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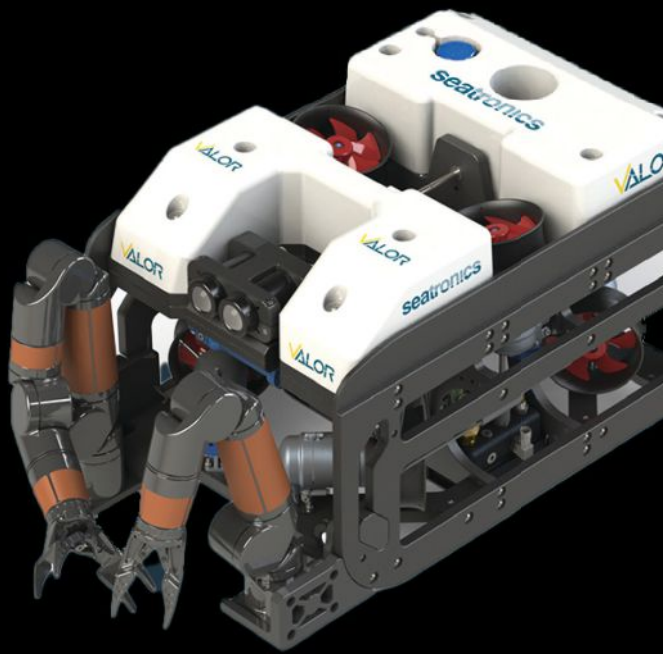
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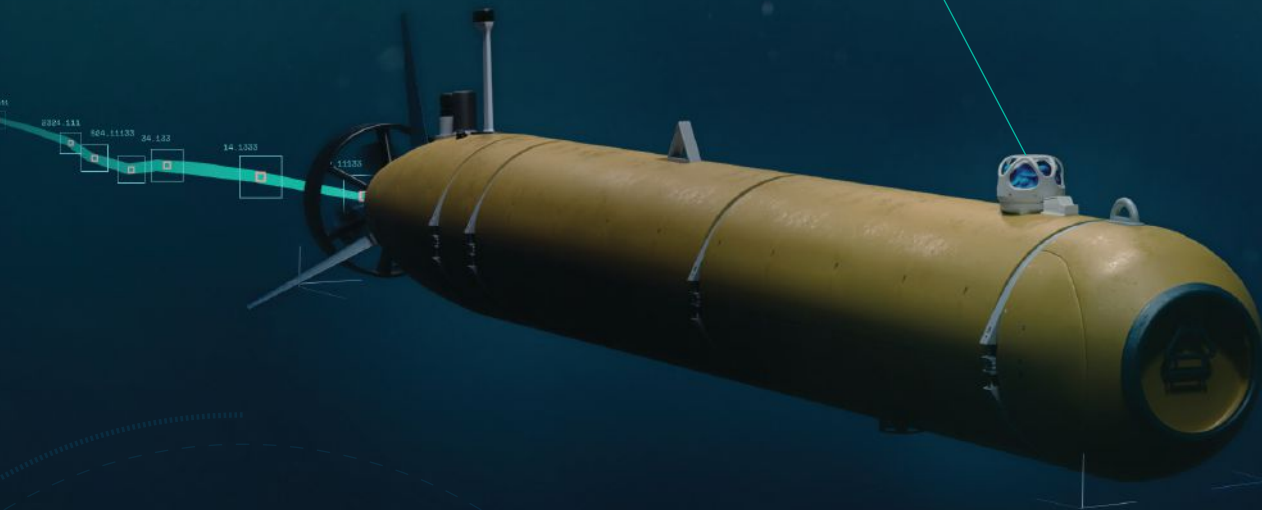
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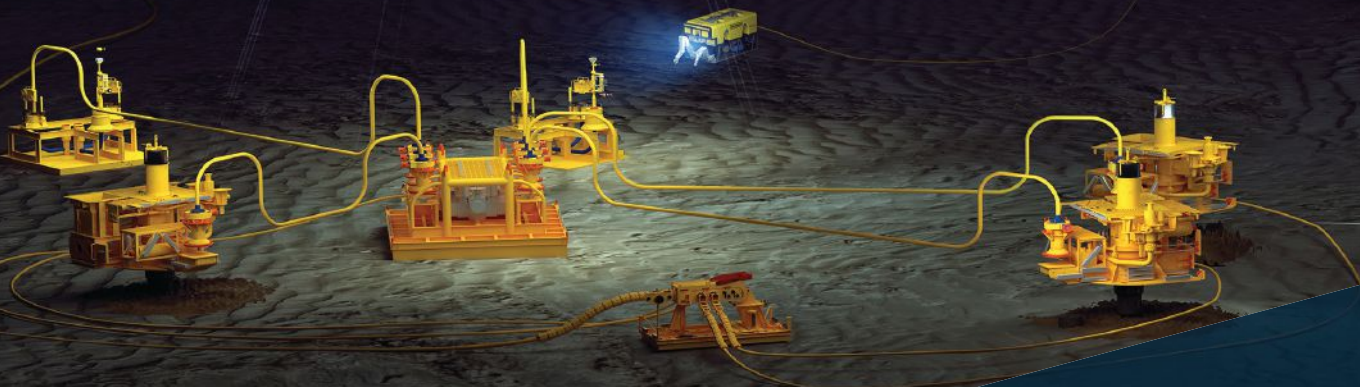


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ON THE COVER:

The advent of rapidly deployable AUV's like Advanced Navigation's Hydrus—depth rated to 3000 m and capable of optimized still image and video capture, obstacle avoidance, water analysis, and 3D point cloud mapping—signals a new era for remote subsea survey. (Photo credit: Advanced Navigation)

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[WITH THANKS - Ed.]

There is nothing artificial about the promise of AI. Recent breakthroughs in ocean tech have thrust us into a new era of supervised autonomy, in which the application of advanced marine robotics and the integration of ever smarter control systems continue to facilitate and extend the trial and adoption of remote operations.

This paradigm shift, while still gradual, has found a new gear of late with the introduction of several tried-and-tested commercial products and services, all of which serve to validate a scalable formula for sustainable efficiency gains: More cost-effective, remotely-operable technology in the field equals less personnel at sea—and at risk—while fewer team-heavy vessels lead to a critical reduction in sector-wide carbon emissions.

This month's features include an exclusive interview with the bright minds at Advanced Navigation, an access-all-areas pass to one of Oceaneering's Remote Operations Centers, and a closer look at Nauticus Robotics' Aquanaut AUV/ROV. Our thanks also go to NOAA and NavTech Radar.

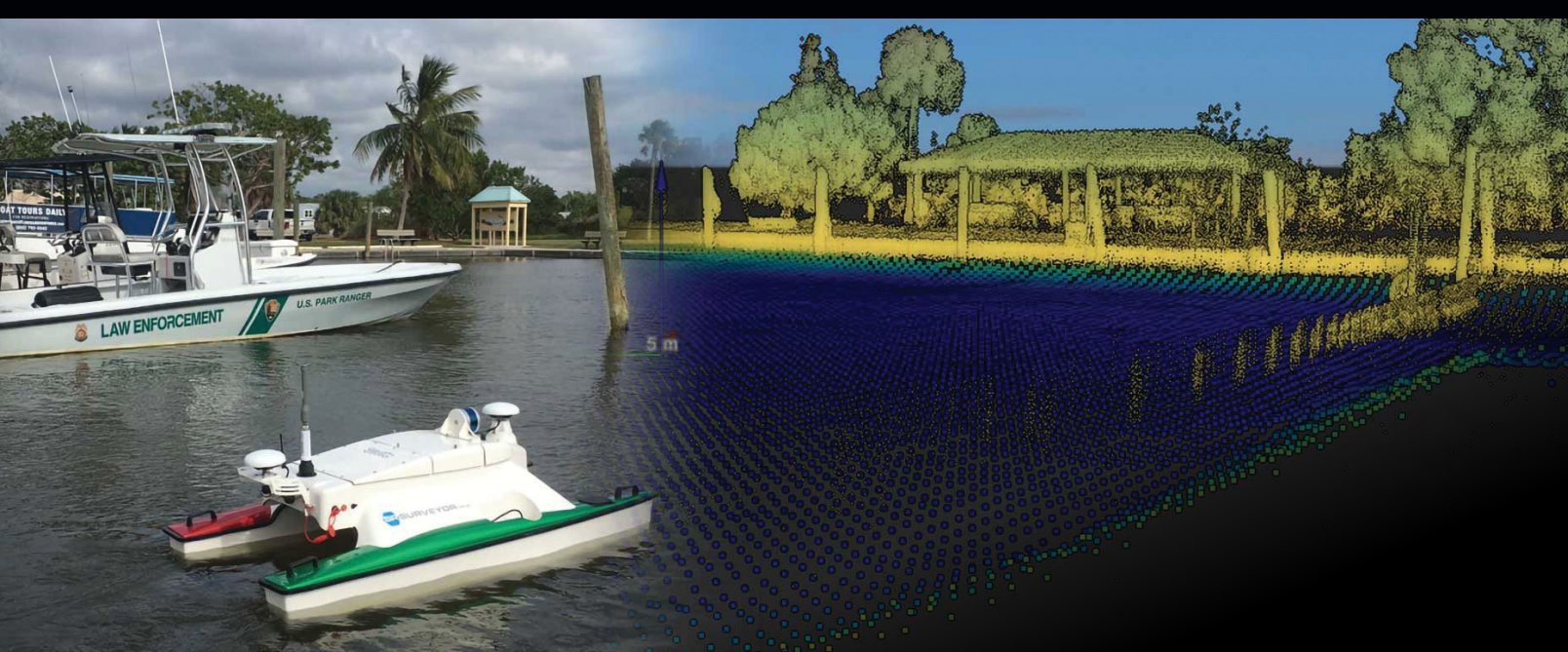
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Intelligent Marine Robotics

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We engineer and manufacture unmanned systems for an increasingly data-centric world.

Our portfolio of marine robotics and specialized services provide commercial, government, and defense markets around the globe with solutions to optimize the efficiency and sustainability of inter-coastal and offshore activities.



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REIMAGINING INTELLIGENCE FOR OCEAN EXPLORATION



By Jeremy Weirich
Director, NOAA Ocean Exploration



Most of our ocean remains a mystery, but its wonders are slowly being revealed as we continuously improve our abilities to access and study it. Even with our progress, there's growing pressure to accelerate global efforts to explore, analyze, and understand the ocean, for the benefit of all.

To more rapidly address unmet needs, the ocean science community is turning to remote technologies and artificial intelligence (AI). Ocean scientists have been using remote technologies like uncrewed systems and telepresence for decades. While AI is relatively new to the field, it shows great promise for transforming how we acquire and process the foundational data needed to manage, sustainably use, and protect our ocean.

HARNESSING AI CAPABILITIES

In the United States, the National Oceanic and Atmospheric Administration (NOAA) leads the charge to better understand and predict changes to the ocean. NOAA's AI strategy calls for developing and applying AI to efficiently and effectively deliver high-quality products and services across mission areas, including fisheries assessments, habitat characterization, environmental modeling, and ocean exploration.

NOAA Ocean Exploration is dedicated to exploring the ocean. To increase the pace of exploration, we're working to integrate AI into our operations and support development of applications to tackle some of our community's complex challenges. By providing funding and test bed opportunities and working with partners, like the NOAA Ocean Exploration Cooperative Institute, we are able to extend our interests and influence.

Internally, we're focusing AI efforts on making our data more user-friendly and optimizing operations. This includes developing a model to

identify exploration gaps in the U.S. Exclusive Economic Zone. This multipartner, multiplatform resource will enable the ocean exploration community to strategically prioritize where and how we explore.

More exploration means more data. We've already archived quite a lot, and we want people to use it. Starting with underwater video from expeditions on NOAA Ship *Okeanos Explorer*, we're looking at how AI can maximize use of our data. Video is among the most useful data we acquire, but the time and effort required to manually annotate and analyze it can hinder discovery. To alleviate this, we're building a model to automate detection and identification of marine life to quickly deliver results.

PREPARING AI PROFESSIONALS

The future of ocean exploration is not one without humans. It's one that pairs humans and AI with the tools and technologies that provide the greatest ocean access. Among them, "swarms" of uncrewed vehicles navigating autonomously, making sense of their environment, and deciding how to complete assigned tasks.

To help get us there, we're investing in developing an AI-ready workforce. We offer training to our staff, support student involvement in grant-funded projects, provide internships with our office, support similar opportunities with partners, sponsor AI and related competitions, and more.

As a national and international leader in ocean exploration, we're committed to using and advancing AI and developing and supporting innovative tools and technologies to further our own work and that of the broader ocean science community. By doing so, we will dramatically increase the scope, scale, and pace of ocean exploration and, ultimately, discovery.



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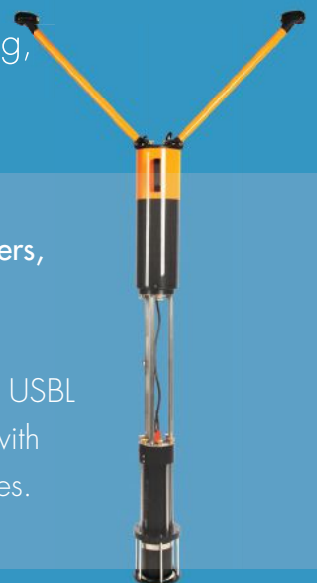
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AN EXCLUSIVE INTERVIEW WITH ADVANCED NAVIGATION



Peter Baker

Senior Product Manager, Subsea
Advanced Navigation



Ed Freeman

Managing Editor
Ocean News & Technology



Whether for exploring sea, land, air, or even space, in little over a decade Advanced Navigation has established an industry leading reputation for developing navigation systems for advanced robotics. The company's mission is bold and uncompromising: to drive the autonomy revolution with AI-powered systems. ON&T's Ed Freeman recently sat down with Peter Baker, Advanced Navigation's Senior Product Manager, Subsea, to find out what this means for the ocean industry.

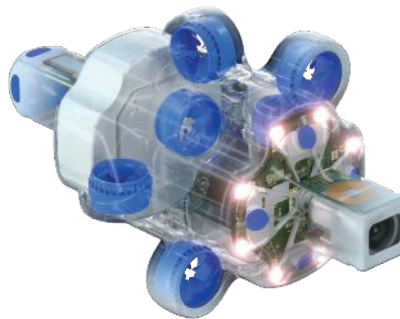
EF: For any readers that might not be familiar with the Advanced Navigation story, give us a quick overview of how the company came to be.

