase of the groundbreaking Pemba'q In-stream Tidal Energy Project.

The total in-stream tidal energy project will deliver up to nine megawatts of electricity to the Nova Scotia grid. This will reduce greenhouse gas emissions by 17,000 tons of carbon dioxide a year and power approximately 3,000 homes in Nova Scotia.

"This 'tidal technology is the result of a tremendous international effort combining world-class scientific and



» Sustainable Marine's new 420kW PLAT-I 6.40 floating tidal energy platform (Photo credit: Sustainable Marine)

## BIDEN SIGNS EXECUTIVE ORDER TO DOUBLE OSW BY 2030

President Biden recently signed an Executive Order that includes doubling offshore wind power generation in U.S. federal waters by 2030. The order further directs the Department of Interior to conduct a full assessment of the siting processes that will align U.S. public lands and water management practices with Administration goals to advance renewable energy production.

The new Administration's actions have also established the White House Office of Domestic Climate Policy and created a federal government-wide task force that will coordinate actions between agencies. Overall, the order addresses job creation, infrastructure expansion, and was to alleviate climate change. The inclusion of offshore wind energy development in the Executive Order acknowledges the important role the industry will play in the administration's renewable energy goals, which will drive investment, revitalize ports, and provide new, well-paying jobs for workers, particularly those in disadvantaged communities often affected by pollution.

Liz Burdock, president and CEO of the Business Network for Offshore

engineering expertise from our German, Scottish and Canadian teams, and is the culmination of a decade of research and development," said Jason Hayman CEO of Sustainable Marine. "We are very fortunate to have such strong support from our major shareholders, SCHOTTEL and Scottish Enterprise, the Government of Canada, and a wide range of partners and collaborators. The PLAT-I 6.40 has been designed specifically for the Pemba'q Project—where we will deliver the world's first floating tidal array—in Nova Scotia, which has of the best natural resources in the world to produce clean renewable tidal energy."

The Pemba'q Instream Tidal Energy project is a groundbreaking initiative and is being supported by the Government of Canada with \$28.5 million in funding—one of Canada's largest-ever investments into tidal energy.

"We are harnessing the power of our tides to power our homes, our businesses and our communities," said the Honorable Seamus O'Regan Jr., Canada's Minister of Natural Resources. "This is how we build our clean energy future."

"The construction and launch of Sustainable Marine's floating in-stream tidal technology is a significant milestone for Canada's marine renewable energy sector. The project has engaged many local suppliers and offers a sustainable and clean solution for electricity production using a local resource. Projects and innovation like this are central to building Canada's Blue Economy," said Elisa Obermann Executive Director of Marine Renewables Canada.

The PLAT-I 6.40 launched builds on the lessons learned and experience gained from Sustainable Marine's previous successful deployments in Scotland and Nova Scotia. It was designed specifically for the FORCE site, and produces 50% more power than its predecessor, the PLAT-I 4.63, which has undergone rigorous testing since 2017, firstly in Scotland before relocation to Grand Passage, Nova Scotia, in 2018. During testing the system has successfully produced power and has demonstrated it can operate in adverse weather conditions. It is also crucially measuring environmental effects and has not recorded any evidence of adverse effects on fish or marine animals.

Wind, said: "President Biden's actions confirm the critical role that offshore wind energy will play in creating a clean U.S. energy grid and achieving White House commitments to combat climate change. His call to double offshore wind production in U.S. federal waters sends a clear signal of support to our industry, which will generate billions in new investments. Over the next few years, the offshore wind industry will dramatically scale up development of the U.S. supply chain, growing tens of thousands of new jobs in the process. The offshore wind market has been on the precipice of significant growth thanks to states' bold leadership and President Biden's executive order further pushes the industry to new heights with a new sense of urgency."



## BOEM TO RESUME ENVIRONMENTAL REVIEW OF VINEYARD WIND'S PROPOSED PROJECT

The Bureau of Ocean Energy Management (BOEM) has announced that it intends to resume the environmental review of Vineyard Wind's proposed offshore wind project.

"Offshore wind has the potential to help our nation combat climate change, improve resilience through reliable power, and spur economic development to create good-paying jobs," said BOEM Director Amanda Lefton. "BOEM is committed to conducting a robust and timely review of the proposed project."

BOEM will resume the environmental review of the Vineyard Wind Project and proceed with development of a Final Environmental Impact Statement.

On January 22, 2021, Vineyard Wind submitted a letter rescinding its temporary Construction and Operations Plan (COP) withdrawal and requesting that BOEM

resume review of the 800-megawatt wind energy project offshore Massachusetts. The proposed project would be located approximately 12 nautical miles offshore Martha's Vineyard and 12 nautical miles offshore Nantucket in the northern portion of its lease area. Vineyard Wind had paused the Department's consideration of its proposal while it reviewed whether the use of Haliade-X turbines warranted any modifications to their COP.

President Biden issued an Executive Order on January 27, 2021, that called for the Interior Department to identify steps to accelerate responsible development of renewable energy on public lands and waters. Interior has initiated a review of processes and procedures to date as it re-invests in a rigorous renewable energy program.



» The proposed project would be located approximately 12 nautical miles offshore Martha's Vineyard. (Image credit: Vineyard Wind)



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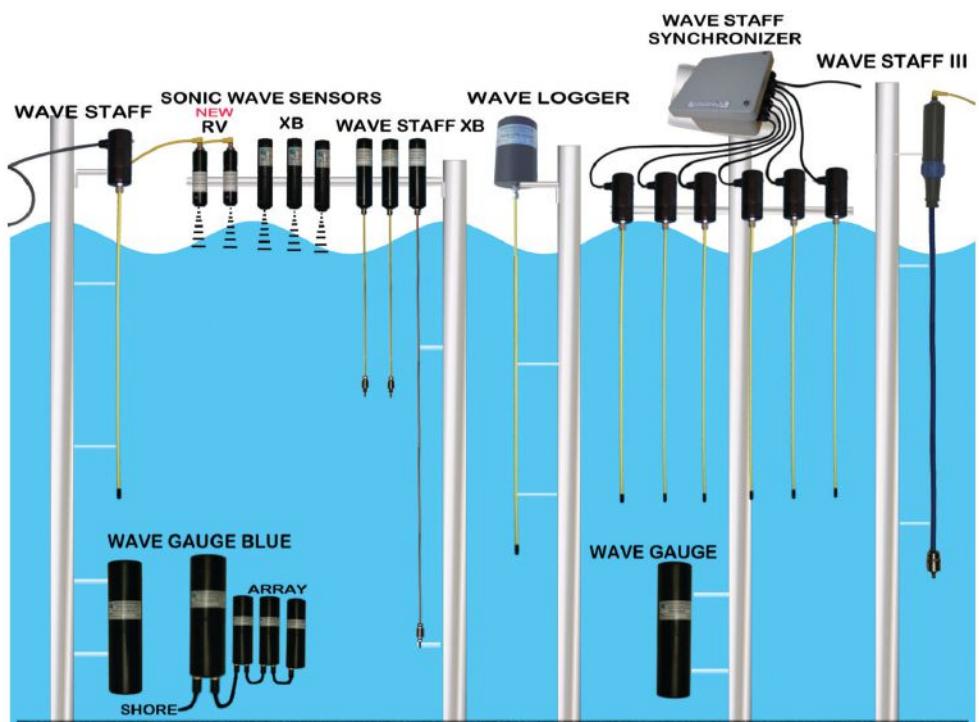
**MEASURE:**  
Waves  
Tides  
Levels

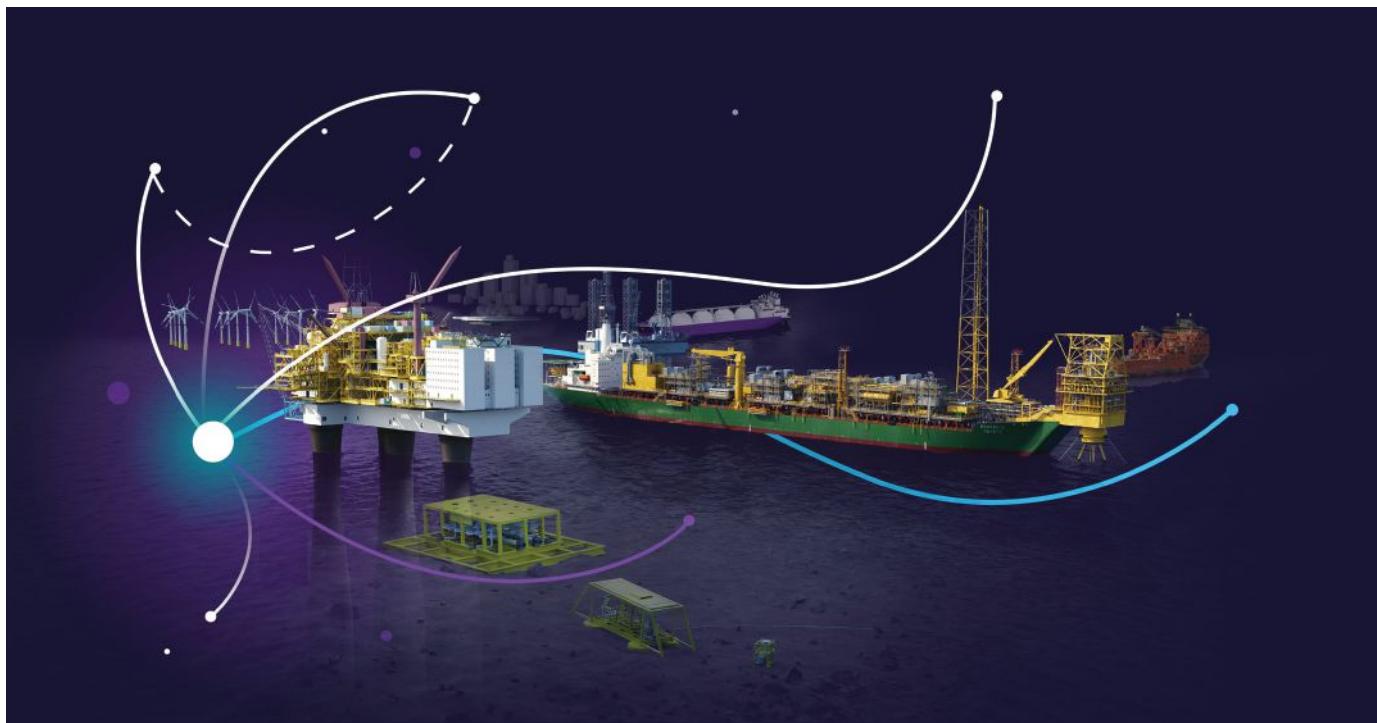
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» Siemens Energy's BlueDrive DC-Grid technology is an efficient, environmentally friendly solution that provides high levels of reliability, availability, and ease of service, with low emissions. (Image credit: Odfjell Drilling)

## ODFJELL DRILLING MINIMIZING RIG EMISSIONS WITH SIEMENS ENERGY TECHNOLOGY

Odfjell Drilling will retrofit its newest deepwater, semi-submersible drilling rigs in the North Sea's Norwegian sector with Siemens Energy's BlueDrive DC-Grid system. The upgrades will be carried out on Deepsea Atlantic and Deepsea Nordkapp, with the opportunity to include Deepsea Stavanger, Deepsea Aberdeen, and Deepsea Yantai at a later stage.

With these upgrades, the rigs will push the boundaries for conventionally powered offshore rigs and set a new technological standard in Odfjell Drilling's strategy towards zero-emission drilling.

"These projects are the result of asking a simple yet challenging question: 'What would be the most efficient technological approach to minimize emissions from a rig in the short term?' The resulting ideas were very well received by Odfjell Drilling's customers and will contribute to their long-term emission targets, so this is business and low-emission targets working hand-in-hand," said Per Lund, Chief Technology Officer and Executive Vice President, Technology & Sustainability, Odfjell Drilling.

"Our agreement with Odfjell Drilling affirms our ability to understand and

deliver complete, innovative, and cutting-edge solutions in line with our customers' expectations, which include design, engineering services, interfacing with third parties and fabrication of state-of-the-art power electronics, as well as financial advice and support," said Jennifer Hooper, Senior Vice President, Industrial Applications Solutions for Siemens Energy.

### BLUEDRIVE DC-GRID TECHNOLOGY

Siemens Energy's BlueDrive DC-Grid technology was developed and refined over many years to meet the offshore industry's demanding energy distribution requirements, especially for propulsion and drilling systems. It is an efficient, environmentally friendly solution that provides high levels of reliability, availability, and ease of service, with low emissions.

The Siemens Energy BlueDrive DC-Grid solution consists of DC/DC converters connected to the existing four drilling drive DC buses from one side and to DC/DC converters connected to energy-storage systems. This allows platform operators to conduct peak shaving of drilling loads, so fewer generator sets can run at higher and steadier loads—reducing fuel consumption

and carbon emissions, improving sustainability, and minimizing a rig's carbon footprint. Further, the solution will increase the power plant's reliability by reducing blackouts, which will prevent downtime and boost asset utilization.

In drilling applications, the Siemens Energy BlueDrive system will be an integral part of the entire drilling process, enhancing the drill string's performance when applying high torque during drilling operations.

The scope awarded to Siemens Energy results from several months of technical and operational clarifications to ensure the rigs' optimal functional profile.

The long-term relationship and technology cooperation between Odfjell Drilling and Siemens Energy also includes several R&D initiatives related to power from shore or nearby platforms and floating offshore windmills to fixed platforms or rigs.

These solutions will complement the Siemens Energy DC Grid and BlueVault battery solution system and provide customers with holistic approaches to solving their power challenges that Siemens Energy can deliver entirely.