PB: Advanced Navigation was founded in Australia in 2011 by engineers Xavier Orr and Chris Shaw to commercialize university research in AI-based inertial navigation. The company has successfully progressed into deep technology fields, including underwater acoustics, inertial navigation systems, and robotics. Today, Advanced Navigation supplies many leading technology companies with solutions for land, sea, air and space applications and considers itself a driver of the autonomy revolution.

EF: What is the core focus for the company right now in serving the ocean community?

PB: We have two subsea product streams—our USBL acoustic navigation system, comprising Subsonus transducer and Subsonus Tag transponder. This system offers incredible performance in challenging high-noise and multipath conditions and unrivalled miniaturization, making it ideal for precision ROV control and asset tracking. Unique to

the Subsonus solution is it supports a multi-transducer configuration that provides unprecedented navigation and INS capability through resolving USBL calculations at both surface vessel and tracked asset.



» Hydrus render showing some of the internal subsystem components. (Image credit: Advanced Navigation)

Hydrus is our latest subsea product—a fully autonomous underwater robot that is designed to bring the capabilities of undersea data capture, water analysis, and image capture into a new era that is accessible to researchers, conservation groups, and established commercial operators. This is not only from an affordability perspective, but

through requiring no training to operate, eliminating special equipment and vessels for launch and retrieval and, with its autonomy, zero human interaction required during missions.

EF: This month's edition of ON&T focuses on Artificial Intelligence (AI) and Remote Operations. How is your company bringing AI to market? And what are the more immediate applications in the field?

PB: AI and, more specifically, artificial neural networks are fundamental parts of the technology that enables a deep fusion of data from different streams and subsystems used in our solutions. This allows our systems to be reactive to local and prevailing conditions in ways that cannot be anticipated or modelled by conventional algorithms. From this reactive behavior, our systems learn how to continue improving in self analysis, guidance, and response. This is an incredibly important future-oriented technology in enabling large-scale adoption of autonomous systems and advanced robotics.

As a pioneer in AI-based inertial navigation systems, the effective and



⚡ A Hydrus AUV in action, performing a close-up survey of a coral reef. (Photo credit: Advanced Navigation)

continued use of AI is intrinsic to our product DNA. For robotics especially, due to the many complex interactive subsystems in play, seamless and intelligent fusing of these systems using AI for reliable and safe autonomous applications is critically important.

We see AI driven autonomous systems like Hydrus adopting goal-oriented operations in future. With mature AI, it will be possible to instruct the robot to perform an inspection or map an area, for example, with the robot itself deducing how to achieve the goal. Currently, mission planning is task based, which is a rigid and defined approach, including configuring conditional behaviors that require effort to set-up. This is the direction the robotics industry is headed and will play an essential role in subsea industries in delivering simpler, faster, safer and affordable operations in this most challenging environment.

EF: You mentioned Hydrus, tell us more about how this handheld plug-and-play AUV represents what you refer to as the Drone Revolution and the impact of such technology for autonomous subsea operations?

PB: We have witnessed a revolution in the aerial drone industry in the last decade or so. Advancements in technology and the resulting adoption of drones for all sorts of commercial enterprise has been in tandem with major reductions in costs, increased use-cases and greatly simplified operation. This led to drone usage evolving from high cost, professional operators only to hobbyist level.

Hydrus represents a paradigm shift in AUV technology. The design of the system is cored around fusing our expertise in AI, inertial navigation, and underwater acoustics with sophisticated FPGA processing and propulsion systems to dramatically scale up access to professional grade data capture to more users than previously possible.

Although subsea drones have been in existence for some time, nothing we have seen captures the almost lifelike capability of Hydrus in its ability to perform tasks, be reactive, and make real-time decisions.

Hydrus is certified flight safe, depth rated to 3,000 m with 9 km range, and is capable of sophisticated functions, such as optimized still image and video capture, obstacle avoidance, water analysis, and 3D point cloud mapping. It is also capable of carrying payload software for extended operations such as object identification and classification.

The extreme affordability of Hydrus compared to technology that is remotely similar, its operational simplicity and high-quality output, has stimulated plenty of interest from subsea industries and entire new ranges of users. We are experiencing distinct opportunities for Hydrus from a broad spectrum of new user bases—over 30% are new to underwater robotics. Much of this interest comes from a holistic in-house design philosophy that delivers fantastic performance and offers massively reduced operating and logistics expenses.

Additional and increasingly important benefits to operators and clients are minimal environmental impact and sensitivity to marine habitats, hassle-free transportation and the resulting reductions in emissions and carbon footprint these factors introduce.

EF: What does the next 12 months look like for the Advanced Navigation team?

PB: Advanced Navigation has exciting plans to forge our technologies to further advance the autonomy revolution. This means continuing to develop and introduce and showcase new, better offerings to our product portfolio, including several INS products over the next few months, and deepen co-integration between products. We also plan a global Hydrus roadshow to demonstrate this innovative technology at key locations.

We are expanding our subsea facility in Australia to significantly increase

production of Hydrus units and further extend our R&D capabilities. We continue heavily investing in all areas of engineering to meet the demands of today and take on tomorrow's challenges. Our aim remains to provide exceptional performance and value to our customers, but to also help them on their respective future journeys.

EF: Readers of ON&T will be familiar with Advanced Navigation's development of subsea technology, but we recently heard your company plans to visit the moon?

PB: Some of our latest developments, including laser photonics and quantum-based navigation systems, are slated for upcoming space missions, which present many similar challenges to subsea. We are honored to be affiliated with the Australian Space Agency, NASA, and Intuitive Machines in pursuing space exploration. Being part of transforming science-fiction into fact

» Hydrus being deployed at Ningaloo Reef in Western Australia. (Photo credit: Advanced Navigation)





» Super-compact Subsonus transducer, with 8-hydrophone array. (Photo credit: Advanced Navigation)

SUBSONUS / Revolutionary USBL and INS

Position Accuracy	0.1 m
Roll & Pitch	0.1°
Acoustic Heading	0.3°
Range & Depth	1,000 m



» Subsonus Tag transponder. Note size, connectorless design, and user display. (Photo credit: Advanced Navigation)

SUBSONUS TAG / High-endurance subsea transponder

Position Accuracy	0.25 m
Range	1,000 m
Depth Rating	2,000 m
Battery Life	18 months

is great recognition for Advanced Navigation's capabilities and experience in extending the boundaries of navigation, AI, and robotics in extreme environments.

We envisage a future conflation of autonomous technologies and methodologies that will enable many industries, including offshore, to significantly benefit from improved safety, reduced environmental impact and enormous gains in efficiency. Collaborative autonomy is coming, where robots can be delivered in place and retrieved by other robots and multiple robots can work in cross-platform harmony.

EF: Well, thank you for collaborating with the team at ON&T today, Peter. If readers want to know more about Advanced Navigation?

PB: You are very welcome. I would encourage ON&T readers to visit www.advancednavigation.com for all the latest news or email sales@advancednavigation.com for any more specific product enquiries.

ABOUT ADVANCED NAVIGATION

Advanced Navigation's mission is to drive the autonomy revolution with high reliability AI powered systems delivering unparalleled capabilities and performance. Our customers choose us for our high performance, reliability and advanced design.

HIGH PERFORMANCE

Our systems deliver the highest performance and richest feature set on the market. We back our performance claims by free product trials.

QUALITY

Our systems are built to the highest quality standards in Australia to endure the test of time in the most difficult conditions. You can rely on our products.

TRUSTED RELIABILITY

All our systems are designed and tested to safety standards with fault tolerance built in to provide you with the highest reliability possible. Our reliability is trusted by many of the worlds largest companies.

WORLDWIDE SUPPORT

Our experts are part of your team. We're on hand to ensure that our solutions are successfully integrated into your systems.





» Investment in Sonardyne's PIES is a sign of improvement in the marine geophysics data market. (Photo credit: Sonardyne)

INVESTMENT IN SONARDYNE'S PIES SHOWS CONFIDENCE IN MARINE SEISMIC MARKET

Marine technology company Sonardyne has reported an uplift in orders for its Pressure Inverted Echo Sounder (PIES) technology into the exploration and reservoir surveillance market in the first half of this year.

Sonardyne's PIES technology, which helps geophysicists to better understand the physical processes that occur in the deep ocean, has been acquired by a string of companies performing both towed streamer and ocean bottom node (OBN) deployments, highlighting increasing activity in the sector.

Among those investing in PIES are marine geophysics data and services company PGS Geophysical and ocean bottom nodal firm Magseis Fairfield. Geophysical services provider PXGeo has also ordered a number of Sonardyne's PIES.

PIES is a long endurance, self-contained oceanographic instrument for precisely measuring average sound speed in the water column as well as water depth information. By collecting these observations as seismic data is being acquired, PIES helps to reduce uncertainty in the imaging data, helping to provide a clearer image and guide operational decisions.

"PIES continuously measure the two-way travel time of sound waves propagated through the water column from the seabed to the sea surface as well as the pressure (depth) at the seabed," said Sonardyne sales manager Trevor Barnes. "This data is used to calculate a continuous time history of the average water velocity and tidal variation throughout the entire water column. By doing this, these environmental variations can be removed from the reservoir imaging data, providing geophysicists with a clearer image of their reservoirs."

PIES are regularly used across the marine seismic market as well as by oceanographic institutions interested in understanding the ocean. The instrument can be deployed on the seabed by ROV or freefall deployed from a surface vessel and configured for autonomous monitoring campaigns lasting several months to several years.

An embedded acoustic modem also allows users to retrieve data wirelessly on-demand, or adjust monitoring regimes, from crewed or uncrewed survey vessels. PIES can also be deployed in wired configurations, allowing a constant data feed to topside facilities.

For more information, visit: www.sonardyne.com.

KONGSBERG MARITIME LAUNCHES ECOADVISOR™ TOOL FOR VESSEL OPTIMIZATION

Kongsberg Maritime has launched EcoAdvisor™, an intelligent and dynamic decision support system for optimizing a range of vessel operations.

EcoAdvisor™ is an outcome of a joint 'Intelligent Efficiency' research project between Kongsberg Maritime, vessel operator DOF Subsea AS (DOF), Sintef, NORCE and Innovation Norway, with the aim of developing technologies to monitor and reduce the GHG (greenhouse gas) emissions during vessel operations.

EcoAdvisor™ monitors the vessel operation and its environment, including power generation, propulsion, environmental forces and control system dynamics. EcoAdvisor™ enables operators to achieve reductions in fuel, emissions and maintenance costs, without compromising vessel redundancy margins or vessel operational efficiency.

With stricter regulations and a global need for industry to operate as sustainably as possible, EcoAdvisor™ provides live advice on how ship owners can reduce their carbon footprint whilst at the same time reducing OPEX.

"EcoAdvisor™ demonstrates clearly how a decision support tool relying on the power of digitization can help vessel operators remain competitive in a growing green market," said Odd Hagen, VP Offshore sales, Kongsberg Maritime. "Several factors contribute to inefficiencies in maritime operations, such as multiple engines running at low utilization, load variations, and large power fluctuations due to mission equipment and thrusters. Vessel owners have found it challenging to achieve sustainable operations due to conservative requirements from charters and a lack of a holistic overview of their operations."

"EcoAdvisor™ creates an intelligent and comprehensive overview of all these factors, delivering advice that

enables efficient, cost-effective and sustainable solutions to be made without compromising vessel redundancy margin. Further, the history log and reporting functions in EcoAdvisor™ can be used to determine the Energy Efficiency Existing Ship Index (EEXI) the Energy Efficiency Operational Indicator (EEOI) and Carbon Intensity Indicator (CII) to ensure compliance with the IMO."

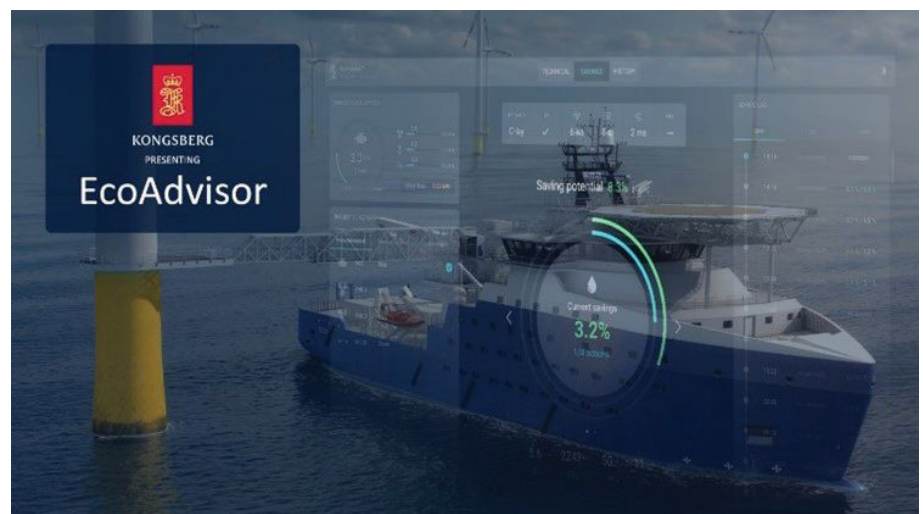
EcoAdvisor™ works by collecting and analyzing real-time data from various systems onboard. These include dynamic positioning (DP), integrated automation systems (IAS), navigation and power management systems (PMS). This data is passed through a non-linear optimization solver to find the optimal set up of the power plant for the current environmental conditions, considering the demand from various consumers including thrusters, mission equipment and hotel loads. The optimal load reference for engines and state of charge reference for batteries is computed based on their efficiency and power loss.

Based on this analysis, operational advice is provided to the Captain, DP operator and Chief Engineer as to what machinery (engines, batteries and thrusters) can be

stopped to run the vessel more efficiently and sustainably. This advice is dynamic—if a change in the mean weather conditions (wind, wave and current), power plant system or DP system settings is detected, EcoAdvisor™'s recommendations will be revised accordingly. All advice is backed up by a system overview indicating why these changes are desirable, how any steps will alter the balance between efficiency and redundancy margin, and what the real-time effect of the measures are.

EcoAdvisor™ includes a Voyage Energy Calculator (VEC) feature for transit operation. This helps the operator to determine the total energy consumption for varying speed profiles including added resistance due to wind, wave and current for selected routes based on the weather forecast. This allows operators to decide the optimal speed with minimum fuel energy consumption for a specific trip, according to their departure/arrival time requirements.

Utilizing EcoAdvisor™'s innovative features on the optimization of the use of generators, thrusters, and the setup of the power plant, while maintaining and ensuring safety during DP operations, DOF currently has 'Intelligent Efficiency' pilot schemes running on two vessels (*Skandi Vega* & *Skandi Africa*) and are expecting positive data from these.



CHECK THE TECH



RELIABLE RADAR LOCALIZATION FOR ASVs IN GNSS-LIMITED MARINE ENVIRONMENTS

Understanding the precise location of an Autonomous Surface Vessel (ASV) is critical to its safe and successful navigation. Traditionally this has relied on Global Navigation Satellite System (GNSS) to provide positioning to a few meters. However, issues with multipath, jamming, spoofing, and solar activity can hinder GNSS accuracy, calling into question its reliability for truly autonomous operations.

With traditional marine radar failing to provide the cm-level of accuracy required for autonomy, many ASV developers are now looking at camera and LiDAR technology thanks to their successful application in land-based autonomy projects. However, cameras perform poorly in the unfavorable weather, common at sea, and LiDAR lacks the sufficient range required for full marine autonomy.

USV/AUV developers need a sensor that can accurately provide GNSS-denied positional information, whilst being resilient to changes in external conditions.

THE VALUE OF RADAR

Navtech Radar recently developed a radar-based approach to autonomous navigation that utilizes W-band radar (76-77GHz). The solution is known as Terran360 and is the world's first single-sensor radar localization solution. Unlike typical marine radars that use X-band (8-12GHz) frequency, Navtech's millimeter-wavelength radar provides greater resolution, resulting in a rich data source to build up a clear picture of the local environment. Terran360 combines Navtech's high-resolution sensor with Oxboticas best-in-class radar localization algorithm.

Terran360 builds a high-resolution map of the environment using radar data to extract key natural landmarks. This allows a vessel to position itself to cm-level accuracy, using a single Navtech radar, making Terran360 the ideal localization solution in GNSS-denied environments such as ports or inland waterways.

TERRAN360 IN ACTION

Navtech Radar recently conducted field testing of Terran360 in Devon, UK. Localization accuracy for the trial was directly compared to onboard GNSS with correction services. One traversal of the designated route was completed to build up a map of the environment using radar data. Subsequent runs of the same route were then completed in order to localize against it. Terran360 uses around 10 MB/km of space for map building, meaning that only less than 3.5 GB of space would be needed to map the whole of the River Thames.

Navtech concluded from these results that Terran360 was able to accurately determine vessel position to less than 10 cm throughout the journey when compared to the onboard GNSS. Navtech also noted that the system was able to localize in instances where landmarks were often over 250 m away.

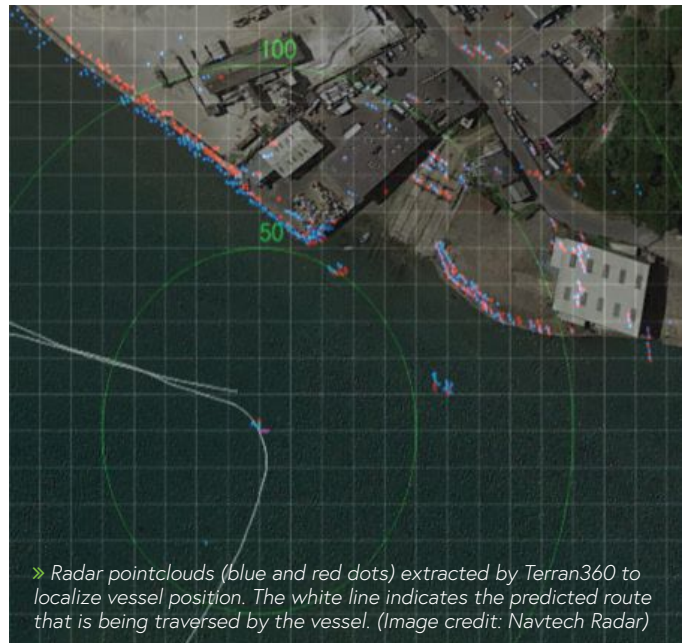
SCALING AUTONOMY

As marine operators look to scale their autonomy projects, Navtech Radar is currently working with early adopters to carry out full trials of Terran360 and demonstrate how the easily integrable technology outputs its position over a standard NMEA UDP string. By fusing Terran360's radar map with GNSS, the system can output positional information in a UTM frame of reference.

To find out more, visit: www.navtechradar.com.



» Vessel used for data collection trial, fitted with a Navtech radar. (Photo credit: Navtech Radar)



» Radar pointclouds (blue and red dots) extracted by Terran360 to localize vessel position. The white line indicates the predicted route that is being traversed by the vessel. (Image credit: Navtech Radar)

COLLABORATION FOR TECHNOLOGY TRANSFER OF UNDERWATER DIGITAL SIGNAL PROCESSING TECHNIQUES

CSignum Ltd., a global leader in wireless underwater communications, asset digitization, and actionable insights for ocean and freshwater industries, has completed a two-month research project in underwater wireless communications with Newcastle University, renowned for its leadership in underwater acoustic communications research.

CSignum is preparing in coming months to commercially test and launch its HydroFi Modem, the first reliable point-to-point wireless radio communications system that enables the transmission of data through the water-air boundary. Led by Newcastle University Professor Jeffrey Neasham and CSignum CTO Mark Rhodes, the knowledge exchange and research project focused on increasing the HydroFi™ Modem communications data rate and transmission distances from underwater to above water receivers, as well as improving battery life for real-world deployments.

"We were able to significantly improve the amount of fixed data we could transmit in a



» HydroFi™ Modem enables the transmission of data through the water-air boundary. (Photo credit: CSignum)

shorter time by using a faster data rate," said CSignum CTO Mark Rhodes. "This means our modems are powered on for a shorter period and so will use less power to communicate a given data payload. This will be of great benefit in terms of how operators choose to allocate resources to remotely deploy and service the HydroFi modems and receivers in ocean observing, environmental monitoring, aquaculture, renewable energy, and oil and gas environments."

"In addition, we improved the HydroFi communication waveform, coding and receiver structure to deliver greater robustness against local

sources of electromagnetic interference," said Professor Neasham of Newcastle University. "All radio systems need to be compatible with the electromagnetic environment generated by local elements of integrated systems and natural atmospheric sources. Another strength of the HydroFi Modem is that it is not affected by rough sea states, turbid conditions, or shallow water splash zones."

CSignum intends to continue its successful collaboration with Newcastle University to enhance future versions of the HydroFi radio modem and incorporate resulting breakthroughs into the

technology roadmap. On completion of the project, the collaborative team identified some clear ideas for future development in the areas of power consumption and advanced DSP techniques, which will further extend the product performance envelope.

As a result, CSignum and Newcastle University efforts will build on their respective IP portfolios. CSignum currently has 22 granted and in-force patents, with further pending patents, in such areas as bidirectional water-to-air and air-to-water wireless communications, automation, antenna design, remote command and control, adaptive bandwidth, redundancy and failover, and low power management. These technologies are designed to deliver sensor data through the water-air boundary, water column, seabed and subsea structures. As a result, operators in ocean observing, environmental monitoring, aquaculture, renewable energy, and oil and gas will be able to modernize their infrastructures with digitized, real-time data to make smart decisions.

SAAB SEAEYE PARTNERS WITH NEKTON MALDIVES MISSION

A Saab Seaeeye Falcon underwater robotic vehicle will join a fleet of submersibles on the Nekton Maldives Mission to help the Maldives Government carry out the first systematic survey and sampling of the Maldives from the surface to 1,000 meter depths.

As an official partner, Saab Seaeeye has donated the use of a Seaeeye Falcon to work alongside human-occupied

submersibles, autonomous systems and research technologies.

The Maldives state is 99% ocean and 1% land, sitting on average 1.5 meters above sea level. As a result, the nation faces a growing threat from rising seas.

For the first time, the mission will establish a 'baseline health check' on the status of the Maldives ocean

and provide data to scientists and policy makers worldwide to enable the protection of critical nurseries, spawning habitats and related ecosystems.

The Nekton Maldives Mission, September 4 to October 7, will help create extensive new protected marine areas and ensure the ocean continues to provide for the Maldivian people.

CSA OCEAN SCIENCES COMPLETES ECOLOGICAL ASSESSMENT FOR GULF OF MEXICO FISHERY MANAGEMENT COUNCIL

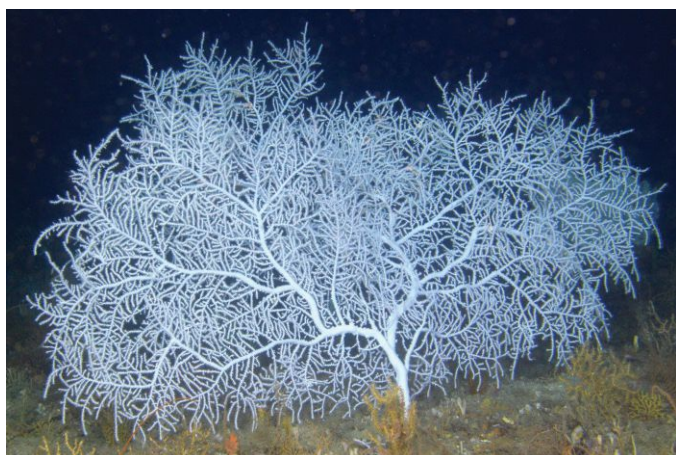
CSA Ocean Sciences Inc. (CSA), an international marine environmental consulting and survey company, has released details of an important marine environmental study to evaluate coral and coral-related habitats (sites) considered to be Habitat Areas of Particular Concern (HAPC) in the northern Gulf of Mexico on behalf of the Gulf of Mexico Fishery Management Council (Council).

The objective of the project was to carry out a scientifically robust ecological assessment of target HAPC—areas initially identified by the Council's Coral Working Group in 2014 but extended following further analysis by the Council's Coral Advisory Panel and Coral Statistical and Scientific Committee in 2021—and establish a

means of prioritizing which sites would benefit from protective intervention measures and ongoing mitigation. This work centered around a site-specific and comparative review of potential risks to mesophotic corals (found in water depths of 30 to 150 m) and deep-water corals (deeper than 150 m) in federal waters of the Gulf of Mexico, from 9 to 200 nautical miles offshore.

"Corals and coral reefs are far more widely distributed in GOM waters than previously understood, so accurately mapping these habitats and understanding how they impact the broader benthic ecosystem are essential steps in determining the most appropriate sustainability practices or interventions," said Project Manager Steve Viada. "As well as providing essential insights into the impacts that coral communities have on critical fishery species found at the sites, the research profiled the sensitivity of certain corals to disease and other notable shifts in environmental factors."

The work was underpinned by a comprehensive literature review of the selected coral sites, including a compilation of the most up-to-date information about deep reef corals, coral diversity, and other benthic habitat attributes found in the GOM; the design and preparation of a systematic framework for general ecological assessment across sites; and the creation of an exclusive geodatabase of project-related spatial data supported by a web-based dashboard designed to help the Council validate key management and mitigation decision making and for general outreach purposes.



MIROS WINS TRIO OF SENSOR CONTRACTS WITH SUBSEA 7 PIPELAY SUPPORT VESSELS

Miros Group has secured a trio of three-year agreements with Subsea 7 to install its internet of things (IoT) dry-sensor WaveSystem.

As part of project requirements for the monitoring of wave and current to a water depth of 10 m, WaveSystem will be installed on three of Subsea 7's pipelay support vessels—Seven Waves, Seven Rio and Seven Sun—alongside access to Miros Cloud services delivering real-time sea state data. The award for Miros follows an agreement between Subsea 7 and Petrobras in Brazil for new long-term, day-rate vessel contracts.

Each contract comprises a three-year period plus a subsequent one-year option. The contracts are due to commence between Q1 and Q3 2022.

Andrew Wallace, Miros' VP Offshore Solutions commented: "We are thrilled to expand our services further to Subsea 7 by equipping Miros WaveSystem to the Seven Waves, Seven Rio, and Seven Sun vessels."

"This is a testament to Miros' expertise and reliability in delivering accurate wave measurements via our cloud-based graphical user interface (GUI) Miros.app. Providing Subsea 7 access to real-time wave and current data which can be shared across departments is an important function for both onshore and vessel-based personnel and key to ensure safe and efficient operations at all times."

Filipe Salvio, Operations Manager at Subsea 7 added: "The cloud-enabled WaveSystem onboard our three pipelay support vessels

allows us to deliver the best service to our customer independently of offshore weather conditions. This system provides us with accurate wave, current and speed through water data granting us to work safe, precise and highly effective at all times."



» Pipelay support vessels (PLSV) Seven Waves, Seven Rio and Seven Sun. (Image credit: Subsea 7)

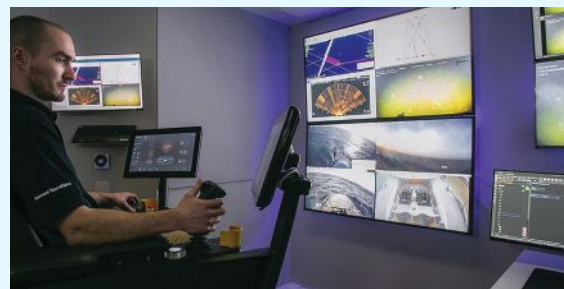
FUGRO AND OCEAN INDUSTRIES CONCEPT LAB UNIFY OFFSHORE CONTROL SYSTEMS FOR REMOTE OPERATIONS

Research teams from Fugro and the Ocean Industries Concept Lab (OICL) at Oslo School of Architecture and Design have been exploring how best to harmonize maritime design by integrating digital innovation in next-generation workplaces for safe remote operations. Simplified, standardized control interfaces will enhance training, remove the potential for error and enable operators to successfully perform remote operations.

Fugro and OICL have been exploring the application of the open-source OpenBridge user interface design system to streamline available solutions at sea and on land. Although remote

operations are bringing important new efficiencies to the maritime industry, if they require the integration of multiple systems from different suppliers, they can be very complex to use. With the expanding pool of assets being utilized from Fugro's remote operations centers this standardized interface will ensure consistency and promote safe and efficient operations.