# KONGSBERG MARITIME INTEGRATED SOLUTION FOR WIND TURBINE INSTALLATION UNITS

Kongsberg Maritime (KM) technology is at the center of an ambitious new project to build a next-generation Wind Turbine Installation Unit (WTIU), destined to be among the largest of its type.

Kongsberg Maritime has signed a Letter of Intent with Chinese shipbuilder Yantai CIMC Raffles Offshore to deliver a large technology package for the BT-220IU Wind Turbine Installation Unit. BT-220IU is to be built for the Norway-based company OIM Wind, with an option for another vessel of identical design. The vessel will be suitable for transporting and installing multiple sets of next- and future-generation wind turbines, and their foundations.

Crucial to the cost-effective and environmentally responsible profile of the new vessel, which is expected to be delivered by the end of 2022, is a Kongsberg Maritime Integrated Solution for Wind Turbine Installation Units. This well-proven solution combines KM's motion control, propulsion and dynamic positioning functionalities to maintain operability in all conditions.

Monitoring and controlling of the KM components will be handled by a K-Chief 700 marine automation system, and the company's scope of delivery is rounded out with a comprehensive Digital Solution with a new planning, advisory, monitoring and reporting tool to improve the safety and operation of the vessel.

Included in the delivery are Bergen LNG (Liquified Natural Gas) engines, together with an LNG Fuel Gas Supply System. KM's new state of the art PM azimuth thrusters will secure optimized performance both for transit, maneuvering and dynamic positioning. The scope of supply also includes an array of appropriate deck machinery.

The electrical system will make use of KM's Energy Storage Solution, a green, load-smoothing initiative which will optimize power production and enable the vessel to operate for limited periods on battery power alone. By allowing these stretches of zero-emission running, the solution will reduce the need for installed power and minimize maintenance costs, and can reduce energy consumption by up to 30%.

With the highly efficient power plant running on LNG the vessel will be the most environmentally friendly WTIU built to date.

OIM founder, President and CEO Oddgeir Indrestrand, said: "OIM have been working closely with Kongsberg Maritime for many years, and we are very happy to include their advanced range of future-proof equipment and solutions into our units."

"It's a source of real pride for us to be such an integral part of the specification for this new wind turbine installation unit," said Brynjulf Standal, Vice President Sales-Offshore, Kongsberg Maritime. "The environmentally friendly principles which shape its design, construction and operation mirror our own ambitions to engender sustainability in offshore wind projects, and of course in all maritime sectors. Our technologies are a key element in achieving these green goals."



» Equipped with Kongsberg Maritime systems, OIM Wind's new vessel will, on completion, be capable of sustainably transporting and installing multiple sets of next-generation wind turbines.



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## KONGSBERG MARITIME TO LAUNCH NEXT GENERATION HUGIN ENDURANCE AUV

Kongsberg Maritime has announced the launch of the next generation of its advanced HUGIN Autonomous Underwater Vehicle (AUV). Named HUGIN Endurance, the new AUV boosts operational duration to approximately 15 days, enabling extended survey and inspection missions far from shore.

This longevity allows HUGIN Endurance to undertake extensive missions without the support of a mothership. Shore-to-Shore operations offer the opportunity to reduce carbon footprint for commercial activities and yet retain unrivaled data resolution and accuracy. With this in mind, KONGSBERG has added its Maritime Broadband Radio (MBR) communications system to HUGIN Endurance's payload, allowing it to surface and share large quantities of data swiftly with any suitably equipped installation, such as another vessel, shore station or a wind turbine fitted with an MBR antenna.

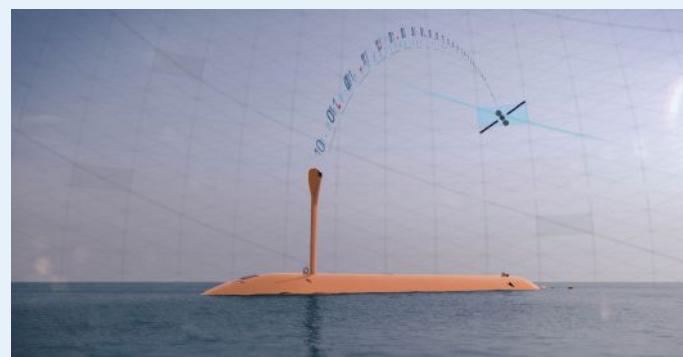
For defense applications, HUGIN Endurance makes persistence a reality. Whether it is long range military survey; wide area mine detection, classification and identification; or even patrolling a choke point listening for submarines, this new extended range capability offers new solutions to existing and future challenges.

HUGIN AUVs already set the standard for autonomous underwater operations thanks to their rugged reliability and accurate, cutting-edge sensor payloads. The HUGIN Endurance is no exception; it can be equipped with a wide array of sensors including the high-resolution KONGSBERG HiSAS synthetic aperture sonar, a wide swath multibeam echo sounder, sub-bottom profiler and magnetometer, together with other sensors to detect parameters such as methane, current and turbidity.

This proven portfolio of hydroacoustic sensors, communications and other technologies—teamed with unparalleled operational range—ensures that HUGIN Endurance is well equipped for advanced situational awareness scanning, and mapping/inspection activities for far-field applications such as offshore wind farms. It also delivers significant sustainability benefits, not only when contrasted with conducting operations from surface vessels but also compared with other AUV operations, as the reduction in the need for surface support further diminishes the environmental footprint.



» Kongsberg Maritime's new HUGIN Endurance AUV can map up to 1,100 square kilometers on a single mission. (Image credit: Kongsberg Maritime)



» KONGSBERG has added its Maritime Broadband Radio (MBR) communications system to the HUGIN Endurance's payload, allowing it to surface and share large quantities of data swiftly with any suitably equipped installation. (Image credit: Kongsberg Maritime)

"We are proud to launch HUGIN Endurance, which represents a step change in AUV operations," said Richard Mills, Vice President of Marine Robotics Sales, Kongsberg Maritime. "Teaming long endurance with large area coverage capabilities allows a single AUV to map areas up to 1,100 square kilometers in a single mission—a target impossible until now. With its unprecedented long-range capability and advanced communications, HUGIN Endurance sets a new standard for autonomous subsea mapping and inspection, yielding unmatched operational flexibility, efficiency and sustainability."



## SUBSEA 7 INKS SUBSTANTIAL CON- TRACT OFFSHORE ANGOLA

Subsea 7 has been awarded a substantial<sup>(1)</sup> contract by Cabinda Gulf Oil Company Limited (CABGOC). The contract is for the Sanha Lean Gas Connection (SLGC) project comprising the construction and installation of the Lean Gas Platform (LGP) system in Block-O offshore Angola, at a water depth of approximately 70 meters.

Project management and engineering will be performed from Subsea 7's offices in Paris and Lisbon. Fabrication will take place at Sonamet's yard in Lobito, Angola from 2021 to 2022, while offshore

operations will occur from 2022 and 2023.

Gilles Lafaye, Senior Vice President Africa, Middle East and Caspian Region said: "We are delighted to have been awarded this contract by CABGOC, following a public tender. This is the result of a long-term collaboration with the client and a track record of delivering successful projects. The project reinforces Subsea 7's presence in Angola and our commitment to support Africa's energy industry".

(1) Subsea 7 defines a substantial contract as being between USD 150 million and USD 300 million.

## ALLSEAS SELECTS SEATOOLS FOR DEEP-SEA MINING EQUIPMENT

Allseas has awarded subsea technology company Seatools the contract for the delivery of the complete electrical, hydraulic, and control system for Allseas' deep-sea mining nodule collector. The project is part of Allseas' development program to realize advanced deep-water equipment for the gathering of polymetallic nodules from the ocean floor in a responsible way.

Driven by the green energy transition, the interest in high-grade seafloor polymetallic nodule deposits has risen in the past few years due to the depleting terrestrial deposits for metals such as copper, nickel, manganese, and cobalt. Nevertheless, subsea mining does not take place on a commercial scale yet as current technology readiness levels fall short. Allseas, as a pioneering offshore contractor, aims to close the technology gaps by developing advanced deep-water equipment to gather nodules responsibly from the ocean floor. A key component of the equipment under development is a tracked subsea vehicle for the collection of polymetallic nodules. The purpose of this crawler vehicle is to maneuver over the seabed, collect mineral rich nodules from the sea floor, and transport them to a surface vessel.

While the core nodule collection technology and surrounding mechanical assembly will be developed in-house, Allseas has contracted Seatoools to bring its nodule collector alive by the delivery of the entire hydraulic, electronic, and control system. More specifically, Seatoools will perform the entire engineering trajectory, spanning design, building, testing and delivering of the subsea crawler's infrastructure and related vessel equipment required to operate the vehicle at full ocean depth.

For the project, Seatoools will draw upon its extensive track record and knowledge with regards to the design and manufacturing of deep-water, heavy-duty subsea machinery such as subsea rock installation ROVs. Furthermore, Seatoools will also draw upon recent pilot subsea mining projects through which a unique technology toolbox has been developed. Nevertheless, the project demands new technology elements as well. Advanced technology development and qualification processes and methods such as hardware in the loop (HIL) simulations will be applied to bring new technology elements to appropriate maturity and quality levels before they will be applied in the field.

Speaking of the contract, Seatoools' Managing Director Jan Frumau said: "This is a truly pioneering project in the deep-sea mining sphere at which there is a lot at stake for our client and perhaps even for this emerging industry as a whole. We are thrilled Allseas, being one of the most highly respected offshore contractors worldwide, has selected Seatoools to partner up for such a groundbreaking project. This contract underpins our belief that we are positioned as the preferred partner for industrial quality infrastructure solutions for all types of subsea equipment. We strongly believe that we will equip Allseas with state-of-the-art subsea technology."



» Allseas aims to close the technology gaps by developing advanced deep-water equipment to gather nodules responsibly from the ocean floor. (Photo credit: Allseas)

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## TDI-BROOKS INTERNATIONAL COMPLETES G&G CAMPAIGN OFF EQUATORIAL GUINEA

TDI-Brooks International, Inc. has completed a geophysical and geotechnical (G&G) campaign for Trident Equatorial Guinea off the coast of Equatorial Guinea in the Elon Field. The site survey work was performed off the *R/V Proteus*, a research vessel owned and operated by TDI-Brooks.

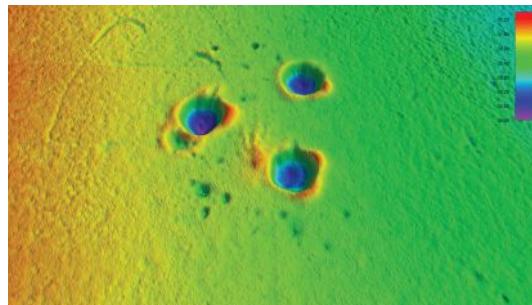
The goal was to assess seabed conditions prior to the emplacement of a drilling rig at three proposed locations (previously drilled) together with reconnaissance survey work at two additional platforms and along a number of proposed cable/pipeline routes. Survey objectives included the following:

- Undertake a Debris Clearance Survey (DCS) at each of the locations.
- Identify and establish areal nature of the previous spud can footprints.
- Establish the nature of the shallow soils, within the top 5 m and to a depth of >20- 25 m.
- Acquire deep CPT data >20 m at two locations.
- Acquire representative data at nominal proposed Relief Well Locations (RWL).
- Reconnaissance of existing platforms and along proposed routes (single lines).

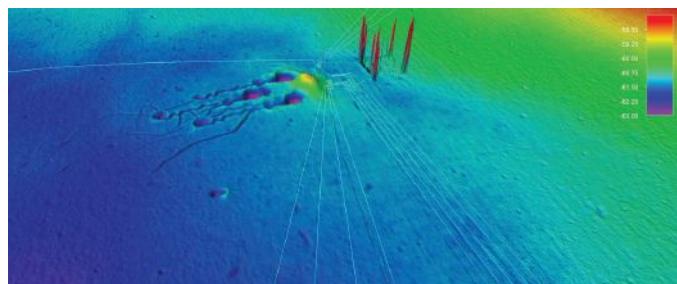
In addition to a site survey, TDI-Brooks completed gCPT measurements at two proposed drill sites. The purpose of the TDI-Brooks Gravity CPT (gCPT) tool is to transport a precisely calibrated memory cone penetrometer down to the seabed

to gather dynamic PCPT cone data from the mud line to 10+ m BML. In addition to its 1,800 lb (800 kg) driving head with lifting bale and trigger, the rig comprises a self-contained PCPT cone penetrometer that measures tip resistance ( $qc$ ), sleeve friction ( $fs$ ), and pore pressure ( $u_2$ ) using standard ASTM dimensions and protocols for its 15-cm<sup>2</sup> cone.

TDI-Brooks provides laboratory analysis on sediment samples via their state-of-the-art laboratory facility in College Station, Texas. Their environmental, geochemical, and geotechnical laboratories all provide high-quality analytical services and scientific interpretation.



» 25 cm cube grid. (Image credit: TDI-Brooks)



» 50 cm cube grid. (Image credit: TDI-Brooks)

## C-KORE TO DELIVER SUBSEA MONITORING TOOLS FOR CHINESE PROJECT



» C-Kore's subsea testing tools are used by operators and installation contractors around the world on both installation campaigns and fault-finding operations. (Photo credit: C-Kore Systems)

C-Kore Systems has recently signed their first contract for delivery of their subsea monitoring tools for a Chinese operation. The C-Kore tools will be used to perform subsea testing on the main umbilical before tying back into the existing structures.

C-Kore's subsea testing tools are used by operators and installation contractors around the world on both installation campaigns and fault-finding operations. The Cable Monitor unit confirms the insulation resistance and continuity of the electrical lines while the Subsea TDR unit localizes anomalies within 20 cm. With C-Kore's automated units and online training, no extra offshore support is needed to run the equipment.

Cynthia Pikaar, Sales and Marketing Manager of C-Kore commented, "We are very happy to be working on this important installation project with our Chinese customer. We have worked hard to ensure our solutions fit the

customer's needs. With our technology being used by operators all over the globe to simplify their subsea testing, we are excited to be expanding into China."

Greg Smith, General Manager of C-Kore commented further, "It is great that our technology is branching out into the Chinese market. We have developed our tools to be easy to use with no offshore engineer required. This is a big advantage in the current market when travel is restricted due to the pandemic. We look forward to the successful deployment."

For further information on C-Kore's innovative subsea testing technology, visit [www.c-kore.com](http://www.c-kore.com).



» Photo of the Towed Dock on the surface. (Photo credit: ISE)

between Dalhousie University and ISE with funding provided by Innovation for Defence Excellence and Security (IDEaS).

The dock provides a platform for an AUV to autonomously latch onto while remaining subsea. Once latched, the AUV can then charge its batteries and download the data for the operators. Then once that is complete, the AUV can unlatch and begin its next mission. This essentially eliminates the risks of launching and recovering during rough sea states as well as greatly reducing the amount of downtime between missions.

The purpose of phase 1b was to develop a prototype and prove the concept in a real-world subsea environment using the ISE Explorer AUV and the new dock prototype. At a distance up to 90 meters, the AUV uses multi-beam sonar to align itself with the dock and navigate towards the target. Once it is within a range of 10 meters, the AUV automatically switches to camera tracking and homes in on the light array on the dock. Over a period of 10 days the dock was put

## ISE COMPLETES PHASE 1B OF AUTONOMOUS AUV DOCKING TESTING

International Submarine Engineering Ltd. (ISE) has successfully completed the second stage in the autonomous dock prototype project. This project is a joint project

through extensive testing in highly turbid water and fully autonomous connections were being made between the AUV and the dock with resounding success.

There are many options for the next stage of this project though the current focus is to include an uncrewed surface vessel to tow the dock with a towed listening array on the AUV as part of the persistent maritime surveillance scope. Adapting the dock to allow for launch and recovery opens a lot of possibilities for the technology in other applications.

The success of this project thus far highlights the experience and expertise ISE has acquired in over four decades of work in the subsea marine industry. ISE will be releasing updates to this project on its website.



» Rendering of the AUV and the Towed Dock. (Image credit: ISE)

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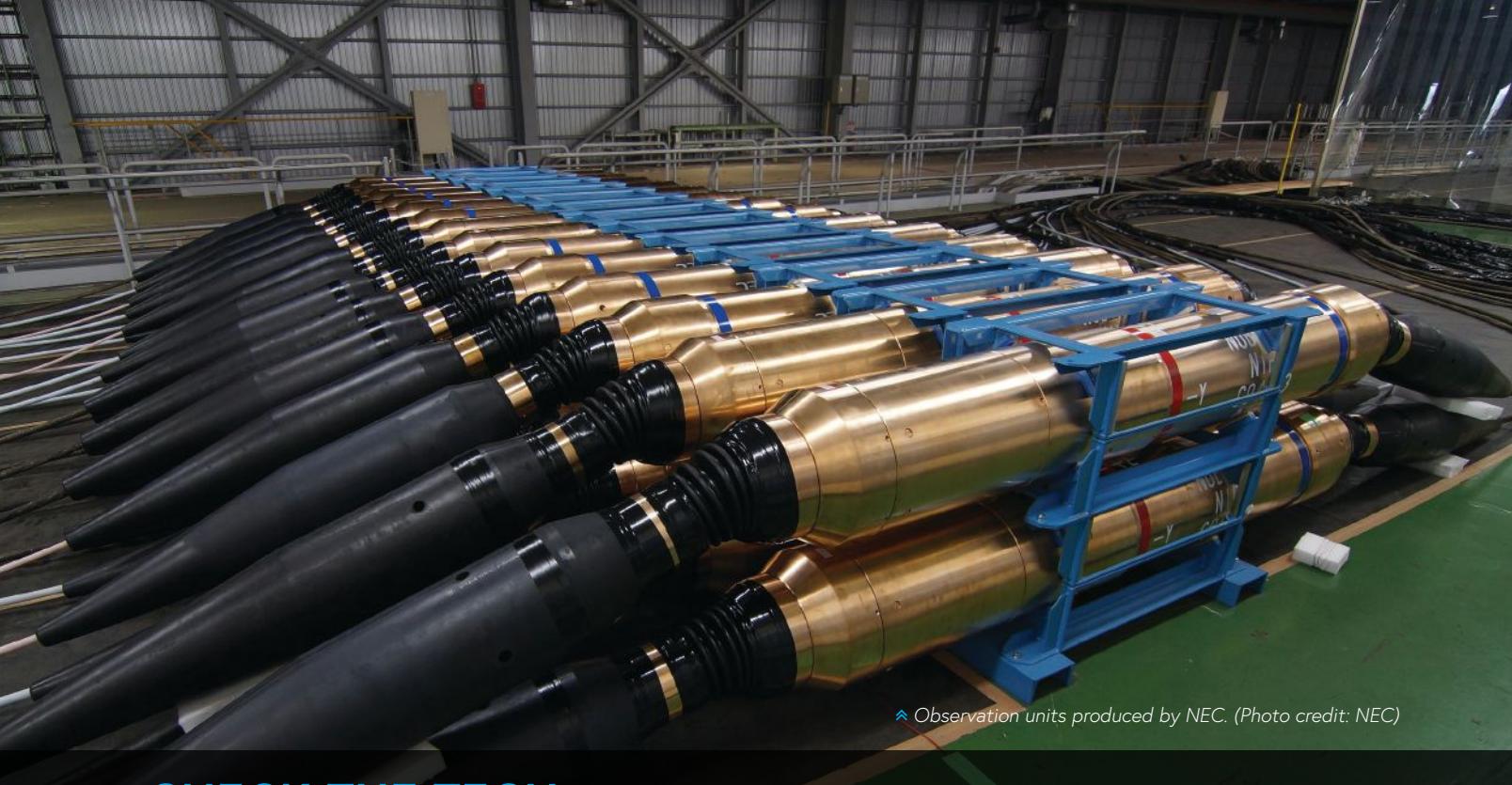
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▲ Observation units produced by NEC. (Photo credit: NEC)

## CHECK THE TECH

# A PRACTICABLE SOLUTION: SUBSEA TSUNAMI WARNING SOLUTIONS

The ability of fiber optic cables to transmit huge quantities of data at incredibly fast rates has transformed the world. In the approximately four decades since their debut, virtually every human activity has been impacted by the speed and capacity of optical fibers. But in some way, we are still only scratching the surface of what optical fibers are really capable of.

One of these applications is the use of optical fibers to collect scientific data about the ocean. There are several different ways to do this, but earthquake and tsunami warning systems are among the more common applications. These use submarine fiber optic cables to connect a series of seismic monitoring units placed on the sea floor. The cables deliver the data collected by these units to shore stations at the speed of light.

Warning systems using cables have several advantages over other types of systems, such as buoys. The transmission speed over fiber optics is higher than that of the satellite links typically used for buoys. Also, buoys require considerable maintenance and can be out of service for some time before they can be repaired.

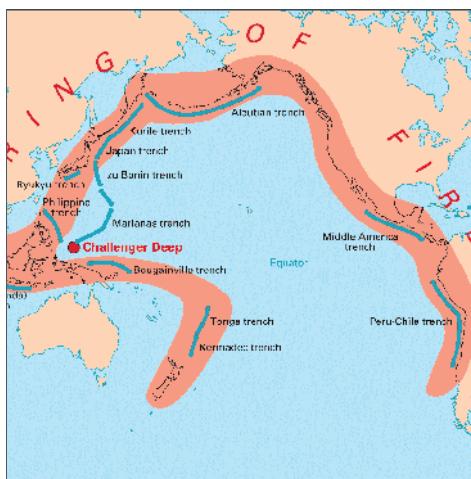
The downside of cabled warning systems is that they are very expensive. The cost of such a system can be US\$ 30,000 or more per kilometer. Funding on that scale is rarely available for a purely scientific project.

This is why many of the relative handful of cabled earthquake and tsunami warning systems are located in the Pacific "Ring of Fire."

These nations have had to deal with devastating tsunamis in the past and have invested large sums of money to attempt to mitigate the human and economic suffering that they cause.

Taiwan is one of the leaders in this field. Its Central Weather Bureau (CWB) has been working to improve the early warning capability for earthquakes and tsunamis off the eastern coast of Taiwan since the establishment of the Marine Cable Hosted Observatory (MACHO) project in 2007.

The CWB has continued to invest in tsunami warning technology and at the end of 2020 unveiled a new cabled seismic and tsunami observation system. Delivered by NEC Corporation, the 620-kilometer-long submarine cable network reaches a depth of 5,800



» The Pacific's "Ring of Fire" is home to the handful of cabled earthquake and tsunami warning systems in service. (Image credit: USGS)

meters and includes optical submarine cables, submarine observation units, and optical submarine repeaters, all manufactured and assembled at NEC factories in Japan.

According to the CWB, when an earthquake occurs in the eastern sea area of Taiwan this new system can provide an emergency warning more than 10 seconds before the actual tremor is felt on land. Moreover, a warning can be issued 20 to 30 minutes before a tsunami reaches the coastal area. As a result, this system will contribute to the enhancement of disaster prevention and mitigation capabilities. For example, public transportation systems, including MRTs (Mass Rapid Transit) and HSRs (High Speed Rail) can quickly decelerate in the event of an earthquake.

CWB is not stopping there. It reported earlier in 2020 that it is in talks with the government of the Philippines on extending its tsunami warning system to the Philippine island of Luzon. This system would be one of the longest (approximately 800 kilometers) and one of the few truly international cabled observatories to date.



» Submarine fiber optic cable landing operation. (Photo credit: NEC)



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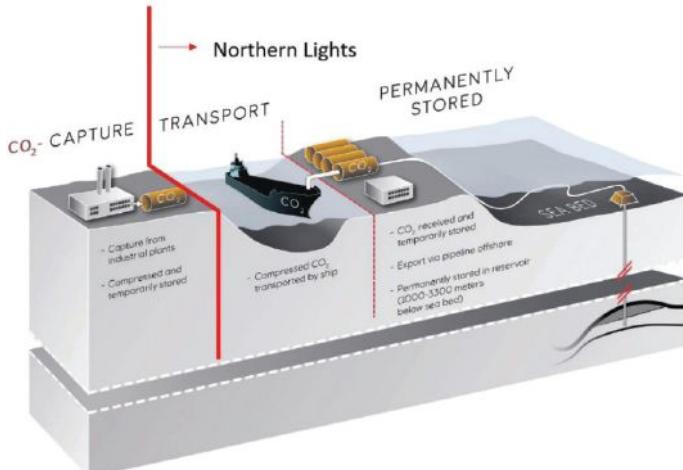
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## ALCATEL TO BUILD A DC/FOTM SUBSEA CONTROL INFRA-STRUCTURE

Equinor and Alcatel Submarine Networks (ASN) have signed a new contract for the roll out of the submarine cable for subsea control infrastructure for the Northern Lights project.

The standalone DC/FOTM, lean cable infrastructure, highly reliable and delivering high-power over long distances, will connect the Oseberg A platform, to the Aurora injection well, first of a series. The system is ready to be further extended, from the same cable, whatever the distance, to connect additional templates as the volume of captured CO<sub>2</sub> will be increased.



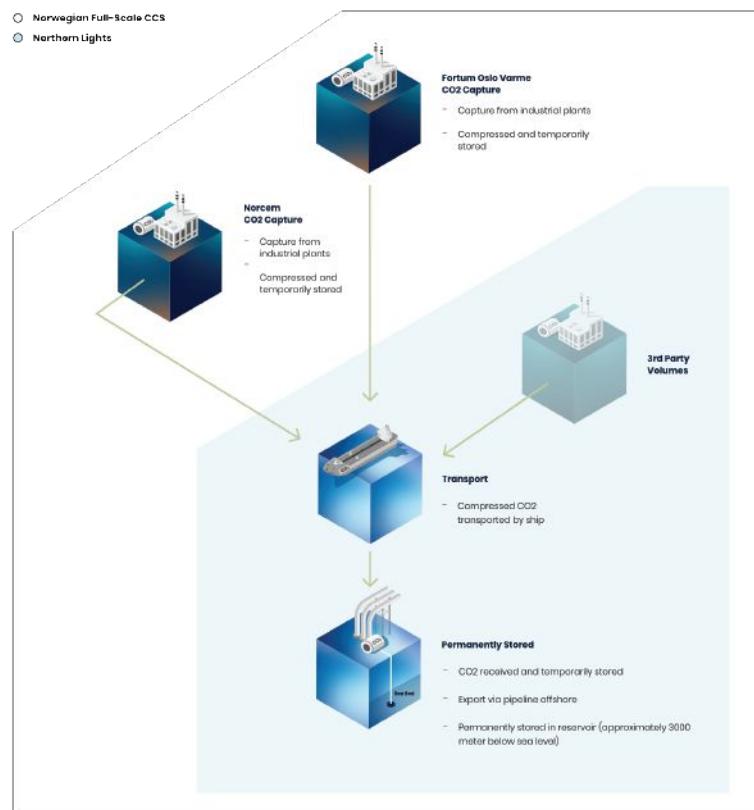
» The DC/FOTM solution to be deployed on Northern Lights. (Image credit: Alcatel)

DC/FOTM solution to be deployed on Northern Lights, is based on standardized products, whatever the project configuration, saving risks, costs and lead time. DC/FOTM, qualified and co-developed with Equinor, is contracted on several Equinor projects.

The Northern Lights project is part of the Norwegian full-scale carbon capture and storage (CCS) project "Langskip (Longship)," supported by the Norwegian government. The project will initially include capture of CO<sub>2</sub> from Norwegian industrial capture sources. The Northern Lights project comprises transportation, receipt and permanent storage of CO<sub>2</sub> in a reservoir in the northern North Sea.