OICL's Professor, Kjetil Nordby said: "The collaboration with Fugro has allowed us to accelerate the expansion of the OpenBridge platform to new maritime applications. In addition, we have a strategy of supporting all ocean industries workplaces at sea and on land,



» Fugro and OICL have been exploring the application of the OpenBridge user interface to facilitate remote ops. (Photo credit: Fugro)

and direct collaboration with industry leaders such as Fugro helps us accelerate OpenBridge growth."

Peter Looijen, Fugro's Director of Innovation in Europe added: "As Fugro continues to deliver innovative solutions, ensuring a common control interface promotes multi-asset operations. Through our work with OICL we have improved business efficiencies and witnessed the positive impact of next-generation user interface integration."

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MANAGING OFFSHORE OPERATIONS FROM AN ONSHORE COMMAND CENTER

By Mark Philip, Nick Rouge, Kenneth Solbjør, and Christopher Lyon



There are many benefits for transferring control of offshore ROV operations to shore to carry out subsea tasks from survey to inspection and commissioning.

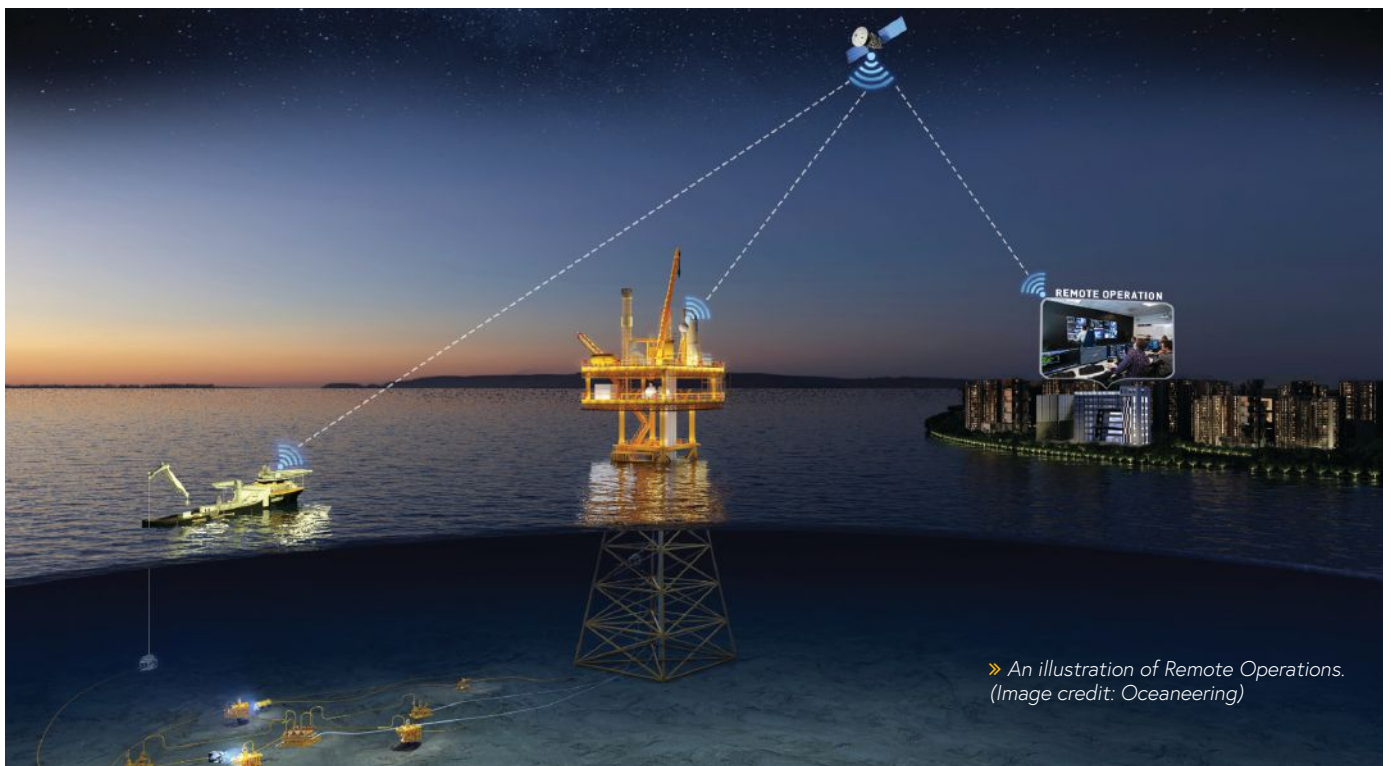
Working from a remote onshore-based location eliminates offshore and transportation safety exposure for the shore-based team and allows for the transition from 12-hour operations to 24-hour without the need for additional personnel mobilization.

The flexibility provided by operating from Oceaneering's Onshore Remote Operations Centers (OROCs) has been key to responding to unforeseen changes in the end users'

operations. For example, subsea specialists are often required to go offshore, but typically spend several non-productive days on the asset waiting to conduct the operation for which they were needed, due to logistics and scheduling uncertainty. Remote piloting of ROV systems from shore eliminates this downtime and enables teams to optimize the use of specialist oversight, many times across multiple operations—all from a single location.

REMOTE PILOTING AND THE FIRST OROC

Oceaneering completed its first proof-of-concept remote piloting demonstration in 2004, when an ROV in the North Sea was controlled from our office in Stavanger, Norway.



» An illustration of Remote Operations.
(Image credit: Oceaneering)

In 2015, in response to increasing demand from customers to reduce offshore headcounts, Oceaneering opened its first OROC in Stavanger. This state-of-the-art facility has grown to include five operations rooms, allowing simultaneous operation of up to six ROV systems offshore, as well as providing office and lounge facilities for visiting customers. There are plans to add two additional operating rooms due to rising demand.

A key enabler for remote piloting from the Stavanger OROC is the extensive LTE data network established in the North Sea. This high bandwidth, low latency data network is ideal for remote operations. All but two percent of remote activity in the North Sea has been executed using the LTE network, demonstrating the coverage's reliability. Offshore LTE networks are now appearing in other regions, including the Gulf of Mexico (GoM), Canada, Guyana, and Brazil. Starlink satellites will further enhance offshore connectivity and we plan to begin testing and qualifications as soon as it is available.

CROSS-BORDER REMOTE PILOTING

In the summer of 2021, Oceaneering worked with a client in the UK to successfully conduct the first onshore remote piloting of an ROV offshore West of Shetland. It was also the first commercial cross-border implementation due to the pilots being stationed in our Stavanger OROC.

Oceaneering and the client worked together to ensure secure offshore connectivity for the remote operations. This involved close collaboration between Oceaneering and the client to establish a bridge between the data networks of both companies, without compromising their respective cyber security policies. The result of the collaboration established a secure data link via subsea optical fiber to the worksite offshore.

Oceaneering was tasked with observing drilling operations at 141 m water depth. The Stavanger-based team operated the ROV for over 70 hours during the campaign program with 100% uptime.

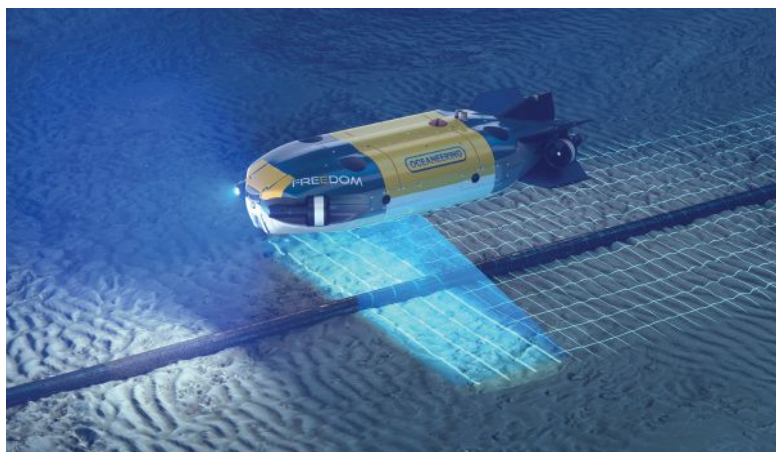
REGIONAL EXPANSION AND REDUNDANCY

In 2020, a second OROC facility was opened in Morgan City, Louisiana, with the capacity to support simultaneous operation of up to four ROV systems. Its primary function is to support remote ROV operations in North and South America. However, the facility offers important redundancy for remote ROV operations, as each of our OROCs can quickly assume the duties of its counterpart in the event of unexpected power or data outages.

In 2021, the Morgan City OROC conducted the first commercial remote piloting of an ROV in the Gulf of Mexico (GoM) using the customer's existing data communications infrastructure, which included a high-speed microwave link to a tension leg platform (TLP) offshore.



» A pilot conducts a remote ROV operation from our OROC in Stavanger. (Photo credit: Oceaneering)



» The remote deployment of a Freedom™ AUV helps streamline mobilization, reduce HSE risks to personnel, minimize environment footprint, and make subsea work more efficient. (Image credit: Oceaneering)

A proprietary remote piloting package was installed by the ROV crew onboard the asset in the GoM. This package established a secure communications link to shore, which was used to transmit video, audio, and control data. By using OROC-based pilots, the customer successfully completed the work scope while reducing overall headcount offshore, thereby reducing HSE exposure and offshore mobilizations.

In the summer of 2022, Oceaneering carried out a successful remote inspection scope in the GoM for a pipeline operator, leveraging the expanding and improved LTE coverage in the region. The customer approached Oceaneering to complete an inspection scope that included remotely collecting cathodic protection (CP) readings of their subsea assets.

The Oceaneering team used the *Brandon Bordelon* multi-service vessel to launch a Millennium® Plus ROV system equipped with a manipulator-held CP reading tool. The customer's representatives witnessed the operation from the Morgan City OROC. All activities were streamed and made available to approved global viewers via Oceaneering's Media Vault cloud-based data management solution.

The data gathered confirmed the integrity of the inspected subsea assets, and further confirmed the viability of using LTE to support remote operations in the GoM.

In Q4 2022, Oceaneering plans to open a third OROC facility in Aberdeen, Scotland.



» A pilot and other optional personnel oversee remote ROV operations from an Oceaneering Onshore Remote Operations Center (OROC) in Stavanger, Norway. (Photo credit: Oceaneering)

TRAINING FOR THE NEW WAY OF WORKING

Remote operation of an ROV introduces new challenges for pilots, in particular the added latency inherent in long-distance data links. As a result, Oceaneering developed a competency program that teaches pilots how to:

- Mitigate the effects of latency
- Safely pass control between local and remote consoles
- Collaborate on control e.g., one pilot flies and the other operates manipulator
- Effectively communicate when not co-located
- Safely manage unexpected loss of communication.

CONNECTING TODAY WITH TOMORROW

Collaboration between service companies and operators has led to the successful implementation of remote ROV operations in Europe and the US GoM. This approach has brought benefits such as reducing HSE exposure to personnel and providing leadership in operations that are now the norm.

The biggest challenge in moving ROV control to an onshore facility has historically been the data communications path. Communications infrastructure offshore has greatly improved over the past 10 years, with optical fiber cables and LTE networks becoming more widely available, especially in the North Sea and GoM. On projects where existing communications infrastructure is insufficient, Oceaneering can install a fully redundant satellite agnostic intelligent link (SAIL) to ensure 99.9% uptime for data communications.

As a result of this connectivity, remote operations have grown exponentially over the past three years and Oceaneering recently surpassed the significant milestone of 85,000 hours of remote ROV operations, with half of this total occurring in 2021 alone.

It means Oceaneering Remote Operations has moved 7,083 offshore personnel days to onshore, contributing to a significant reduction in personnel on board (POB) for our customers.

Oceaneering remains focused on advancing ROV and automated vehicle systems to realize a reduced carbon future. Remote operations play an important part in lowering carbon footprints associated with offshore energy generation. Our Liberty™ E-ROV and Freedom™ AUV systems further the goals of streamlining mobilization, reducing HSE risks to personnel, reducing environment footprint, and making subsea work more efficient. Furthermore, we continue to advance a new generation of ROVs designed specifically with remote operations in mind.

With our investment in technology and facilities, Oceaneering is fully committed to maintaining its position as the leading provider of remote ROV and Survey services. For more information, visit: www.oceaneering.com.

WHOI ENGINEERS WORK TO ADAPT SWARMING CAPABILITIES FOR LOW-COST UUVs

In aerial and terrestrial applications, robotic swarms allow for mission adaptability, robustness, and scalability. In aerial and terrestrial applications, access to GPS data and high-speed communications allows robotic swarms to operate functionally; however, expanding swarming capabilities below the ocean surface remains a significant challenge.

Implementing swarming techniques for underwater missions requires structured, accurate clocks and communications and localization systems. Additionally, many swarming methods currently available configure the swarm as individuals in a group and require each vehicle to operate independently within the group. Instruments needed for successful underwater swarms are often costly and unsuitable for smaller, less complex UUVs.

Users in these fields are often constricted by operational and financial means, limiting the quantity and types of equipment used. Available, inexpensive UUVs do not have the sophisticated navigation and positioning systems available to larger, more expensive UUVs, making it operationally difficult to operate and locate underwater. Introducing swarming activities for low-cost UUVs could enable other users in areas such as scientific research and environmental monitoring to survey and monitor complex phenomena in the ocean more effectively.

Woods Hole Oceanographic Institution (WHOI) engineers have been working to open swarming capabilities to more end users. Their work combined two previous projects, single-beacon navigation and single-element positioning, to create a coordinated structure. In the structure, the swarm has one "leader" whose location is known and multiple "followers" who passively listen to the leader using simple, inexpensive hydrophones.

WHOI Research Engineer, Nicholas Rypkema, who has been part of the group innovating multi-vehicle missions underwater, highlights the benefits of low-cost swarming. The main benefits to users include the ability to complete missions

more quickly, retain more data, lower operating costs, and reduce acoustic transmissions.

"Our single-leader approach brings truly cooperative swarming to the underwater environment in a scalable, easy-to-operate way and reduces the use of acoustics so as not to interfere with acoustics-based sensors and communications," said Rypkema. "By keeping system cost in line with the cost of available inexpensive UUVs, multiple vehicles could be used to reduce the time and expense of current missions; and we can open up a number of novel underwater swarm applications that would be difficult to perform using a single vehicle, such as sampling ocean phenomena that vary over time and space, or acoustically tracking man-made or biological underwater targets."