Alain Biston, President of Alcatel Submarine Networks, said: "We are pleased to work in close cooperation with Equinor on DC/FOTM projects, and especially for green applications participating to control climate change. Our innovation capabilities will help Equinor to be a pioneer for the capture of CO<sub>2</sub> in offshore reservoirs. This project gives us the opportunity to leverage submarine network technologies to develop new green subsea applications."

<https://web asn com/en/presse-release/northernlight.html>



» The Northern Lights project is part of the Norwegian full-scale carbon capture and storage (CCS) project. (Image credit: Alcatel)

## XODUS COMPLETES INTER-ARRAY CABLES STUDY FOR EMPIRE WIND

Xodus Group has completed an inter-array cables installation study for Equinor's Empire Wind Phase 1, an 816-megawatt offshore wind project currently under development off New York.

Xodus was tasked with maturing the inter-array cable installation concept to identify technical solutions or installation methodologies that may add value to the project if introduced at an early stage. The company also developed a study for cable

loadout, installation, logistics and the accommodation strategy and provided schedule estimates for installation and testing.

James Hunt, Xodus' Global Interconnector and Cables Lead, said: "Early engagement with the supply chain is crucial in reducing costs and risk in offshore wind projects. We commend Equinor in taking the initiative to engage with us at the formative stage of the project where the cost of change is low, but the ability to influence is high."

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

## TEKMAR TO SUPPLY CPS TO UK, FRENCH OFFSHORE WIND FARMS

Tekmar Energy recently announced a contract award from cable manufacturer Prysmian Group to supply its Generation 10 TekTube® Cable Protection System (CPS) for the Neart na Gaoithe (NnG) offshore wind farm in the UK.

The 450 MW NnG project, jointly owned by EDF Renewables and ESB, is located in the Firth of Forth, Scotland. Once complete the project has the potential to generate enough renewable energy to supply power to around 375,000 Scottish homes.

The latest generation of Tekmar Energy's TekTube® CPS will protect NnG's subsea export cables as they transition from the seabed through the dynamic zone. The systems will be delivered in 2021 from the companies state-of-the-art manufacturing facility in the North East of England, where significant investment has been made to ready the facility for Generation 10 production, which commenced at the beginning of this year.

Russell Edmondson, Managing Director at Tekmar Energy, said, "We are delighted that Prysmian Group has selected our latest advancement in CPS technology for deployment on NnG. The award reflects the offshore markets continued confidence in our industry-leading cable protection solutions and is a testament to our teams' commitment to continual product development."

Since their launch in 2007 and 2013 respectively, Tekmar Energy has delivered over 8,800 TekLink® and TekTube® cable protection systems, installed on over 90 offshore wind projects worldwide, protecting over 30 GW of subsea infrastructure.

Generation 10 brings together the latest advancements of these systems which are now cross-compatible and highly configurable to meet future project demands, including bigger turbines, larger cables, new climatic conditions, latest installation techniques, and utilising improved cable data.

In addition and following an award for the array cable scope in 2020, Tekmar Energy announced that Prysmian Group has selected its Generation 10 Cable Protection System (CPS) to protect export cables on the Saint-Nazaire offshore wind farm, meaning the project's entire subsea cable system will be protected with Tekmar Energy's patented CPS technology.

Saint-Nazaire is a 480 MW offshore wind farm located off France's Atlantic Coast and owned by EDF Renewables and Enbridge. It is the



» The latest generation of Tekmar Energy's TekTube® CPS will protect NnG's subsea export cables. (Photo credit: Tekmar)



» Tekmar Energy has delivered over 8,800 TekLink® and TekTube® cable protection systems, installed on over 90 offshore wind projects worldwide. (Photo credit: Tekmar)

first commercial-scale wind farm installed in French waters.

Russell Edmondson, Managing Director at Tekmar Energy, said, "We are delighted that our industry-leading cable protection systems have been chosen to protect both array and export cables on Saint-Nazaire offshore wind farm, a project characterized by a challenging seabed that demands a robust and dependable cable protection solution."

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# TENNET SCALING UP TRANSMISSION CAPACITY STANDARD

Offshore wind plays a crucial role in the energy transition. In a growing trend towards more sustainable energy, TenneT is preparing for the new EU climate targets.

Europe has recently decided to reduce its carbon footprint by 55% instead of 40% by 2030 compared to 1992. The goal of reaching a fully climate-neutral Europe by 2050 will require innovative and cost efficient standards in the energy system. The North Sea region with its offshore wind potential will undoubtedly become the new powerhouse of North-West Europe and forge new cooperation between neighboring countries.

The future will see an internationally coordinated rollout of Hub-and-Spoke projects: combining wind power connection, coupling of energy markets through interconnection and smart integration into the main onshore grids. Driving progress on this North Sea vision, in 2020 TenneT announced a cooperation agreement to explore the feasibility of connecting Dutch and British wind farms to the energy systems of both countries via a WindConnector.

In order to be able to connect more powerful offshore wind farms and thus bring more energy onshore, TenneT pooled and further developed the best experience from the German 900 MW HVDC and Dutch 700 MW AC grid connection systems. The result is a new approach of connecting future grid connections with a transmission capacity of 2 Gigawatt (GW) by using 525 Kilovolt (kV) HVDC systems.

Tim Meyerjürgens, COO of TenneT, said: "Only a massive expansion of offshore wind energy will enable Europe to reach the Paris climate goals, which foresee climate neutrality by 2050. TenneT has many years of expertise in offshore grid connections and implements innovative and economical solutions. With the new future 525 kV HVDC system with a transmission capacity of 2 GW, we are defining the new global benchmark to achieve these goals."

Since cooperation is crucial in the energy transition, TenneT together with market parties started developing a research and development (R&D) initiative for a 2 GW, 525 kV HVDC grid connection system. With a design and layout study for the offshore platform a generic platform was designed, to enable interoperability of the proprietary solutions offered by all HVDC suppliers participating in the R&D phase. The intensive interaction between TenneT and the market parties involved has resulted in providing insights on the required functionality and performance of the innovative HVDC system. Development and testing of the 525 kV DC subsea cable system will be carried on by multiple cable manufacturers. The certification is due to be received in the course of 2022.

In the light of this process and the new standard, TenneT is announcing tenders for at least five offshore grid connections in the Netherlands and Germany. The tenders for the first projects with a 2 GW connection will start in March 2021 in country specific clusters. The first tender will cover at

least two projects in the IJmuiden Ver wind area in the Netherlands to be in operation in 2028 and 2029. In Germany the first projects will be BalWin1 (in operation in 2029) and BalWin2 and BalWin3 (in operation in 2030). With these five innovative grid connection projects and the other projects already in development, TenneT will increase its transmission capacity from 8.5 GW now to approximately 26.3 GW in 2030. This is the equivalent of annual electricity consumption of nearly 33 million German and Dutch households.

The new standard aims to further reduce the costs of offshore wind to minimize the spatial and environmental impact. The new 2GW standard will more than double the capacity in comparison with the previous 900 MW HVDC standard. It will prepare TenneT for the planned acceleration of offshore wind deployment in Germany and the Netherlands. The new transmission standard supports the vision towards larger offshore wind farms and a North Sea wide Hub-and-Spoke system, combining wind power connection, coupling of energy markets through interconnection and smart integration into the main onshore grids. As part of this development, the Dutch IJmuiden Ver projects will be ready to connect a future multi-purpose interconnector (WindConnector) to the UK.

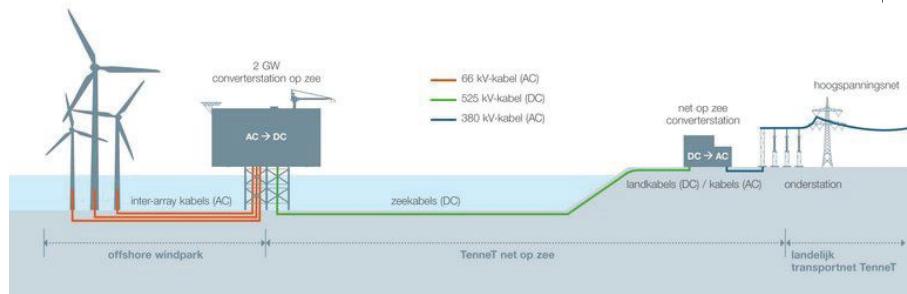
After an extensive evaluation of possible scenarios for the contracting strategy, the scope of the contract will be divided into three parts for the main scope of work:

- Offshore platform (topside and jacket), together with HVDC offshore and onshore converter including HVDC system responsibility
- Construction works, building and building services for the onshore station
- 525 kV HVDC cable supply and installation offshore and nearshore
- The onshore cable installation contracting strategy will be decided at a later stage



» 2 GW, 525 kV HVDC grid connection system. (Image credit: TenneT)

For more information, visit:  
[WWW.TENNET.EU](http://WWW.TENNET.EU)



» TenneT is announcing tenders for at least five offshore grid connections in the Netherlands and Germany. (Image credit: TenneT)

## NEXANS WINS FURTHER CONTRACT FOR AMAZON CABLES



» *Nexans has been involved from the start of the Amazônia Conectada project in 2015. (Image credit: Nexans)*

Nexans Submarine Telecom and Special Cables (STSC) business continues to develop its customer relationship with the Programa Amazônia Conectada (PAC) to bring high-speed data connectivity to a remote and environmentally sensitive region of Brazil.

The project involves laying fiber-optic cables on the riverbeds of the Amazon Basin.

In 2020, 470 km of submarine cables were delivered, taking the total length installed so far to 1,170 km. This has now been followed by an order for a further 620 km of cable, scheduled for delivery in 2021. The project is just one example of the growing momentum

that enabled Nexans STSC to build a record backlog of orders by the end of 2020.

The Amazônia Conectada project is a strategic initiative developed by the Brazilian Army, with the support of the country's Ministries of Defense, Health, Education and Communication. The overall plan is to install approximately 6,000 km of sub-fluvial fiber-optic cables in rivers of the Amazonas region to provide efficient and reliable internet connection. This will bring connectivity to more than 50 cities and 4.5 million people, providing opportunities for improving public health, education and supporting sustainable development.

Nexans has been involved from the start of the Amazônia Conectada project in 2015. It has supplied un-repeatered submarine fiber optic cables (URC-1) with 100 GB/sec data transmission capacity for the four phases completed to date. When delivered in 2021, the latest order will take the total length of cable supplied to 1,790 km, providing a perfect example of Nexans's commitment to leading the charge for a brighter future that is more connected, accessible, safe and sustainable.

Because the project is taking place in the environmentally sensitive rainforest area, environmental factors are of critical importance. This is why the cables are being laid on the riverbeds rather than being installed on aerial towers that would need trees to be felled. The Nexans cables are designed to provide the latest communications technology with no need for maintenance. Crucially, tests carried out by the Brazilian authorities prior to approval confirmed that the URC-1 cables would not emit a single particle of pollutant into the river.

General Decílio de Medeiros, Deputy Chief of the Science and Technology Department of the Brazilian Army, said: "This flagship project is bringing digital inclusivity that will benefit the less favored populations of the Amazon region and those who live far from urban centers. It is very demanding technically and we welcome the support of Nexans in delivering advanced and highly-reliable fiber-optic cables. We were particularly impressed that Nexans ensured

smooth delivery throughout the COVID-19 pandemic, overcoming travel and sanitary restrictions through innovative procedures such as virtual testing, online training and live video transmission."

The latest order for the Amazônia Conectada project is just one of many won by Nexans STSC as it ended 2020 with a record order backlog. The main contracts are for customers worldwide in South America, Asia-Pacific, Africa and Europe. They cover STSC's complete diversified submarine product portfolio covering control umbilicals and Remote Operated Vehicle cables (ROVs), to the energy industry and fiber-optic cables for the offshore telecom industry.

All the cables will be manufactured at STSC's plant in Rognan, Norway, with project execution and engineering split between the plant and the Norwegian office in Oslo.

Krister Granlie, Vice President of Nexans STSC Business Unit, said: "Nexans has a long track record in submarine fiber-optic projects dating back to 1986, with over 54,000 km of cables installed and in operation worldwide. We are very proud that our recent momentum has enabled us to achieve a record backlog of orders. The key to this success is exemplified in the Amazon project – products that are technically excellent supported by a relentless focus on customer service and delivery."

For more information, visit:  
[WWW.NEXANS.COM](http://WWW.NEXANS.COM)

## PHILLY SHIPYARD CONTRACTED FOR NAVY CABLE SHIP DESIGN STUDY

Philly Shipyard, Inc. has been awarded a contract to participate in an industry study for the development and design of the U.S. Navy Cable Ship T-ARC(X) Program—a replacement for the Navy's only undersea cable installation and repair ship, USNS ZEUS (T-ARC 7).

The ship's primary mission will be to transport, install, retrieve, and repair undersea cables and equipment, with many additional

capabilities including ocean surveys and deployment of unmanned underwater vehicles (UUVs).

In accordance with U.S. Navy specifications, Philly Shipyard will perform capability and cost trade studies in key areas, investigate options to maximize affordability and producibility, and develop concept designs. The industry studies—the precursor for the future detail design and construction (DD&C) contract—will take approximately 12 months. A request for quotation for the DD&C contract is anticipated upon completion of the industry studies.

Per the contract stipulations, Philly Shipyard has selected VARD Electro, MAATS, and Noise Control Engineering, LLC as consultants on the project. [www.phillyshipyard.com](http://www.phillyshipyard.com)

# UNMANNED VEHICLES HELP SCIENTISTS REVEAL SHIFTS IN THE ARCTIC DURING ICEX 2020



By **Capt. Edward Lundquist,**  
U.S. Navy (Ret.)

The U.S. Navy and its NATO allies have long viewed the Arctic as a potential battlefield, especially for nuclear powered submarines that can safely and covertly maneuver under the ice for extended periods of time. Operating friendly submarines, and looking for enemy submarines, requires a foundational knowledge of the environment and how the dynamics work.

The Cold War ended, and the need to operate in the far north lessened. As scientists return to once again measure the ice, atmosphere and

ocean, they have been startled to find that the knowledge they had collected and analyzed in the past was no longer indicative of the Arctic of today.

"The environment is changing for anyone using underwater sound, whether it's for navigation, communications, sensing marine mammals, it's dramatically changing the way we can do things," according to Prof. Henrik Schmidt of MIT. "That's one reason why scientists and navies are interested again."

## U.S. NAVY'S ICEX 2020

One way to gather data and build experience in the region is the U.S. Navy's biennial ICEX (Ice Exercise), which provides a unique opportunity for the military, academia, industry, partner nations, and other agencies and organizations to collect meteorological and oceanographic data on, above and under the Arctic Ocean. A major feature of ICEX is the building of a temporary camp on the ice, which is usually visited by one or more submarines. ICEX 2020 included a series of experiments that have been built upon previous testing, which involves the precise navigation of underwater vehicles operating under the ice.

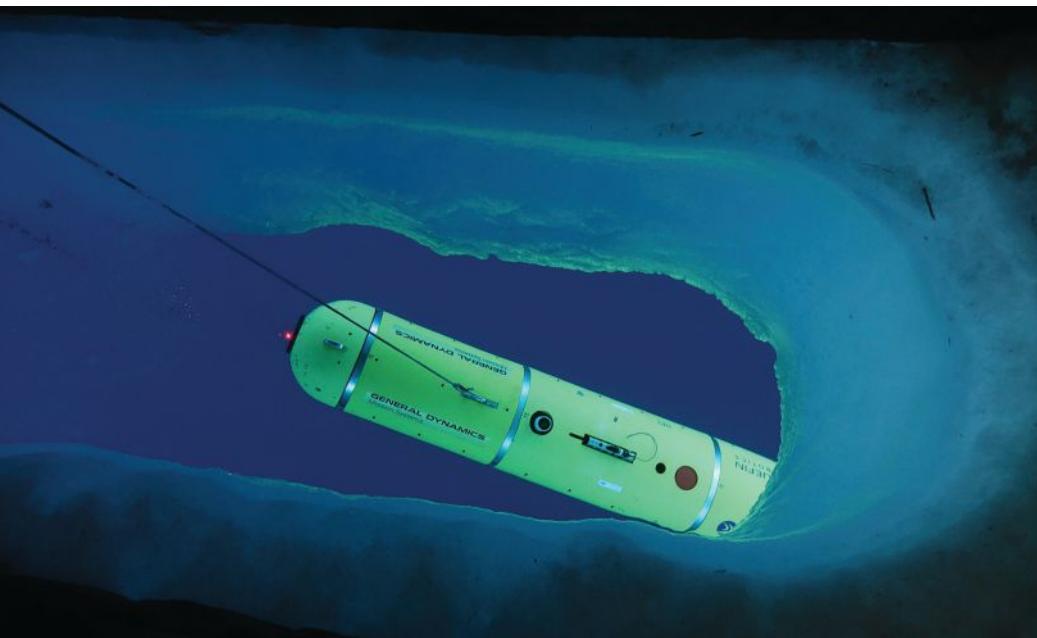
Among the important tools for underwater sensing, construction and warfighting are Unmanned Underwater Vehicles (UUVs), which can conduct missions that are impractical otherwise. Some of the data cannot be gathered any other way and is critical to better understanding the long-term environmental changes in the air, ice coverage, and throughout the entire water column.

That's why researchers from the Laboratory for Autonomous Marine Sensing Systems (LAMSS) at the Massachusetts Institute of Technology (MIT), the Navy's Arctic Submarine Laboratory (ASL), Unmanned Undersea Vehicle Squadron One (UUVRON-1), and General Dynamics Mission Systems (GDMS) Bluefin Robotics brought MIT's Macrura UUV to ICEX 2020 to refine navigation capability and improve situational awareness to better understand the Arctic undersea environment, and how it is different from the 1990s.

"Some of the data collected and reported by autonomous systems cannot be gathered any other way, and it helps us better understand the long-term environmental changes in the air, ice coverage, and throughout the entire water column," said Schmidt.

Today, the water temperature at different depths has changed, so the sound propagation profiles are different, too. What was formerly solid ice is now much more dynamic. One of the limitations in the high north is the lack of land-based communications or satellite coverage.

Most UUV operations occur in open water, with direct communications by means of acoustics or surfacing and transmitting over a data link to the host platform or satellite. GPS provides precise position update, so the vehicle knows where it has been, so that it can mark a precise location for anything it has found. But when



» A Bluefin Robotics-built MACRURA UUV deployed in the Arctic. (Photo credit: MIT, General Dynamics)



» BEAUFORT SEA, Arctic Circle, March 7, 2020: The crew of the Seawolf-class fast-attack submarine, USS Connecticut (SSN 22), enjoys ice liberty after surfacing in the Arctic Circle during Ice Exercise (ICEX) 2020. (Photo credit: U.S. Navy, by Mass Communication Specialist 1st Class Michael B. Zingaro/Released)

operating under the ice, getting a GPS update is problematic.

The precise position is important not only so the vehicle can return after a mission, but so that anything it has detected or observed can be reported with an accurate fixed location to provide appropriate context.

#### UUVS IN THE FIELD

The team developed an experiment involving an integrated communication and navigation-aiding framework known as ICEX tracking range—or *icex-tracker*. The experiment used a network of surface buoys equipped with small acoustic modems suspended beneath the ice which were linked by radio communications to the ICEX Camp Seadragon base camp. Submarines coming to the surface next to the camp used the buoys for positioning.

As a crewmember aboard *USS Connecticut*, Lieut. Cmdr. Dan Goodwin went up to the Arctic for ICEX 2018. A year later, he was selected for a graduate program jointly run by MIT and WHOI program in 2019, where he became part of Schmidt's ICEX team, and found himself back in the Arctic and running experiments from Camp Seadragon.



» The aurora borealis over Ice Camp Seadragon during Ice Exercise (ICEX) 2020. ICEX 2020 is a biennial submarine exercise which promotes interoperability between allies and partners to maintain operational readiness and regional stability, while improving capabilities to operate in the Arctic environment. (U.S. Navy MC1 Michael B. Zingaro)

"Our submarines use inertial navigation systems, so they know where they are when submerged. But subs need to get periodic updates, such as a GPS fix from a satellite. The same applies to UUVs," Goodwin said.

Based on GPS satellite orbital inclinations, the 2020 Camp Seadragon was not so far north so as to completely lose GPS, but the GPS satellites don't pass overhead above the Arctic Circle, so a fix is dependent on fewer satellites than normal.

"INS is very good at speed, heading, and pitch and roll, but sometimes you need something else to give a more precise location. For our unmanned vehicles, we normally use a Doppler Velocity Log (DVR) for measuring speed over ground, but the sea floor is still far away in most cases up in the Arctic unless you're really close to the coast, so that was not an option. We reversed the DVR so it was pointing up to measure speed under the ice above. However, the ice is not fixed—it's moving, too. The ice may only be moving at a knot—while the vehicle is operating at 3 or 4 knots—but that is not insignificant compared to the speed of the vehicle. There are currents, too, that may or may not be moving in the same direction as the ice. So, eventually we have some drift in the location of the vehicle."

To help submarines safely surface next to the camp, a pattern of tethered communications modems is suspended under the ice.

"For ICEX 2020, our science team experimented with MIT's *Macrura*, which is a General Dynamics Missions System Bluefin 21 UUV—to navigate precisely while conducting a submerged mission," Goodwin said. "We used four buoys about 2,000 meters apart, the same buoys that the submarines used, with micro modems at both 30- and 100-meters depths to compensate for the temperature and salinity differences in the water that affect acoustic propagation. This allowed the UUV to adaptively switch between modems depending on the depth of the vehicle to ensure the most coherent acoustic communication. The travel time of those signals provided acoustic aided navigation for the UUV. The system was also able to compensate for currents, which can vary in direction and intensity at different depths."

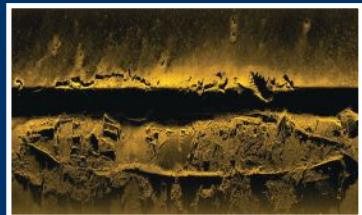
"The quality of science conducted at ICEX is pretty revolutionary," said Goodwin. "We were able to demonstrate under-ice navigation to near-GPS quality. The *Macrura* vehicle knew where it was, and we knew where it was. When we had an issue, we were able to go directly to where it was, cut a hole in the ice, and extract the vehicle."



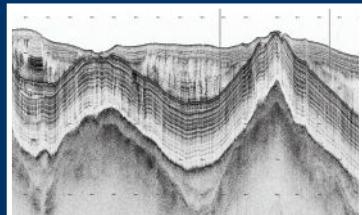
## Clearly Superior Imaging

# SONAR SYSTEMS

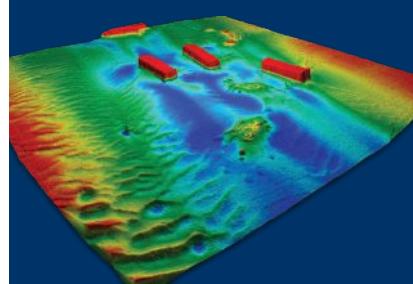
### SIDE SCAN SONARS



### SUB-BOTTOM PROFILERS



### BATHYMETRY SYSTEMS

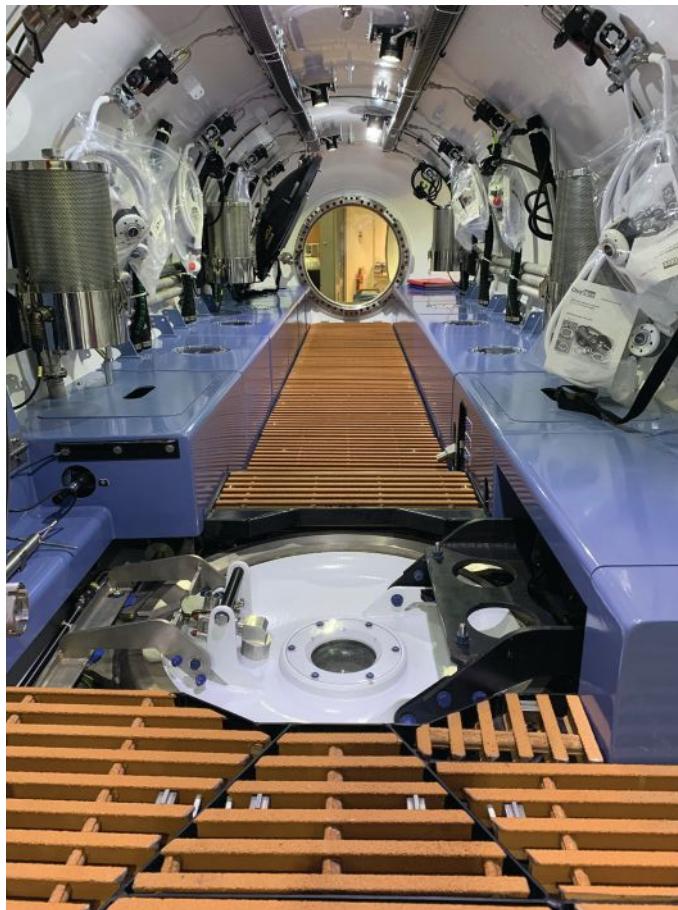


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» Forum's latest LR-class SRV has successfully completed harbor trials.  
(Photo credit: Forum)



» The LR-Class SRV rescue chamber and rescue hatch.  
(Photo credit: Forum)

## FORUM MANUFACTURES TECHNOLOGICALLY ADVANCED SUBMARINE RESCUE VEHICLE

Forum Energy Technologies has completed manufacturing of a highly advanced submarine rescue vehicle (SRV) including cutting edge technologies, which may be utilized to extract submariners from distress situations.

Forum's latest SRV joins a small group of rescue systems in use around the globe. The LR-class SRV, however, surpasses systems manufactured by other suppliers over the last decade, including the NSRS (NATO Submarine Rescue System) and the 'LR7', which was delivered to China.

The LR-class SRV is built to meet the most up-to-date industry standards and classed by Lloyds Register. It is capable of rescuing up to 17 people at a time and operate at depths of up to 600 m. The new model has increased power and an advanced auxiliary thruster control system that allows for speeds of up to four knots, enabling it to operate in high currents. The vehicle is able to attach to submarines at highly precarious angles, above 40 degrees.

The state-of-the-art submersible vehicle also has some of the most advanced sensors and sonars to locate a distressed submarine as quickly as possible. This includes a doppler velocity log, fiber optic gyroscope, sonar and depth sensing. All sensors and sonar systems are fully embedded into Forum's software to deliver advanced functionality, including auto depth, auto heading and autopilot. The latter function utilizes an electric propulsor pivot mechanism and is unique to the company's LR-class SRV.

The LR-Class SRV is divided into two sections, a command module for pilots and a rescue chamber for the submarine crew. The rescue chamber can be pressurized as necessary to ensure rescued crew are decompressed to prevent decompression sickness (the bends). Once at surface, the vessel latches to a decompression chamber where crew are safely transferred.

Kevin Taylor, Forum's Vice President - Subsea Vehicles, commented: "When a navy submarine runs into trouble and sends out an urgent SOS, the rescue mission quickly becomes a time critical military operation to save those on board and prevent worsening health conditions, including decompression sickness (the bends) or fatalities. The SRV must therefore be highly reliable."