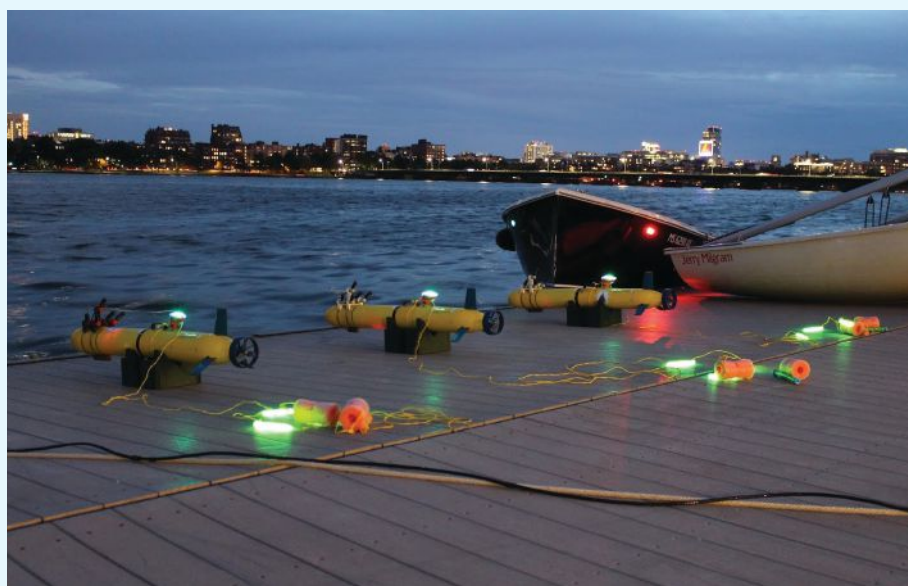
Because these methods are less complex than currently available solutions, users could scale swarms from anywhere between 10 "follower" vehicles to 100s of "follower" vehicles. In addition, Rypkema states the next phase of research could include breaking down large swarms into smaller swarms where operators could program vehicles to sample and monitor within specific determined areas—further

aiding users in understanding the complex environment below the ocean surface.

For more information or to inquiry about licensing opportunities, please contact: Allison Markova, amarkova@whoi.edu.



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» UUV swarms allow operators to optimize mission efficiency, retain more data, lower operating costs, and reduce acoustic transmissions. (Photo credits: Nicholas Rypkema/WHOI)



» Watbot, a fish cage cleaning robot will use M16, Water Linked's new M64 modem. (Photo credit: Watbot)

WATER LINKED TO SUPPLY UNDERWATER COMMUNICATIONS TECHNOLOGY TO WATERBOTS

Watbots has appointed Water Linked as their supplier of underwater communication technology. This newly developed iteration of the M64 modem, called the M16, will enable the Watbot, the most advanced fish cage cleaning robot on the market, to communicate natively with the base station without signal interference.

Watbots is working to redefine the aquaculture net cleaning process with the development of a unique, autonomous robot.

A critical requirement for this innovative concept is that there is a reliable acoustic connection between all the robots working in the farm and their base station.

While Water Linked already had a highly reliable acoustic solution, known as the M64 modem, this unit had a number of limitations with regard to Watbots' needs. Watbots required the modem to be smaller, operate on lower power, offer increased range, have no export restrictions, and provide the highest level

of dependability in a data connection.

With up to 12 robots working in a fish farm at any given time, ensuring that there is no interference created by multiple robots communicating at the same time is of high importance.

The M64 modem has a proven track record operating in the most challenging of environments and was the basis in the development of the recently released Water Linked CageSense™ solution.

Watbots carried out trials of the Modem M64, which combined with reviewing the CageSense™ performance data provided them with the assurance that Water Linked could meet their needs and develop a new modem that would work to meet their specific requirements.

The first delivery of the new M16 modem will take place early in 2023.

Håvard Lillebo, CEO of Watbots, commented: "A robust communication is critical to our solution and working closely

with a proven technology innovator such as Water Linked provides the reassurance required for this key part of our unique solution. We feel this partnership will benefit both companies and reaffirm Norway as a leader in bringing exciting new technology to the underwater industry."

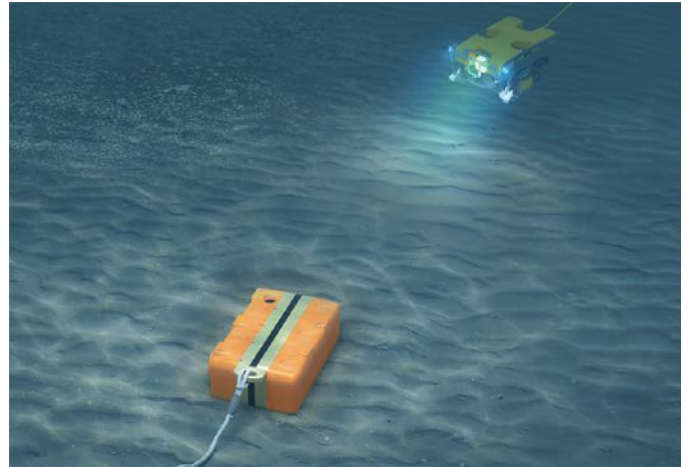
The M16 will benefit from the latest advances that have been integrated into CageSense™ and will provide the subsea industry with an unrivalled acoustic modem for use in the most challenging of environments.

Scott McLay, CEO of Water Linked, stated: "We are all very excited to work with Watbots, a company that aims to set the next industry standard for daily net cleaning and inspection. This requirement has given Water Linked the opportunity to further develop our acoustic modem platform and set a new standard in robust underwater communication."

SERCEL MAKES ANOTHER MAJOR SALE OF NODAL OBN SOLUTION

CGG has announced that Sercel has sold a second batch of 12,000 GPR300 nodes to BGP Inc., following their earlier major order of 18,000 GPR300 nodes in 2021. This represents a significant increase in the seismic survey equipment currently being deployed on a project in the Middle East. Impressed by the performance of the GPR300, the crew expects a further improvement in productivity. Now deploying a total of 30,000 GPR300 nodes, the operation is considered the largest seabed seismic exploration project to date and demonstrates Sercel's ability to provide state-of-the-art seismic acquisition solutions for even the very largest OBN projects.

Liu HaiBo, BGP Offshore President, commented: "First results have clearly shown the GPR300's efficiency in the shallow water environment and its added value for high-precision subsurface imaging. For these reasons, it seemed obvious to continue and widen our collaborative work with Sercel to provide essential support to our client for its upcoming challenging projects."



» GPR300 deployed by a ROV. (Photo credit: Sercel)

Emmanuelle Dubu, Sercel CEO, added: "This new major sale of our GPR300 solution featuring QuietSeis®, the most accurate sensor in the industry, reaffirms the confidence that BGP and its client have in our solutions. Sercel is always attuned to the market's needs and strives to develop and introduce innovative technologies well ahead of the curve and act as a pioneer in the field of ocean bottom nodal acquisition."

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AUGUST COMMODITY PRICES HIGHLIGHT UNSETTLING NATURAL AND MARKET FORCES



By G. Allen Brooks
*Expert Offshore Energy Analyst
& ON&T Contributor*

CRUDE OIL:

In financial markets, August is known as the Dog Days of Summer because it is traditionally the vacation month resulting in fewer active traders and reduced liquidity. Those forces often contribute to increased market volatility, which magnifies price moves whenever market and geopolitical events strike. August 2022 has witnessed this phenomenon, especially for oil prices.

August was the third consecutive month marked by falling crude oil prices. In early June, WTI was in the \$120 per barrel range. It ended August below \$90 and has continued to decline. The primary driver for lower oil prices is growing concern about weakening economic activity, with the primary culprit China, who continues engaging in economic lockdowns to curb COVID-19 virus outbreaks. The result has been sharply lower Chinese oil and gas demand, easing the world's supply/demand balance, as manufacturing and transportation suffers.

Oil traders pay attention to economic news, as well as declarations from political and monetary leaders about what policy actions are needed.



» *Oil price volatility continues to be influenced by geopolitical uncertainty.*

Inflation, partially boosted by high oil, natural gas, and electricity prices, is reaching unacceptable levels in economies necessitating drastic government action. Central banks are the focal point of these actions. Monetary authorities across the developed world are lifting interest rates, their primary lever for influencing economic activity, to cool demand, while also hoping supply chain improvements will add supply. This is the traditional inflation playbook, but it usually leads to harmful recessions.

As rates reach levels not seen in years, businesses are forced to adjust operations and strategies in the new world that imposes higher capital costs. Today is a different business world managers are learning to navigate than the world in which they were raised. Adding to these pressures, geopolitical events have become more disconcerting. The Russia/Ukraine conflict continues upsetting economies and energy markets across Europe. The political tensions between China and the U.S., exemplified by the military harassment off Taiwan and throughout the South China Sea, have the world on edge. Unknown outcomes are disconcerting.

Uneven economic statistics—some positive and others negative—grab the business news headlines. Trader and investor emotions oscillate in response creating oil price volatility. In August, within the downward price trend, the month started with WTI at \$94, but fell to \$88.50 three days later only to jump back to \$94 seven days afterward. Five days later, prices were down to \$86.50 before climbing back to \$97 thirteen days afterward. The month ended with WTI barely under \$89, an overall decline of five percent, but with considerable volatility.

We doubt Labor Day will usher in more clarity about economic and geopolitical trends. As we move closer to winter, the potential for significant human suffering in Europe grows as it transitions from heavy dependence on cheap Russian fossil fuels and institutes its December Russia oil ban. Will social unrest over the cost of this transition emerge? How will governments react?

Recession uncertainty needs resolution before forecasters can assess the magnitude of demand destruction and plot a path to recovery. Expect oil prices to remain volatile with a near-term downward bias, but they are likely to end 2022 higher.



» While the Atlantic Basin hurricane season has been unusually quiet to date, heatwaves across the US have continued to drive domestic demand, with EU countries still scrambling to sure up supplies.

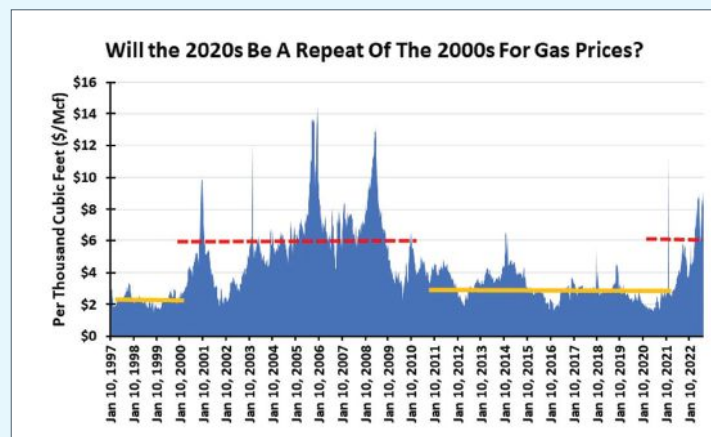
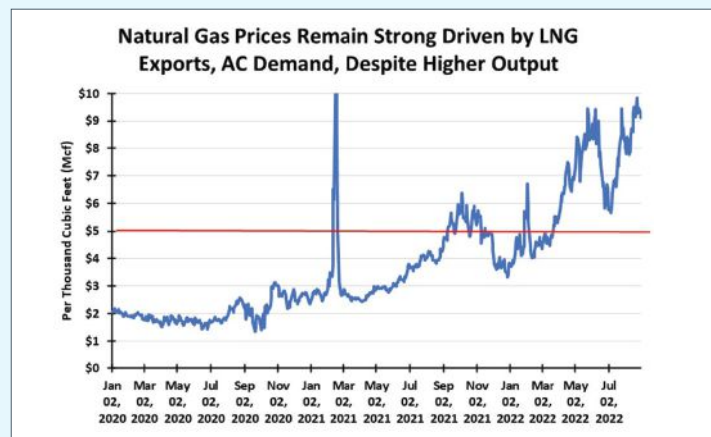
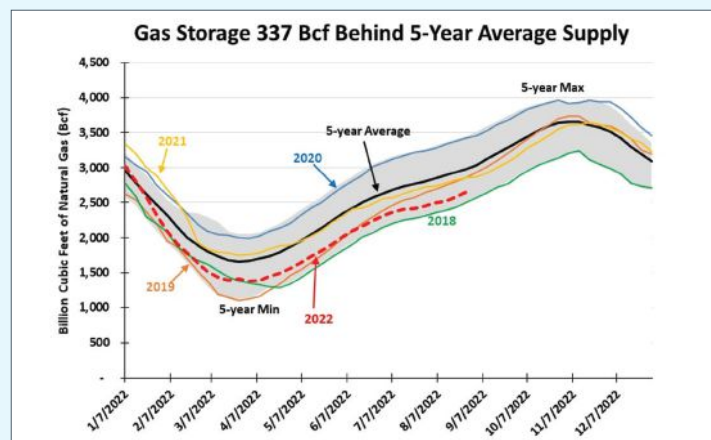
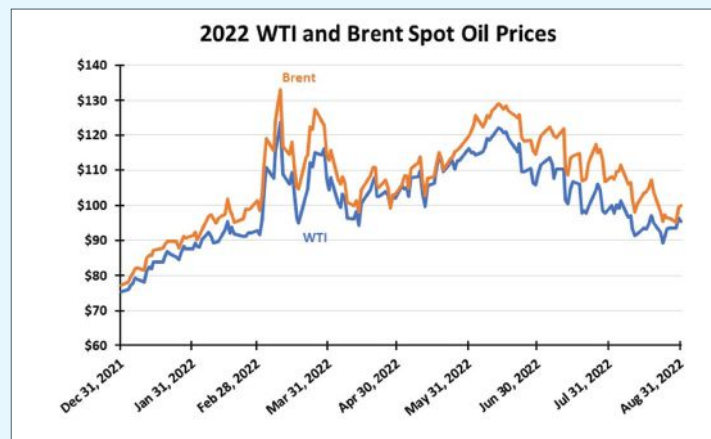
NATURAL GAS:

Natural gas prices have exploded to levels not seen since the The natural gas market remains all about summer heat, Europe's gas storage needs, and hurricanes. Two of those factors have driven domestic gas demand higher, lifting gas prices. Hurricanes have had no effect but are always a threat. The 2022 Atlantic Basin hurricane season is off to its slowest start in 30 years. The absence of a named tropical storm between early July and the end of August is only the fifth time since 1950 (1962, 1967, 1977, 1982, 2022) such an event has happened. Although good news, we are reminded it only takes one storm landing in the wrong location along the Gulf Coast to disrupt gas supply and liquified natural gas exports.