"We have pioneered the development of manned submersibles since 1975 and have supported military organizations and naval forces all around the globe. The completion of the SRV is a huge achievement for the business and testament to our highly experienced engineering, QHSE, purchasing, planning and production teams. I would like to commend these groups for their hard work to realize our vision for the future of specialized submarine rescue vehicles."

The first of the latest LR-class SRV is being packaged and shipped to its final destination later this month (January) before undergoing final sea trials with the client during Q1 2021.

## GREENSEA RECEIVES U.S. NAVY FUNDING TO ADVANCE STAND-OFF COMMAND AND CONTROL

Greensea Systems, Inc. creator of OPENSEA®, the open architecture robotics platform for the marine industry, recently announced the award of a Phase II Small Business Innovation Research (SBIR) ASAP grant totaling \$1,100,000, with option for additional funding, for the continued development of Standoff Command and Control of Remotely Operated Vehicles (ROVs). This project has been funded in whole or in part with Federal funds from the Naval Air Warfare Center Aircraft Division, under Contract No. N6833521C0113.

The Phase II award will further the development of Greensea's long range standoff command and control system for ROVs towards providing the U.S. Navy a capability of conducting water-borne Explosive Ordnance Disposal operations with marine robotics from a safe standoff distance. The standoff



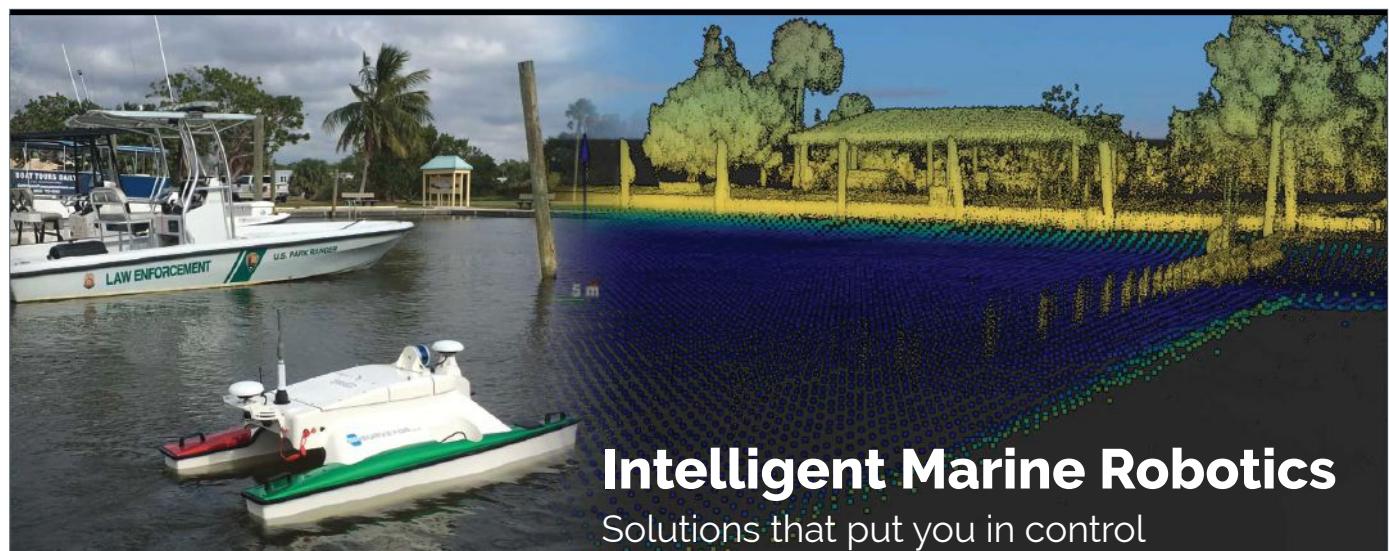
» Greensea's open architecture technology on ROVs furthered by Small Business Innovation Research. (Photo credit: Greensea)

system is hardware, transmission, and vehicle agnostic and provides high levels of autonomy for the ROV as well as the coordination of launch and recovery, vehicle tether, and host USV platform. Greensea's long range standoff system leverages almost 15 years of developing supervised autonomy systems for ROVs and by virtue of being built on OPENSEA, is entirely open architecture. Commercial applications of this technology include operating highly integrated ROVs and robotic systems from Unmanned Surface Vessels by operators located anywhere in the world.

Ben Kinnaman, CEO of Greensea, is the Principal Investigator of this Phase II SBIR award. "The long range standoff command and control of ROVs is the single best solution to keep the warfighter safe by getting them as far as possible from a subsea threat,"

stated Kinnaman. Peter Kerson, Program Manager for EOD Technologies at Greensea, added, "standoff command and control will dramatically increase flexibility and maneuverability of maritime expeditionary EOD forces, and that same flexibility will be invaluable to industry users who want to centralize ROV operations, reduce personnel who have to go to sea, and migrate to fully unmanned offshore services."

While the technology is being developed for the military, Greensea is working with leading marine industry companies on commercialized variants of the technology. Greensea's technology will directly address the shortage of offshore personnel for ROV operations including near-term shortages associated with the COVID pandemic.



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» Marine Corps Long Range USV.  
(Image credit: Metal Shark)



## METAL SHARK DEVELOPING AUTONOMOUS NAVAL DEFENSE SYSTEM FOR U.S. MARINE CORPS

Louisiana-based shipbuilder Metal Shark has been selected to develop and implement the Long Range Unmanned Surface Vessel (LRUSV) System for the United States Marine Corps.

The LRUSV System will usher in a new era of naval technology while increasing the lethality of U.S. forces, with a network of unmanned vessels traveling autonomously for extended ranges and transporting loitering munitions to address targets at sea and on land.

This tiered, scalable weapons system will provide the ability to accurately track and destroy targets at range throughout the battle space. While fully autonomous, the vessels may be optionally manned and they will carry multiple payloads, which they will be capable of autonomously launching and retrieving.

Metal Shark has enlisted autonomous technology developer Spatial Integrated Systems (SIS), recently acquired by Huntington Ingalls Industries, to provide the autonomy solution for the LRUSV system. SIS is a leader in the development of multi-vessel collaborative "swarming" autonomous capabilities, sensor fusion and perception.

Under an "Other Transaction Authority" (OTA) Agreement with Marine Corps Systems Command, Metal Shark will design, build, test, and implement the vessels and will handle the integration of the autonomy system and an advanced Command and Control (C2) software suite.

In addition to the autonomous LRUSV, Metal Shark will also produce manned support vessels for the LRUSV system utilizing its 40 Defiant military patrol craft platform, which the builder is currently producing to create the U.S. Navy's new "40 PB" patrol boat fleet.

"The LRUSV program represents a significant milestone for autonomous technology, for the defense world, and for the entire shipbuilding industry," said Metal Shark CEO Chris Allard. "We are thrilled to be integrating advanced autonomy and Command and Control capability into these highly specialized surface vessels to provide the Marine Corps with a next-generation system."

Under the OTA, Metal Shark will also provide the Marine Corps with associated program management, system engineering, configuration management, quality assurance, logistical support, and the development of technical publications and manuals in support of the LRUSV program.

The LRUSV program is the latest success for Metal Shark's Sharktech Autonomous Vessels division, a wholly-owned subsidiary launched in 2018 and specifically focused on the advancement of unmanned vessel technology. In September, it was announced that the United States Coast Guard had selected a 29-foot Sharktech autonomous test vessel equipped with autonomy by Boston-based technology developer Sea Machines for evaluation by the USCG Research and Development Center. In 2019, Metal Shark was selected by US Navy PMS 406 (Naval Sea Systems Command's Unmanned Maritime Systems division) for the Unmanned Family of Systems Multi Award IDIQ, a blanket Navy contract covering multiple topics in the autonomous space. As a brand-agnostic technology integrator actively engaged with multiple developers in the unmanned space, Metal Shark's Sharktech division has also produced and delivered autonomous vessels equipped with autonomy solutions from L3 Harris (previously ASV Global).

"Metal Shark has designed, built, and delivered over 400 autonomous and remotely operated vessels to date," said Mr. Allard. "As we develop and deploy the LRUSV system for the Marine Corps, we will continue to work with clients across government and commercial markets, integrating the systems of multiple technology partners into our boats, solidifying our leadership position in the autonomous vessel space, and streamlining the path to autonomy."



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## BY 3-1, GROUNDHOGS PREDICT EARLY SPRING—DO COMMODITY MARKETS CARE?

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

### CRUDE OIL:

What a strange winter. Some regions have been buried under snow, while others barely received a dusting. The Polar Vortex, which was anticipated to swamp North America with bitter cold temperatures, barely delivered more than a few cold days—so far. To top things off for energy, we now have multiple groundhogs giving weather forecasts. Punxsutawney Phil and others offer views on what weather may be over the final six weeks of winter. By a 3-1 majority, Phil's wintery prediction was overruled.

With an early spring on the way, weakening heating demand weighed on oil's use at the same time global economic activity is being shut down in response to recurring outbreaks of coronavirus. The oil supply and demand struggle rages on, with hopes for a surge in economic activity as virus cases and hospitalizations retreat and vaccinations increase battling the trends depressing oil demand. Vaccines are the ticket for a return to a "normal" world—whatever normal means.

Saudi Arabia's move to cut a million barrels a day of supply in the new year to help balance the global oil market lifted WTI above \$50 a barrel. Growing optimism for an economic recovery in 2H2021 and increased government stimulus spending is driving the price above \$55—the highest it has been in over a year. Oil company executives are telling investors they will continue to limit their spending. No more growth for growth's sake. Sustaining production, reducing debt, and returning excess cash to shareholders remain their goals for 2021.

Although the drilling rig count has risen every week for the past two months, few people see oil supply growing. In fact, Joe Biden's presidency has produced a major anti-oil and gas agenda. Blocking construction of the Keystone XL pipeline,

stopping new drilling permit issuances, and suspending leasing on federal acreage will slow oil's recovery, and likely boost U.S. oil imports. Assuming economic activity recovers, oil prices will rise, inflicting financial burdens on Americans, especially those in lower income groups.

Market technicians expect oil prices to rise further. That is a risky bet. Maybe \$50 will become a new price floor, however, the global oil supply is growing, while demand is capped both seasonally and due to economic shutdowns. Those are not conditions for rising oil prices. However, maybe a new commodity super-cycle has begun. Near-term prices will reflect the battle between optimism and reality. We cannot predict a winner, yet.

### NATURAL GAS:

A disappointing natural gas withdrawal season so far, due to a warmer than normal winter, may be poised to change. Colder temperatures are projected for the next several weeks, which should strengthen natural gas prices. Whether the cold will be as sweeping as forecast remains to be seen. With gas supply not dropping as projected last summer, the supply/demand balance struggle will tug gas prices up and down daily based on weather reports.

Last summer's optimism for falling gas supply and rising demand that had sent futures prices above \$3 per thousand cubic feet has disappeared. The optimism was crushed as global gas demand collapsed resulting in the cancellation of numerous shipments of liquefied natural gas. Those cancelled shipments went into storage, depressing gas prices.

Climbing oil prices are driving the drilling rig count upward, signaling more associated natural gas supply is on the horizon. As a result, longer-term natural gas futures prices remained largely capped below \$3. Examining the forward gas futures price curve shows that only during the 2021-

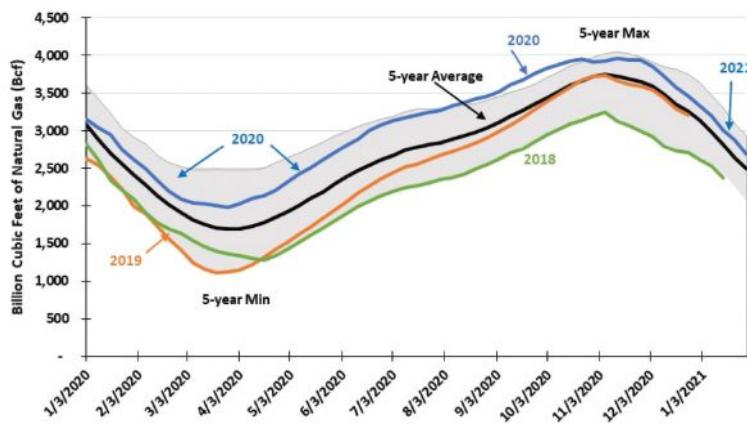
2022 winter months do gas futures prices breach the \$3 mark. This reflects traders' and producers' views that gas supply will continue to be adequate for meeting the needs of the domestic gas market, as well as satisfying growing LNG export demand.

Recent weekly gas storage withdrawals are falling within the market's expectation. Therefore, gas prices are not moving much in either direction. They are influenced more by the outlook for weather, and the most recent forecasts are helping lift spot prices. As of the end of January, gas storage is still above both the prior year and five-year average levels.

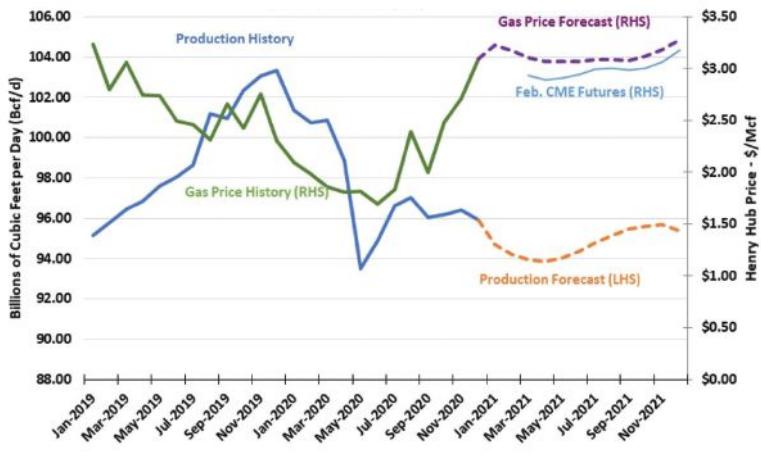
Besides concern over the absence of bitter cold temperatures across the nation, the Biden administration's push of an anti-oil and gas policy agenda is seen as limiting the long-term growth prospects for natural gas, while ignoring the role this cleaner fuel has played, and can continue to play, in reducing United States carbon emissions. The new administration's policy is clearly a sop to the left-wing of the Democrat Party, which continues to push for a Green New Deal. Although espousing that it does not embrace the GND, the Biden administration holds to a view about the nation's energy future that is likely to be unraveled by the reality that renewable fuels remain more expensive and produce less energy per unit than oil and gas. Until politicians and bureaucrats come face-to-face with this reality, the fossil fuel industry will be constantly pressured to 'go out of business.'

Natural gas prices will only begin a sustainable rise when the market becomes convinced that gas supply is inexorably in decline with demand remaining healthy. These market dynamics are not ones seen on the evening weather forecast.

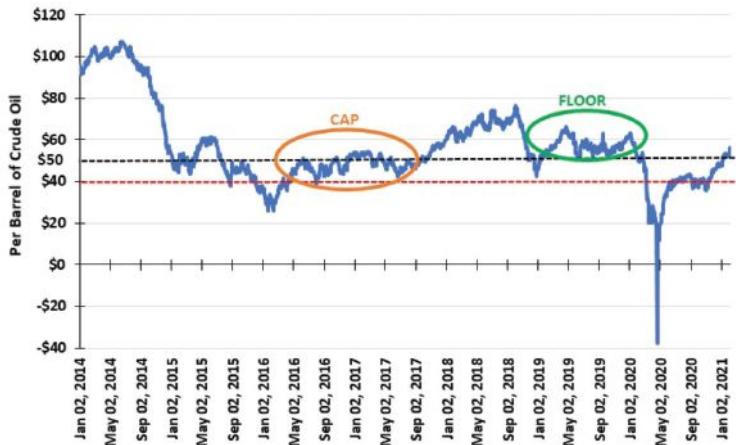
## Gas Storage Remains High Keeping Gas Prices Capped



## EIA STEO Natural Gas Production And Forecast (December 2020 Report)



## Moving Forward: Will \$50 Become Cap or New Floor?





## AMERICAS

### GIPEX

Virtual » April 6-8  
[www.guyanaoilexpo.com](http://www.guyanaoilexpo.com)

### US Offshore Wind

Virtual » May 26-27  
[www.reutersevents.com/events/offshore-wind](http://www.reutersevents.com/events/offshore-wind)

### SIPEX

Virtual » June 1-3  
<https://surinameoilexpo.com>

### International Telecoms Week

Washington D.C. » June 1-4  
[www.internationaltelecomsweek.com](http://www.internationaltelecomsweek.com)

### H2O Conference

Virtual » June 7-10  
[www.h2oconference.ca](http://www.h2oconference.ca)

### Int'l Conference on Ocean, Offshore & Arctic Engineering (OMAE)

Virtual » June 21-30  
<https://event.asme.org/OMAE>

### Floating Wind Solutions

Houston, TX » June 28-29  
[www.floatingwindsolutions.com](http://www.floatingwindsolutions.com)

### 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](http://www.offshorewindus.org)

### Offshore Well Intervention LATAM

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

## EUROPE

### Deep Sea Mining Summit

London, UK » May 27-28  
[www.deepsea-mining-summit.com/](http://www.deepsea-mining-summit.com/)

### Seanergy

Nantes, France » June 8-11  
[www.seanergy-forum.com/en/seanergyforum/Seanergy-2020](http://www.seanergy-forum.com/en/seanergyforum/Seanergy-2020)

### Underwater Technology Conference (UTC)

Virtual » June 16-17  
[www.utc.no](http://www.utc.no)

### Electric & Hybrid World Marine Expo

Amsterdam, The Netherlands  
» June 22-24  
[electricandhybridmarineworldexpo.com](http://electricandhybridmarineworldexpo.com)

### Undersea Defence Technology (UDT)

Rostock, Germany » June 29-July 1  
[www.udt-global.com](http://www.udt-global.com)

### Ocean Business

Southampton, UK » July 6-8  
[www.oceanbusiness.com](http://www.oceanbusiness.com)

### Submarine Networks EMEA

London, UK » September 2-3  
[www.terrapinn.com/conference/submarine-networks-world-europe/index.stm](http://www.terrapinn.com/conference/submarine-networks-world-europe/index.stm)

### SPE Offshore Europe

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

## OTHER REGIONS

### Int'l Conference on Coastal and Ocean Engineering (ICCOE)

Tokyo, Japan » April 3-5  
[www.iccoe.org](http://www.iccoe.org)

### Offshore Well Intervention APAC

Kuala Lumpur, Malaysia » May 18-19  
[www.offsnet.com/owi-apac](http://www.offsnet.com/owi-apac)

### Telecoms World Middle East

Virtual » June 15-16  
[www.terrapinn.com/conference/telecoms-world-middle-east/index.stm](http://www.terrapinn.com/conference/telecoms-world-middle-east/index.stm)

### PHILMARINE

Manila, Philippines » June 15-17  
[www.philmarine.com](http://www.philmarine.com)

### Submarine Networks World

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

### ADIPEC

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

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<b>JANUARY</b> 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
<b>FEBRUARY</b> 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
<b>MARCH</b> Editorial: Feb. 22 Ad: Mar. 11	» <b>Unmanned Vehicles &amp; Marine Robotics</b> » <b>Distribution:</b> GIPEX ☐ / April 6-8	<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
<b>APRIL</b> 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
<b>MAY</b> Editorial: Apr. 19 Ad: May 06	» <b>Marine Renewables</b> » <b>Distribution:</b> SIPEX ☐ / June 1-3 Floating Wind Solutions / June 28-29	<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
<b>JUNE</b> Editorial: May 17 Ad: June 03	» <b>Bathymetric Mapping &amp; Hydrographic Survey</b> » <b>Distribution:</b> Ocean Business / July 6-8	<b>Technologies:</b> Oceanographic Equipment & Instrumentation, Sensor Suites, ADCP, Buoys, ROVs, and more. <b>Industry Focus:</b> Marine Survey, Academic, Geotechnical Services
<b>JULY</b> 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
<b>AUGUST</b> Editorial: July. 26 Ad: Aug. 12	» <b>Deep-Sea Exploration</b>	<b>Technologies:</b> Seabed samplers, Mining machines, Geotechnical tooling, Seafloor imaging equipment, and more. <b>Industry Focus:</b> Offshore Energy, Marine Mining, Scientific
<b>SEPTEMBER</b> Editorial: Aug. 23 Ad: Sep. 09	» <b>Offshore Build, Inspection &amp; Maintenance</b>	<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
<b>OCTOBER</b> Editorial: Sep. 20 Ad: Oct. 07	» <b>Submersibles</b>	<b>Technologies:</b> Manned submersibles, Navigation systems, ROVs, Submarines, Resident Subsea Vehicles, and more. <b>Industry Focus:</b> Offshore Energy, Defense, Academic, Marine Mining
<b>NOV./DEC.</b> 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

## BRISTOW ACHIEVES ISO 14001 CERTIFICATION FOR UK OPERATIONS



» Bristow Group Inc.'s ISO 14001 certification encompasses Bristow's UK oil and gas business business. (Photo credit: Bristow)

Bristow Group Inc. has announced that its UK operations has received International Organization for Standards (ISO) 14001 certification, making it one of the first vertical lift operators in the UK to achieve the global standard. The certification confirms Bristow's UK operations have a Certified Environmental Management System (EMS) in place to monitor, manage, and deliver continuous improvement at its bases in Scotland, England and Wales.

To achieve certification, Bristow successfully completed a rigorous seven-day audit, which demonstrated how its EMS is documented and implemented at all levels of its UK business, its commitment to manage and minimize its impact on the environment, and its commitment to reduce pollution and harm to the environment.

The certification encompasses Bristow's UK oil and gas business, and Her Majesty's Coastguard bases Bristow operates on behalf of the Maritime and Coastguard Agency. Under its EMS, Bristow conducts

audits of its operating bases' environmental plans to ensure a consistent approach across the company.

"It's a significant milestone for Bristow to achieve this accreditation and underlines our commitment to continuously improving on our environmental stewardship and performance," said Matt Rhodes, director UK Oil & Gas at Bristow. "Our robust EMS is already achieving significant energy efficiencies, and we look forward to building on this."

During the certification process, a number of criteria must be met and incorporated into the EMS. These included leadership and top management demonstrating a high level of environmental leadership and commitment, as well as ensuring that it is visible throughout the organization.

"The environmental impact of our operations has understandably become increasingly important to us and our clients, and this certification provides assurance that we are proactively monitoring and managing our EMS and working hard to reduce and offset our environmental footprint and the crucial role we all play in protecting our environment for future generations," added Rhodes.

As part of its ISO 14001 certification, Bristow is committed to achieving a number of environmental objectives, including proactive measures to achieve the company's environmental and compliance obligations such as reducing aircraft emissions and decreasing the environmental impacts of its operations. To accomplish this, Bristow uses a modern fleet with the latest technologies to ensure aircraft engines perform efficiently and are regularly maintained by an experienced engineering team.

Bristow also uses flight planning software for payload management and minimizing time on ground runs. Pilot procedures also play a key role, and Bristow pilots are trained to fly at a lower torque, which burns less fuel, cuts emissions, and increases component life. Bristow also uses the latest technology fuel bowsers with enhanced safety features such as automatic shut off systems, which are regularly upgraded to eliminate spillage.

## ECO WAVE POWER WINS THE "BLUE INVEST-PEOPLE'S CHOICE" AWARD

Eco Wave Power (EWPG Holding AB) recently won the prestigious BlueInvest Award by the European Commission, in the People's Choice category. The award ceremony took place within the framework of the BlueInvest Day event, organized by the European Commission, and the award was delivered to Eco Wave Power by Virginijus Sinkevičius, Commissioner for the Environment, Oceans and Fisheries of the European Commission. Virginijus Sinkevičius congratulated Eco

Wave Power and said that the "People's Choice" Award has a special significance, as it shows the interest, by the general public, in the technology's implementation.

"I am very grateful for winning the People's Choice Award. Being a young woman, developing an innovative wave energy technology is not always easy, but your support and moments like this are what makes it all worthwhile. Thank you for supporting Eco Wave Power's

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**Eco Wave Power**

**Winner of "People's Choice" Award**

mission of changing the world, one wave at a time! And thank you to our shareholders, partners and team, we could not do it without you! I always say that passion is the greatest renewable energy source, and it

is, even stronger than the power of the waves! Keep believing!" said Inna Braverman, CEO of Eco Wave Power, in her Award acceptance speech.

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

# SeaState

THE ON&T PODCAST

SEASON 2 / EPISODE 2

## HOW A FAMILY'S LEGACY AND PASSION CONTINUE TO DEFINE THE WORLD OF ELECTROACOUSTICS

In the next episode of SeaState we talk to a father and daughter team from MASSA Products Corporation. Donald P. Massa is 2nd Generation at Massa. He is both an engineer and a businessman. He is also the co-founder of Massa Products Corporation. Don has a Master's Degree in Electrical Engineering from Northeastern University and served on their Board of Trustees for a decade. He is recognized as a leader in the field of Electroacoustics, and was trained by Frank Massa, his father, who is also known as the "Father of Modern Sonar Transducers." Don has written many papers and has been awarded numerous patents, but most importantly he has developed hundreds of designs that have led to production and has advanced the business. Although most of Massa's business is in B2B and military products, a notable invention of Don's that most people would recognize is the Automatic Bowling Scoring System, which Massa manufactured and sold to AMF for over a decade. He has also followed in his father's footsteps to advance the field of Electroacoustics and has expanded the company beyond transducer design and fabrication to include the innovation and production of electroacoustic electronic systems. He presently serves as President and CTO of Massa Products Corporation, and holds a seat as Chairman of the Board.

Don's daughter Dawn F. Massa Stancavish is 3rd Generation at Massa. She is both the Chief Innovation Officer and the Chief Operating Officer and holds a seat on the Board of Directors. Her talents are in business strategy, and she serves to develop the business both internally and externally. Dawn is responsible for increasing the amount of new product sales at Massa and encouraging customers and partners alike to be proud to sport the MassaSonic® brand for co-branded developments. She is in charge of all new product development, innovation, marketing and sales, and is the liaison between the needs of the industrial/consumer world and the technical capabilities of Massa. She is also responsible for preserving and sharing the family values, traditions, and culture at the company and with her own family. This year, Massa celebrates its 75th Anniversary in business. Dawn is a published writer and artist. She holds a Master's Degree in Psychology from Fairleigh Dickinson University with a focus on Systems Dynamics, has a Certificate in Finance from Harvard Business School, and is a U.S. Patent holder. Dawn serves on the Stellwagen Bank National Marine Sanctuary Advisory Council (SAC) for NOAA, and the Board of Trustees, Overseers' Leadership Council & Governance Committee for the South Shore Conservatory. She also works closely in partnership with Northeastern University in Boston to bring in new COOP students to Massa.



» Massa Products Corporation is run by father and daughter team, Donald P. Massa and Dawn F. Massa.