The LNG export business continues operating at capacity as European gas prices remain 6-8 times higher than U.S. Henry Hub prices. After climbing steadily from spring through summer, Germany and several other European countries have announced their winter storage rebuilds are ahead of schedule. The European Union has mandated its members rebuild their winter storage to 90 percent of capacity by November 1. The early success announcements, combined with reports the EU will intervene in energy markets to lower prices and ease the financial pain for families, caused European gas prices to drop by 20-30 percent. Energy traders are anticipating less LNG being purchased by European utilities in the next few weeks. It does not mean the end of the winter energy crisis. In past winters, meeting heating and electricity demands necessitated not only all gas storage volumes but also maximum Russian gas supplies. The latter supply has declined and potentially may stop this winter, which will pressure European energy markets and economies with unknown outcomes.

Domestically, natural gas prices are driven up by the extended heat waves rolling across the country. They have boosted air conditioning demand and caused grid operators to warn customers to limit their use to avoid facing rolling blackouts to manage demand. Wellhead gas prices are at levels last seen in the 2000s that kicked off the gas shale revolution. The new supply drove gas prices down, promoting gas exports via pipeline and LNG. American natural gas has eased the world's gas shortage. Continued global demand growth sets the stage for additional U.S. LNG export terminals and expanded shipments.

Given current weather patterns and continued high LNG export volumes, unless natural gas production explodes to the upside (not likely), Henry Hub prices will remain elevated. The impact of high gas prices on economies is still less understood than the impact of high crude oil prices, so the future remains cloudy.





» CAPHiWave-5 Project is a grid connected demonstration wave farm. (Image credit: CorPower Ocean)

CORPOWER OCEAN COMPLETES PORTUGAL TEST SITE PREPARATION AHEAD OF MARINE INSTALLATIONS FOR HIWAVE-5 PROJECT

CorPower Ocean has completed the substation and site preparation work in Portugal ahead of marine installations for its flagship HiWave-5 Project, developing a grid connected demonstration wave farm.

The site located off the coast of Aguçadoura, south of Viana do Castelo, is now ready for the export cable installation.

Groundwork involved horizontal direction drilling for the pre-installation of a cable conduit in a work package delivered with local supply chain partners. It was carried out following a rigorous review and authorization process involving Portuguese national and regional authorities.

CorPower Ocean Portugal Managing Director Miguel Silva said careful attention was paid to the on-land preparation work in full dialogue and collaboration with the local community.

"Working alongside our local partners we identified the horizontal directional drilling process, to pre-install a cable conduit under the beach dunes at proper depth, as the most effective approach to minimize impact on the local habitat," said Mr. Silva.

"This method ensured we could avoid trenching from the on-land substation, located within the sand dunes, through to the beach to allow cable pulling from the ocean into the substation. The approach chosen also minimized disruption for the local community and tourists, avoiding the use of excavators and open trenches. We place great importance on our environmental stewardship role engaging with all stakeholders from the outset to ensure the most appropriate measures to protect and respect the ocean, nearshore environment, and all species living there."

CorPower Ocean's next generation commercial-scale C4 WEC (Wave Energy Converter) is currently being constructed in Portugal and Sweden. Working in collaboration with several utility companies, it will be used to form part of a larger four-system array. In preparation for the upcoming marine deployment, CorPower Ocean has also teamed up with international marine energy R&D consultancy WavEC Offshore Renewables to develop a robust offshore environmental monitoring system.

"A sophisticated environmental monitoring system has now been deployed at the HiWave-5 test site, 4km off the coast of Aguçadoura," said Enric Villarín, Project manager at CorPower Ocean. "This equipment, including F-pods and hydrophones, are recording baseline measurements, that are retrieved periodically, to assess the acoustic profile of our technology prior and post marine installation. Cetaceans visual monitoring campaigns are also executed to monitor that our technology is not affecting these mammals negatively. To obtain real-time sea states characterization, wave measurement buoys have been deployed and are sending live data to our servers regarding, height, period and direction of the incoming waves. This is an extension of the environmental efforts ongoing within the project over the last years, and has involved considerable engagement with the local community, most notably the fishing sector which is actively helping with the work."

CorPower Ocean is working to successfully introduce certified and warranted WEC products to the market, making wave energy a bankable technology to attract mainstream renewable project finance and drive rapid deployment scale-up to address climate change.

EQUINOR AND WINTERSHALL DEA TO COLLABORATE ON LARGE-SCALE CCS VALUE CHAIN IN THE NORTH SEA



Equinor and Wintershall Dea have agreed to pursue the development of an extensive Carbon Capture and Storage (CCS) value chain connecting continental European CO₂ emitters to offshore storage sites on the Norwegian Continental Shelf.

- Comprehensive CCS project that connects Germany and Norway
- CO₂ transportation from continental Europe and storage on the Norwegian Continental Shelf
- Estimated pipeline capacity of 20 to 40 million tonnes per year by 2037
- Reconfirming the companies' commitment to meeting EU climate targets

The Norwegian-German (NOR-GE) CCS project has the ambition to make a vital contribution to reducing greenhouse gas emissions in Europe aiming to establish the value chain and infrastructure for the safe transportation, injection, and storage of CO₂ in suitable reservoirs on the Norwegian Continental Shelf.

"This is a strong energy partnership supporting European industrial clusters' need to decarbonize their operations. Wintershall Dea and Equinor are committed to the energy transition and will utilise

the competence and experience in both companies to work with governments and partners to help reach the net-zero target," said Anders Opedal, CEO and President of Equinor.

Through the partnership, both companies are responding to the European demand for large-scale decarbonization of carbon-intensive industries that need safe and large-scale underground CO₂ storage to abate unavoidable emissions from their processes. The partnership intends to connect Germany, the largest CO₂ emitter in Europe, and Norway, holding Europe's largest CO₂ storage potential.

"Wintershall Dea and Equinor will work together to establish technical and commercial solutions for the development of cross-border CCS value chains in Europe and work with governments to shape a regulatory framework that can enable it. We will build on our close cooperation and open the next chapter of German-Norwegian partnership," said Mario Mehren, CEO of Wintershall Dea.

An approximately 900-kilometer-long open access pipeline is planned to connect the CO₂ collection hub in Northern Germany and the storage sites in Norway prior to 2032. It is expected to have a capacity of 20 to 40 million tonnes of CO₂ per year—equivalent to around twenty percent of all German industrial emissions per year. The project will also consider an early deployment solution where CO₂ is planned to be transported by ship from the CO₂ export hub to the storage sites.

CALWAVE SUCCESSFULLY CONCLUDES HISTORIC WAVE ENERGY PILOT OFF SAN DIEGO

CalWave, a leader in wave energy development, has successfully concluded its open-ocean wave energy pilot after 10 months of continuous operation off the coast of San Diego. The project, which deployed in September 2021, was supported by a US Department of Energy (DOE) award with the goal to demonstrate CalWave's scalable and patented xWave™ technology as a cost-effective, sustainable solution for energy generation. Not only does the demonstration represent California's first at-sea, long-duration wave energy project, but it also serves as a critical step toward proving wave power as a commercially viable renewable resource.

The pilot device, named x1™, has now been recovered and decommissioned. Findings will be used to inform CalWave's next grid-connected deployment, scheduled to occur at the federally-approved, 20 MW PacWave wave energy test site off the coast of Newport, Oregon.

Wave energy has been assessed by experts as capable of supplying upwards of a third of global energy demand, yet the development of a viable technology capable of reliably withstanding harsh ocean conditions has been slow to evolve, until now. CalWave's pilot verified its xWave™ system as effective for overcoming the key challenges of performance, reliability, survivability, and cost.

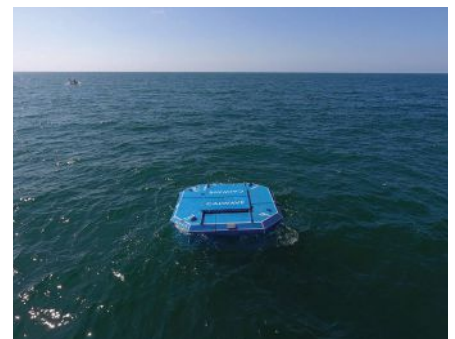
Next opportunities and outlook

In January 2022, CalWave was awarded the single largest award of \$7.5 million from the U.S. Department of Energy's latest \$25 million commitment to accelerate ocean energy development to further develop their xWave™ technology for use on local energy grids and microgrids.

CalWave has been contracted to build a 100 kW version of the xWave™ architecture for a two-year deployment off the coast of Oregon at PacWave South, the nation's first

accredited, grid-connected, pre-permitted wave energy test facility.

Marcus Lehmann, CalWave's CEO & Co-Founder said: "Our pilot of the x1™ provided us with critical results necessary to advance on the path towards commercialization. As offshore wind development is growing rapidly in the US and globally, we recognize the significant opportunities for wind and wave farm co-location."





US OFFSHORE WIND 2022: MORE MARKET ENTHUSIASM AND LESS UNCERTAINTY



» In addition to the constant footfall of delegates, the exhibition floor was awash with the latest data acquisition technologies. Much of the discussion centered around Ports Development and routes to funding. (Photo credits: Reuters)

Reuters Events' US Offshore Wind (USOW) conference was held in Boston, Massachusetts, on July 18 – 19 and generally considered one of the most important offshore wind events in the US. ON&T was on location and the tremendous buzz surrounding the future of the US offshore wind market was palpable.

The consensus was that the US offshore wind market has gained enough momentum that it can deliver a degree of certainty that has been lacking in the past. The industry has made incredible strides forward in the past year-and-a-half and, while actual construction has yet to begin on the nation's first commercial-scale offshore wind farm, there is a clear project pipeline and optimism in the development of a domestic supply chain. It should be noted that this event took place prior to the passage into law of the 2022 Inflation Reduction Act (IRA), which is expected to bring additional stimulus to the offshore wind market.

There were several recurring themes that resonated both from the program and the exhibit floor, but from ON&T's perspective, the two most significant were Ports Development and Data Acquisition and Analysis.

PORTS DEVELOPMENT

In a panel discussion on port development, panelists from Connecticut, Massachusetts and Virginia stressed the importance of upgrading US ports to service the upcoming demand for new offshore wind farms. There was a general agreement among the panelists that ports in the country's northeast are rising to this challenge, but that more investment would be needed. It was noted that unlike the European model, where there are massive ports supporting large-scale industrial activities, many of the ports in the northeastern US are much smaller and were built to meet a demand from a specific industry, such as fishing, containers, automotive, etc., but also face space limitations due to the many competing land uses along the coast. As one would expect, funding models

for port expansion and the reliance on federal, state, and private partnerships was central to the conversation.

DATA ACQUISITION & ANALYSIS

Many of the exhibiting companies at this year's event were from the marine survey industry and heavily involved in the collection of environmental data for the first wave of offshore wind projects.

The general feeling seems to be that, although the federal environmental permitting process was progressing more expeditiously than in the past, it is still not fast enough to reach the stated goal of 30 GW by 2030. To accomplish this, the almost unanimous opinion is that new technologies would be needed, specifically artificial intelligence (AI) and virtualization.

To this end, there was a wide range of emerging technologies on display. Some exhibitors advocated for the use of USVs; others favored the deployment of AUVs for survey work. Buoys were also discussed, particularly for marine mammal tracking. All of these technologies hold the promise of collecting vast amounts of data more economically than ever before.

Once the data are collected, then AI would go to work. The data would be synthesized and made available in a form that would expedite analysis and, subsequently, the permitting process. The potential efficiency and cost-savings of these technologies are impressive and undeniable.

Once again, Reuters US Offshore Wind proved more than just a meeting of the minds; but rather a convergence of idea and applied concepts to advance this burgeoning industry. Next year's event is slated for July 11 – 12, once again in Boston, Massachusetts.

For more information, visit: <https://reutersevents.com/events/offshore-wind>.



» Huisman's rig of the future. (Image credit: Huisman)

HUISMAN DEVELOPING HARSH ENVIRONMENT SEMI-SUB TO LOWER EMISSION SIGNIFICANTLY

Facing an energy supply gap due to rapid decline of traditional fossil fuel sources and fast, but not fast enough, growth of renewable energy sources, Huisman has arrived at a solution. The company's Harsh Environment Semi-Submersible Drilling Rig is aimed at making the extraction of fossil fuels as sustainable as possible while we make the transition to renewable energy.

Huisman is working towards the energy transition, developing numerous solutions for the harvesting of renewable energy. This includes those for offshore and onshore wind as well as geothermal energy. However, to ensure energy security during the transition, the company continues to develop increasingly sustainable solutions for conventional energy production.

This approach is being given additional stimulus by current geopolitical situations, which threaten the traditional supply lines of energy. To ensure reliable access to energy at this time, Europe is being forced to consider a range of alternative sources. This includes the potential of making wider use of North Sea gas reserves—the 'local' offshore production offers the lowest carbon footprint relative to other fossil fuel options such as LNG and coal, while providing energy security.

Huisman believes, however, that even this carbon footprint can be reduced. It has, therefore developed a Harsh Environment Semi-Submersible Drilling Rig that will lower emissions significantly.

The philosophy behind the rig is one of holistic optimal efficiency. As a result, the Harsh Environment Semi-Submersible Drilling Rig offers both significant cost and emissions reduction.

Examples of the rig's efficiency include a low drag electrified robotic drilling system that offers consistent speed of operation, as well as a unique heave compensated drilling floor, able to operate in rough seas. This results in increased productivity and uptime of the rig. Together with the rig's sustainability-focused hybrid power system, including energy storage systems storing regenerated energy, this ensures that emissions can be reduced by 30 – 40% per well.

A 40% reduction of onboard personnel and a large functional deck space contribute to this emission reduction.

Ideally, the rig is powered with onshore-produced hydroelectricity,

via a power cable from a nearby platform. Alternatively, it can be powered by two floating wind turbines, moored next to the rig. Both radical, but realistic solutions offer extreme low emissions per well. With inclusion of the wind turbines, the reduction in emissions can be increased to as much as 86%.