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Don Massa & Dawn Massa Stancavish Receiving the 2018 Massachusetts Family Business of the Year Award from NEU Center for Family Business

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## KONGSBERG DIGITAL LAUNCHES REMOTE, SIMULATION-BASED DP TRAINING

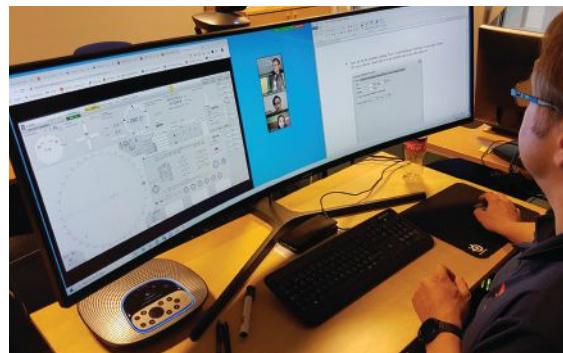
Kongsberg Digital (KDI) and The Nautical Institute are pleased to announce an approved remote simulation solution for Dynamic Positioning (DP) Induction Courses. This has been developed by KDI to support training centers worldwide during the COVID-19 pandemic lockdowns, and has now been approved by The Nautical Institute.

Since the start of the pandemic, KONGSBERG has been ramping up the delivery of cloud-based eLearning and remote training solutions to support education and training institutes and meet the challenges imposed by the impossibility of carrying out tuition in a physical classroom situation. The latest addition to its cloud-based simulation training solutions is a remote DP simulation application, which enables instructors to

continue providing their students with mandatory DP simulation-based education through remote access to KONGSBERG's cutting-edge K-Sim DP technology.

As a response to the COVID-19 situation, the NI has reviewed and approved the use of KONGSBERG's cloud-based remote DP simulators, equivalent with the NI Class C DP simulators required for the DP Induction courses. By temporarily approving remote simulation training, The Nautical Institute is helping the industry to maintain mandatory DP skills through the pandemic crisis. The remote training solution is valid until April 1, 2021, with the option to further extend approval depending on the coronavirus situation.

Over the last 10 months, cloud-based simulation has proved indispensable in enabling training centers to deliver essential courses. KDI's eLearning modules and remote training solutions provide online access to many of the company's high-fidelity simulators via the K-Sim Connect portal,



» Kongsberg Digital's cloud-based solutions give students access to advanced simulations from their own PCs. (Photo credit: Kongsberg Digital)

enabling distance learning and permitting students to continue to take courses and acquire basic skills outside the training center.

## DNV GL'S OIL & GAS AND POWER & RENEWABLES BUSINESSES CHANGES TO ENERGY SYSTEM

DNV GL, the assurance and risk management company, will combine its current Oil & Gas and Power & Renewables businesses into one new business area called Energy Systems.

The move will better reflect the emerging energy future, which will see renewables take a greater share of the energy mix and decarbonization become a major focus. Energy Systems, will provide certification, advisory and digital monitoring services to the entire energy value chain. Ditlev Engel, CEO of the current Energy business area since 2016, will lead the new business area, which will consist of approximately 4,000 energy experts, making it the world's leading resource of independent energy experts and certification body.

"The creation of Energy Systems is our response to a rapidly changing energy market in search for deeper decarbonization," said Remi Eriksen, Group President and CEO of DNV GL. "We want to enable our customers to tackle the energy transition—faster. By combining our expertise, we will better serve customers operating in, and entering the energy market. This new structure will help us serve all players in the energy market."

Whilst renewable energy is increasing market share, DNV GL will continue to work with the oil and gas sector as it refocuses on decarbonization. The sector will play an essential role in the energy transition with natural gas set to become the single largest energy source by the middle of the decade, whilst hydrogen, ammonia and carbon capture and storage will be important tools in the low carbon toolkit for the hard to abate sectors.

Ditlev Engel, CEO – Energy Systems, said, "Joining forces in Energy Systems gives DNV GL the size to work with the key industry players to help scale green energy technology and optimize safety from production to consumption. There is no hiding from the fact

that we are on course for damaging global warming, but we have the technology to transition faster. I see a greater willingness amongst policy makers and companies to speed up the decarbonization of the sector and we at DNV GL are ready to play our part, so we can tackle the needed energy transformation much faster."

As part of an ambitious strategy to grow in key markets, DNV GL can also announce the acquisition of US based engineering consultancy Energy and Resource Solutions, Inc. (ERS). Consisting of around 80 experts, ERS, like DNV GL, helps customers to manage and reduce energy costs through program design, outreach, implementation and evaluation services. ERS will be an integrated part of DNV GL.

The decision to create the Energy Systems business area was taken after a strategic review of DNV GL's business, which also led to the renaming of the company to DNV from March 1, 2021. Going forward, DNV GL will be a company of three houses consisting of approximately 12,000 experts; the leading maritime classification society, the world's largest resource of independent energy experts and certification body, and a business assurance house that is shaping how products and supply chains are assured.



## KATHRYN LINK JOINS WHOI AS VP FOR OPERATIONS AND CFO

Woods Hole Oceanographic Institution (WHOI), the world's independent leader in ocean discovery, exploration, and education, has announced the appointment of Kathryn Link as Vice President for Operations and Chief Financial Officer, effective March 8, 2021. Link will act as financial and strategy advisor to help lead and support academic research enterprises across the institution. She comes to WHOI from the Broad Institute, where she led a team responsible for strategic management of research funding.

"We are thrilled to welcome Kathryn to WHOI, where we are certain she will make an immediate impact," said Peter de Menocal, president and director at WHOI.

"Her strong record of driving results and growth, her vast financial experience in the non-profit sector, and her shared commitment to the ocean and planet align perfectly with our mission and vision."

Link brings more than 25 years of experience to WHOI. Prior to the Broad Institute, she held leadership positions at the Wyss Institute for Biologically Inspired Engineering at Harvard University, and was a founding director of Harvard's Department of Stem Cell and Regenerative Biology. She also served as Executive Administrative Dean for the School of Arts and Sciences at Tufts University.

"It is an exciting time to join a renowned organization such as WHOI," shared Link. "I've dedicated my career to supporting the world's most innovative scientists and engineers as they explore, discover, and problem solve, and I look forward to working with the entire WHOI team to continue building on its strong operational and financial excellence."

[www.whoi.edu](http://www.whoi.edu)



» Kathryn Link,  
Vice President for Operations  
and Chief Financial Officer,  
Woods Hole Oceanographic Institution



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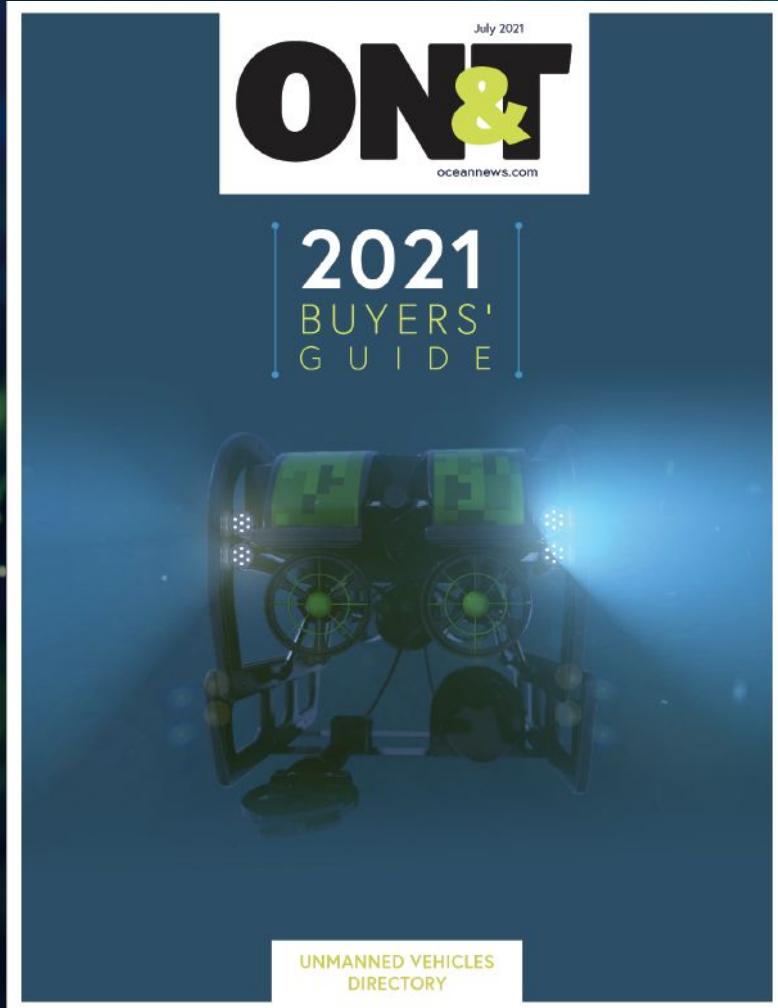


MVI is a small business, multifaceted solutions provider working with a wide variety of industries and government agencies whose project needs are in the fields of ocean observing systems, engineering and development, subsea communications, ROV operations and training, environmental consulting, marine mammal observation, offshore field operations and sampling, and the provision of Subject Matter Experts (SMEs) to address marine environmental challenges.



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## GIMBALS AND MOUNTING SYSTEMS



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Sören Lieske, Sales Manager

SOMAG AG Jena is a worldwide leading specialist for high-precision gimbal systems. The company provides Gyro Stabilization Mounts designed for high-quality data acquisition and surveillance applications at sea. These units ensure precise sensor stabilization in harsh maritime environments. SOMAG Mounts are unique as they are not limited to a specific hardware set. They can stabilize any payload as long as it meets the specifications of the Mount, making the devices suitable for a wide range of applications.

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Kongsberg Seatex is a leading international marine electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems. Our commitment is to provide quality products and solutions for safe navigation and operations at sea in the commercial offshore, maritime, hydrographics and defence industries.

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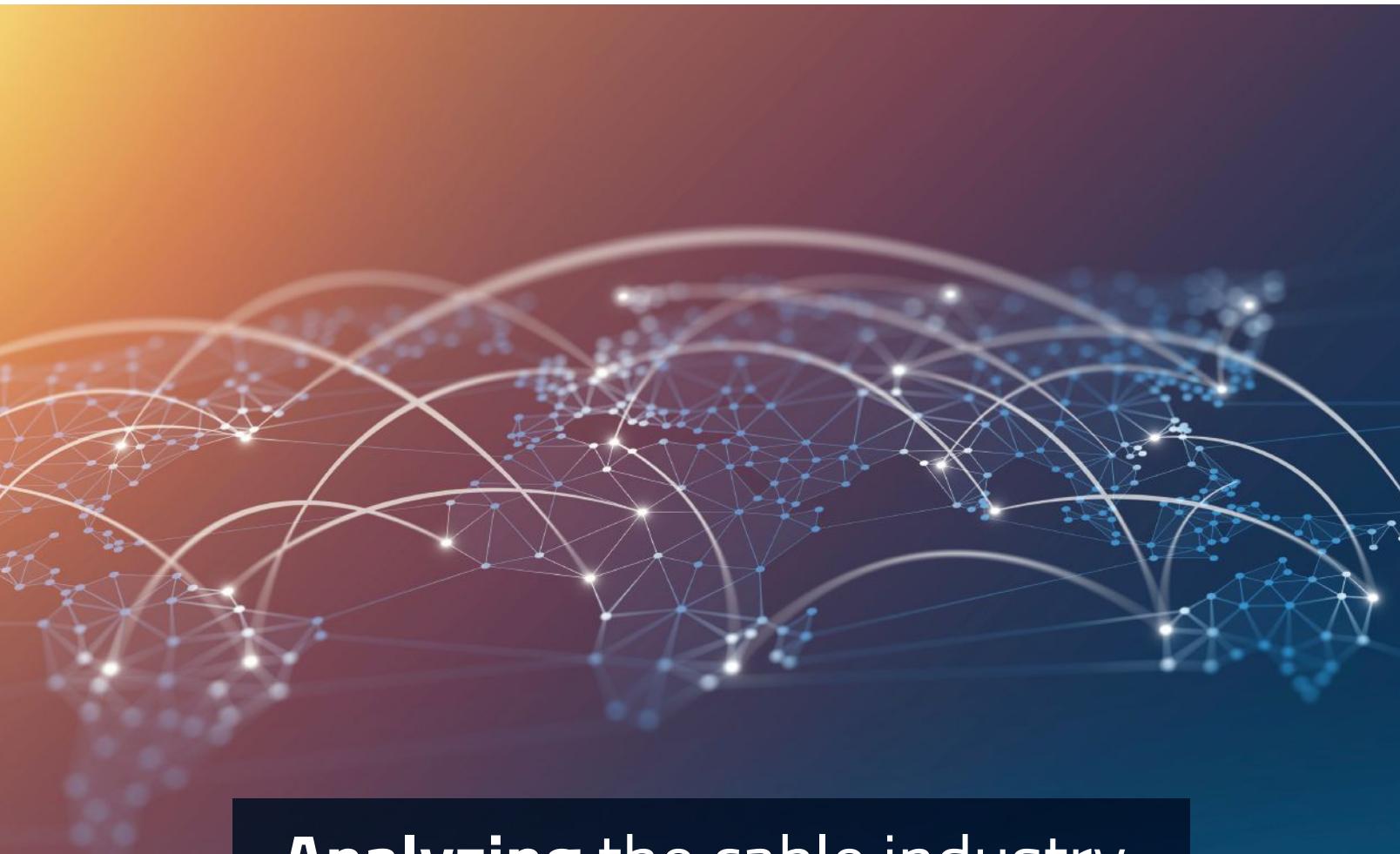
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Analyzing the cable industry.

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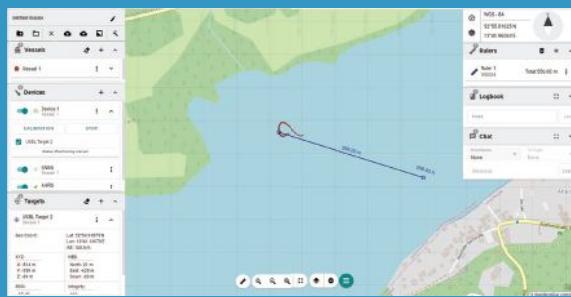
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