Dieter Wijning, Huisman Product Manager, said: "It's clear that we need an intermediary solution while we make the transition to renewables. And that, if Europe is to have a reliable source of energy for the time being, this is going to involve consumption of oil and gas. We think it's important that this exploitation of fossil fuel reserves is done as efficiently and cleanly as possible. It is our vision to drive the growth of renewable energy while making fossil fuel extraction more sustainable."

Features & benefits of the Huisman Harsh Environment Semi-Submersible Drilling Rig:

- High efficiency robotic drilling system
- Unique heave compensated drill floor
- Fully hands off deck handling
- Hybrid power system with external connection
- 40% less people on board
- 25% lower cost per well
- Up to 86% less emission per well

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MCDERMOTT AWARDED PRE- FEED CONTRACT FOR PROPOSED H2PERTH PROJECT FROM WOODSIDE ENERGY

McDermott International has been awarded a Pre Front-End Engineering Design (Pre-FEED) contract from Woodside Energy for the proposed H2Perth project located in the Kwinana/Rockingham area in Western Australia.

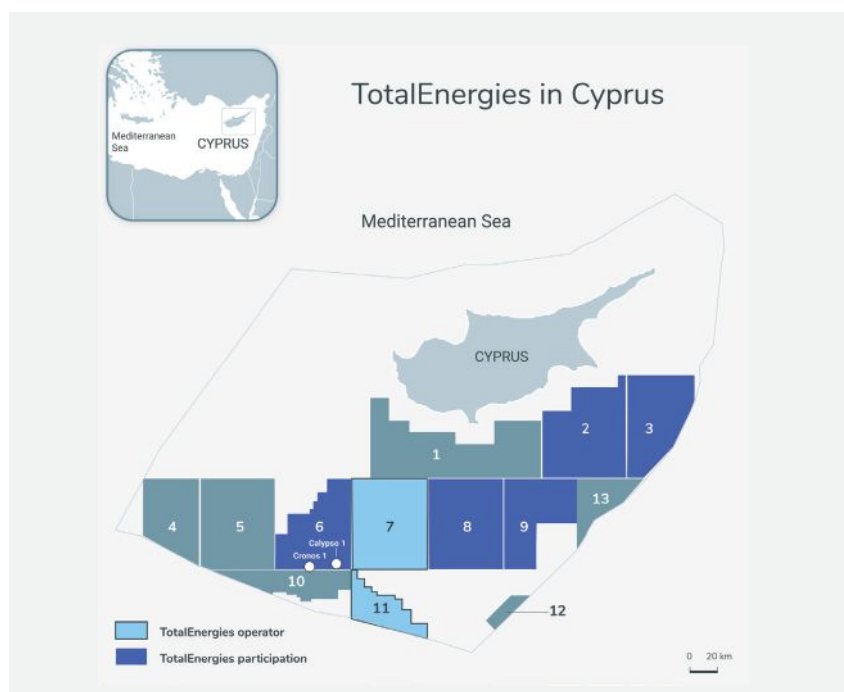
Under the contract scope McDermott will provide pre-FEED services for a proposed export-scale production facility for renewable and lower-carbon hydrogen and ammonia. Hydrogen will be produced using electrolysis technologies and natural gas reforming with carbon emissions abated or offset.

"This award follows the successful completion of the concept study on H2Perth and decades of experience executing both onshore and offshore projects for Woodside Energy," said Tareq Kawash, Senior Vice President, Onshore of McDermott. "We are pleased to continue supporting Woodside's energy transition opportunities and are mutually aligned on the importance of driving lower-carbon energy to advance Australia's vision as a global leader in clean, innovative, safe and competitive hydrogen production."

Work on the project will be executed from McDermott's office in Perth, Australia, and its engineering center of excellence in The Hague, the Netherlands.



MCDERMOTT



» Cronos-1 well is the fourth exploration well drilled by Eni Cyprus and the second well in Block 6 (Image credit: TotalEnergies)

ENI AND TOTALENERGIES MAKE SIGNIFICANT GAS DISCOVERY OFFSHORE CYPRUS

Eni has announced a significant gas discovery in the Cronos-1 well drilled in Block 6, 160 km off Cyprus coastline, in 2,287 meters of water depth. The Block is operated by Eni Cyprus holding 50% interest with TotalEnergies as partner.

Preliminary estimates indicate about 2.5 TCF of gas in place, with significant additional upside that will be investigated by a further exploration well in the area.

The well has encountered an important gas column in a carbonate reservoir sequence of fair to excellent properties. The intense data acquisition campaign has shown an overall net pay of more than 260 m with intervals owning excellent permeability. Studies on a fast-track development options are already ongoing.

Cronos-1 well is the fourth exploration well drilled by Eni Cyprus and the second well in Block 6, following the gas discovery of Calypso-1 in 2018.

The gas discovery of Cronos-1 can unlock additional potential in the area and is part of Eni's successful effort to provide further gas supply to Europe.

"This successful exploration well at Cronos-1 is another illustration of the impact of our Exploration strategy which is focused on discovering resources with low technical cost and low carbon emissions, to contribute to energy security including to provide an additional sources of gas supply to Europe," said Kevin McLachlan, Senior Vice President, Exploration at TotalEnergies.

Eni has been present in Cyprus since 2013. The Company operates Blocks 2, 3, 6, 8, and 9, and has participating interests in Blocks 7 and 11 operated by TotalEnergies.

The drilling of another exploration well on Block 6 is planned, in order to investigate significant additional resource upside and to evaluate the best development options.

DNV AWARDS AIP FOR GREEN AMMONIA FLOATING PRODUCTION UNIT DEVELOPED BY H2 CARRIER

An industrial scale concept for a floating production unit to produce green ammonia at sea has secured Approval in Principle (AiP) from DNV, affirming the technical feasibility of the design.

The so-called P2XFloater concept, developed by Norway-based H2 Carrier, is based on the conversion of an existing Very Large Gas Carrier into a floating, production, storage and offloading unit (FPSO) that can serve to produce environmentally friendly ammonia for the local or for the world market.

The FPSO would source electricity from a wind farm or other renewable source to provide power for electrolysis of seawater to produce the hydrogen as input to the so-called Haber-Bosch process which produces liquid ammonia by combining hydrogen and nitrogen of under high pressure and high temperature. The required nitrogen would also be produced onboard the FPSO.

DNV's Vice President, Business Development for Floating Production, Conn Fagan, said the AiP covers all aspects of the integrated vessel concept including structural integrity, mooring, ammonia production, ammonia storage and cargo handling.

"The AiP assessment has looked at the technical challenges associated with offshore ammonia production and has concluded

that there are no insurmountable difficulties to preclude future classification of the design," said Fagan.

"For application of the concept in future projects, detailed engineering studies will of course need to be carried out with particular attention to addressing the hazards associated with ammonia and hydrogen for a particular layout and location."

"The innovative P2XFloater™ concept provides a low-cost, fast-track and flexible solution to produce green ammonia on an industrial scale and at a competitive price. Market demand is rapidly increasing primarily due to the decarbonization of the industrial and maritime sectors," said Mårten Lunde, CEO of H2Carrier AS.

Mr. Lunde added: "We are very pleased to have been awarded the AiP from DNV, which is a significant technical milestone that gives us a springboard for further development towards commercial realization of this concept."



» From left, Erik Henriksen (DNV) and Sebastian Kihle (H2Carrier)



AUTONOMY FOR MILITARY AND OFFSHORE APPLICATIONS



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GLOBAL ENERGY EMPLOYMENT RISES ABOVE PRE-COVID LEVELS, DRIVEN BY CLEAN ENERGY AND EFFORTS TO STRENGTHEN SUPPLY CHAINS

Global employment in the energy sector has risen above its pre-pandemic levels, led by increased hiring in clean energy, according to a new IEA report that offers the first worldwide benchmark for employment across energy industries.

The inaugural edition of the *World Energy Employment Report*, which will be published annually, maps energy sector employment by technology and value chain segment. The report provides a data-rich foundation for policy makers and industry decision makers to understand the labor-related impacts of clean energy transitions and shifts in energy supply chains following Russia's invasion of Ukraine.

The amount of energy jobs worldwide has recovered from disruptions due to COVID-19, increasing above its pre-pandemic level of over 65 million people, or around 2% of the total labor force. The growth has been driven by hiring in clean energy sectors. The oil and gas sector, meanwhile, saw some of the largest declines in employment at the start of the pandemic and has yet to fully recover.

With the recent rebound, clean energy surpassed the 50% mark for its share of total energy employment, with nearly two-thirds of workers involved in building new projects and manufacturing clean energy technologies. At the same time, the oil and gas sector is also experiencing an upswing in employment, with new projects under development, notably new liquefied natural gas (LNG) infrastructure.

The energy sector is set to see its fastest employment growth in recent years in 2022, however high input costs and inflationary pressures are adding to hiring and supply chain challenges already present in some regions and subsectors, such as solar, wind, oil, and gas. Policy responses to the pandemic and Russia's invasion of Ukraine, including the US Inflation Reduction Act, will continue to add to new hiring demand and to shifting the status-quo of global energy supply chains.

Energy jobs counted in this report span the value chain, with around a third of workers in energy fuel supply (coal, oil, gas and bioenergy), a third in the power sector (generation, transmission, distribution and storage), and a third in key energy end uses (vehicle manufacturing and energy efficiency). More than half of energy employment is in the Asia-Pacific region. This reflects rapidly expanding energy infrastructure in the region and access to lower-cost labor that has enabled the emergence of manufacturing hubs that serve both local and export markets, notably for solar, electric vehicles and batteries. China alone accounts for 30% of the global energy workforce.

In all IEA scenarios, clean energy employment is set to grow, outweighing declines in fossil fuels jobs. In the Net Zero Emissions by 2050 Scenario, 14 million new clean energy jobs are created by 2030, while another 16 million workers switch to new roles related to clean energy. New energy jobs may not always be in the same location nor require the same skills as the jobs they replace, requiring policy makers to focus on job training and capacity building to ensure that energy transitions benefit as many people as possible.

"Countries around the world are responding to the current crisis by seeking to accelerate the growth of homegrown clean energy industries. The regions that make this move will see huge growth in jobs," said IEA Executive Director Fatih Birol. "Seizing this opportunity requires skilled workers. Governments, companies, labor representatives and educators must come together to develop the programs and accreditations needed to cultivate this workforce and ensure the jobs created are quality jobs that can attract a diverse workforce."

Around 45% of the world's energy workers are in high-skilled occupations, compared with about 25% for the wider economy. Some fossil fuel companies are retraining workers internally for positions in low-carbon areas to retain talent or to maintain flexibility as needs arise. However, this is not an option everywhere, and ensuring a people-centered and just transition for affected workers must remain a focus for policy makers, especially in the coal sector where employment has been declining consistently for several years.



NORTHERN LIGHTS TAKES IMPORTANT STEP TO DECARBONIZE EUROPE

Northern Lights, a JV owned by Equinor, Shell and TotalEnergies, has signed the world's first commercial agreement on cross border CO2 transportation and storage with Yara. This is an important step for the development of large-scale decarbonization of heavy industries to help meet climate ambitions.

Yara and Northern Lights have agreed on the main commercial terms to transport CO2 captured from Yara Sluiskil, an ammonia and fertilizer plant in the Netherlands, and permanently

store it under the seabed off the coast of Norway.

"This is a major milestone for the development of carbon capture, transport and storage. With the first commercial agreement for transportation and storage of CO2, we open a value chain that is critical for the world to reach net zero by 2050. Together with our partners, we are building infrastructure to decarbonize industry and energy, securing industrial activity and jobs in a low carbon future," said Anders Opedal, CEO and president of Equinor.

From early 2025, 800,000 tonnes of CO2 will be captured, compressed and liquefied in the Netherlands, and then transported by ship to the terminal for storages at 2,600 meters under the seabed on the Norwegian continental shelf.

There is significant storage capacity on the Norwegian continental shelf, where Equinor and partners have decades of experience from CO2 capture and storage at the Sleipner and Snøhvit fields. Large-scale CO2 capture from industries and storage of CO2 safely under

the seabed, will enable the decarbonization of hard to abate existing industries, that emits CO2 as part of their processes.

"With this commercial agreement, we are passing a major milestone in the development of a value chain for carbon capture, transport and storage. We experience an increased demand for this service, particularly from large industrial clusters on the European continent. Capture, transport and storage of CO2 is also a prerequisite to produce blue hydrogen and ammonia. These products can eliminate emissions in several energy sectors and act as low carbon feedstock in many industries," said Irene Rummelhoff, executive vice president for Marketing, midstream and processing in Equinor.

With the volumes from Yara, phase 1 has reached full capacity and Northern Light JV is now working to mature phase 2 for final investment decision increasing the total capacity to 5-6 million tonnes CO2 per year.



» The Northern Lights site at Øygarden near Bergen. (Photo credit: Rikard Wilson/Equinor ASA)

E M P O W E R I N G

SAAB SEA EYE

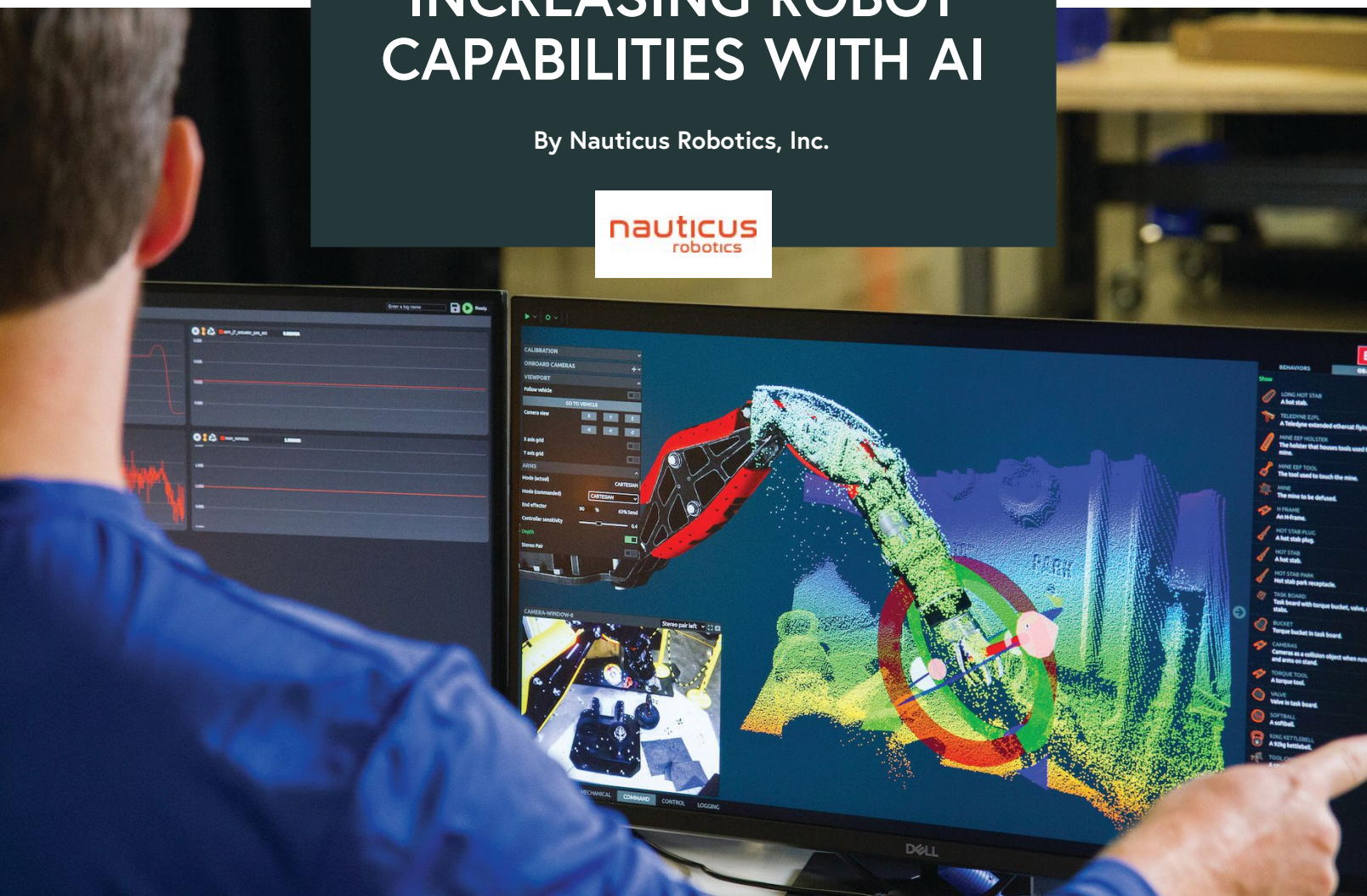


SAAB

INCREASING ROBOT CAPABILITIES WITH AI

By Nauticus Robotics, Inc.

nauticus
robotics



» Aquanaut collects 3D environmental sensory data which allows an onshore operator to direct Aquanaut's autonomous functions. (Photo credit: Nauticus)

The role of artificial intelligence (AI) in technology is to analyze input and provide intelligent, useful, and productive output. This capability allows technology to take on human tasks in a more efficient and streamlined way, aided by the near limitless power of big data.

The increased need to operate in extreme conditions has accelerated the development of underwater robots. Today, with growing access to AI and machine learning (ML), AUVs and ROVs are used by offshore operators to perform complex subsea tasks and deliver increased service life for oilfield equipment; boosted

productivity; enhanced efficiency; improved safety; and reduced operating costs.

SUPERVISED AUTONOMY

Nauticus Robotics, Inc., a developer of ocean robots, autonomy software, and services to the ocean industries, has taken a design approach that combines a robot's task-performing features in a way that provides more complete solutions for operators with subsea infrastructure.

"We applied concepts from space flight to figure out how to communicate with robotic assets in a remote setting over a

latent network," said Nicolaus Radford, Nauticus Robotics CEO. "We knew that if we cut the umbilical, we'd be limited in the communication techniques available to us and limited in bandwidth. This is why we developed some fairly complex software to help facilitate communications under the sea that increase reliability and drive invariance to latency."

By recognizing the importance of having a balance between capabilities and controls, Nauticus has designed ROVs and AUVs capable of performing a wide range of manipulative tasks while being controlled by a multi-layered, multi-tool, software platform. This new capability

has the potential to transform the way subsea services are provided by creating a platform that is not just for individual robots but unifies all products into a single control architecture to create a "supervised autonomy" for all vehicles across all mission phases, including third-party vehicles.

INSIDE THE TECH

Today, most subsea manipulation tasks require a person to be in direct real-time control of the manipulator. This can be achieved locally or "over the horizon," but only when certain conditions are met, such as communications being consistently within appropriate speed and latency tolerances.

Nauticus has developed a significantly different approach—one that utilizes an autonomous robot and a human in the loop.

The added human supervisory layer of control governs the manipulation process of certain operations to ensure a greater level of safety.

"When directly controlling a robot over a remote connection, there can be some instability and potential for human error," said Todd Newell, Senior VP of Business Development with Nauticus Robotics. "To solve this problem, we created a machine intelligence framework that can control the robot over a latent and much slower network. In other words, we had to make these robots very smart with a high degree of self-directed and self-sufficient behavior."

This method of control combines a proprietary acoustic communications method, with a human supervisor who authorizes stepwise autonomous actions through "mouse clicks, not joysticks." When a robot with advanced

control software, powered by AI and ML, is paired with a supervisory feature, the umbilical can be removed, eliminating the need for a large surface support vessel. And, as with any AI/ML software, it gets more capable over time by automatically learning and improving from experience.

UNDERWATER TRANSFORMER

The robotic centerpiece of Nauticus' push into ocean technology is *Aquanaut*, an all-electric subsea robot with two robust arms that can transform from a long-range AUV to an untethered ROV. In AUV mode, with the arms enclosed within its hydrodynamic hull, the underwater robot can cover over 50 nautical miles in one mission, owing to its onboard lithium-ion battery and thrusters for propulsion.

Along its journey, *Aquanaut*'s onboard high-precision perception sensors enable it to survey the seabed and collect data. Once the robot reaches its destination, it transforms into ROV mode. The top half of the hull raises and the head swivels into place to expose stereo cameras and powerful 3D sensors.

Additional thrusters emerge to provide better maneuverability. Two eight-axis arms unfold with built-in force sensors and grippers and the robot is ready to perform a range of manipulation tasks. These can include cleaning, inspection of cathodic protection (a common corrosion mitigation method for submerged metal structures), flooded member detection (FMD), and other tasks to assess the condition of seafloor infrastructure.

Aquanaut collects 3D environmental sensory data which is decoded with ML algorithms that help synthesize plans for the robot's actions within the context of its library of autonomous behaviors. A "human-in-the-loop" directs the autonomous functions via an onshore operator that monitors or manages crucial actions taken by the platform. This provides an additional layer of protection for assets and the surrounding environment.

By using supervised autonomy and the proprietary sea-to-surface network, *Aquanaut* can operate completely tether-free. For longer projects, *Aquanaut* can utilize a subsea wireless network to receive instructions and transmit data back to the remote-control center.



» Future subsea docking station option for Nauticus Robotics' next generation Aquanaut. (Image credit: Nauticus)

Communication is facilitated via an onboard, high-speed acoustic modem. A small unmanned surface vessel relays signals between the robot and communication satellites, enabling the robot to be controlled from anywhere in the world.

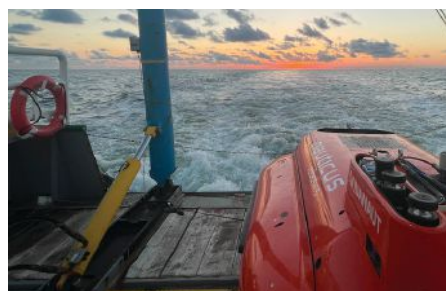
THE TAKEAWAY

Adaptive machine intelligence is at the technological core of the modern robotics landscape, and smarter machines enable a fresh view to ocean-based activities and the ways the human-to-machine interface (HMI) can be changed to provide economic and environmental value.

Starting primarily as a US government contractor, Nauticus Robotics demonstrated how autonomous undersea robots could be utilized to help defend against maritime threats. The company's leaders then studied how ROVs and AUVs were being used in the O&G industry and knew they had found a niche where they could make a difference. The company embarked on a mission to take the features of these two robotic technologies and combine them into one robotics platform and then remove the need for an umbilical but using machine intelligence and supervised autonomy.

Nauticus Robotics estimates that this technology has the potential to lower the CO2 footprint of offshore vessels by over 90 percent and reduce the need for people offshore by over 95 percent as compared to the current alternative legacy technologies, all at approximately 50 percent of the current cost of traditional methods. Beyond making the oceans safer and offshore energy markets more efficient, Nauticus Robotics is also researching and developing technologies for autonomous shipping, aquaculture, and subsea mining.

For more information, visit:
www.nauticusrobotics.com.



» Nauticus Robotics' Aquanaut pictured before deployment in the Gulf of Mexico. (Photo credit: Nauticus)



» Expedition yacht *Dapple* in Bora Bora.
(Photo credit: Saab Seaeye)

SAAB SEA EYE'S FALCON CHOSEN AS EXPEDITION YACHT RESCUE ROBOT

For expedition yacht *Dapple* a Saab Seaeye deep-rated Falcon robot has been chosen as a standby rescue resource for emergency recovery of their manned submersible.

In addition, the 1,000 meter-rated Falcon comes fully equipped for undertaking a wide range of scientific research and survey operations.

Dapple's dive manager, Marc Taylor, says that the Falcon is a proven commercial choice, so fits their criteria, "and it makes sense because we already have a Falcon aboard another vessel in our fleet."

Operators worldwide favor the Falcon, a small, intelligent robot with the power and task range typically found in much larger systems.

Not only can owners view underwater from aboard the yacht in high-definition images transmitted by the roaming Falcon, but the robot has many other uses.

It can examine the hull millimeter-by-millimeter, recover items from the seabed, cut ropes and cables, and clean critical fittings.

Specialist cameras, survey systems and manipulator arms can be fitted for research and survey missions.

For *Dapple*, the Falcon is equipped with an extensive range of technology including HDTV cameras, a multifrequency scanning sonar, multibeam sonar, laser system and an eventing suite. It also comes with both a three jaw and a five-function manipulator, each with rope cutters, along with hydraulic cable cutter and rotary cleaning brush.

Although the Falcon's key role is recovery of *Dapple's* submersible, for general diving safety the Falcon can survey a dive site beforehand, then watch over a diver when below and transport items back and forth during a dive.

The Falcon's global success comes from being a small meter-sized, yet powerful, highly maneuverable, multi-tasking, easy to use vehicle, depth rated up to 1,000 meters and enhanced with Saab Seaeye's revolutionary iCON™ intelligent control system.

It has a trusted reliability record covering over a million hours of undersea operations, working in the most challenging environments, mastering turbulent waters and strong currents whilst remaining stable during filming, scanning and undertaking delicate tasks.

» Saab Seaeye Falcon can be fitted with a host of cameras, sonar and tooling for a wide variety of tasks.
(Photo credit: Saab Seaeye)



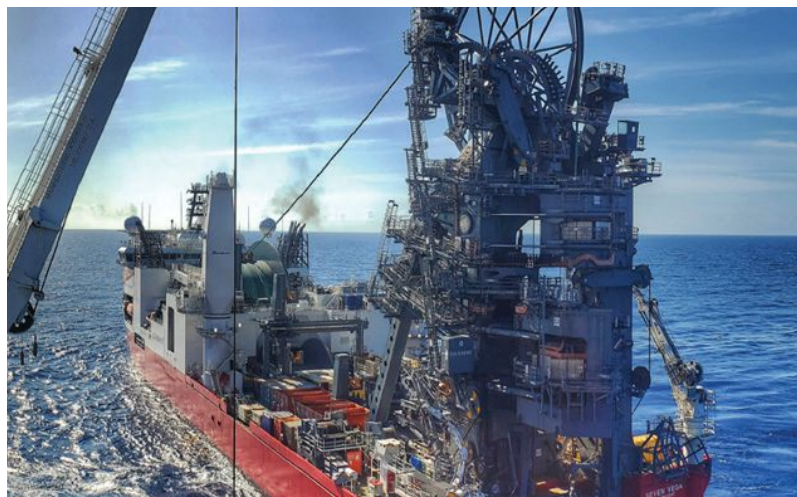
SCHLUMBERGER, AKER SOLUTIONS, AND SUBSEA 7 CREATE JOINT VENTURE

Schlumberger, Aker Solutions and Subsea 7 have announced an agreement to form a joint venture to deliver a step change in subsea production economics by helping customers unlock reserves, reduce time to first oil and lower development costs while simultaneously delivering on their decarbonization objectives.

The proposed joint venture will comprise the subsea businesses of Schlumberger and Aker Solutions, with Subsea 7 purchasing 10% of the joint venture for \$306.5 million. This combination brings together deep reservoir domain and engineering design expertise, an extensive field-proven subsea production and processing technology portfolio, world-class manufacturing scale and capabilities, and a comprehensive suite of life-of-field solutions to customers all over the world.

The transaction is subject to regulatory approvals as well as other customary closing conditions and is expected to close during the second half 2023. Following completion of the transaction, Schlumberger will own 70% of the joint venture, with Aker Solutions and Subsea 7 owning 20% and 10%, respectively.

Olivier Le Peuch, CEO of Schlumberger said: "This joint venture will bring together world-class businesses that are uniquely positioned to provide subsea technologies to help our customers improve recovery and reduce overall subsea development costs. Customers will benefit from enhanced services that leverage



digital and technology innovation to drive improved performance while increasing energy efficiency and reducing CO2 emissions."

Kjetel Digre, CEO of Aker Solutions said: "By combining our strong and complimentary competence and technologies, this compelling combination will deliver an industry step change that will benefit our customers, employees and significantly increase shareholder value. The offshore market activity is increasing, and this joint venture will drive enhanced offerings both in terms of subsea production economics and low-carbon solutions."

John Evans, CEO of Subsea 7 said: "We are excited to build on our highly successful alliance with Schlumberger and partnership with Aker Solutions. This new joint venture is a critical step as we collaborate on the integrated subsea projects that drive maximum value for our customers."

HELIX ROBOTICS SOLUTIONS EXTENDS ITS AGREEMENT TO CHARTER FOR JONES ACT-COMPLIANT VESSEL SHELIA BORDELON

Helix Robotics Solutions Inc., the U.S. Robotics division of Helix Energy Solutions Group, Inc., has extended its agreement with Bordelon Marine, LLC to charter the DP2 Jones Act-compliant Ultra-Light Intervention Vessel (ULIV) M/V Shelia Bordelon through June 2024.

Helix currently primarily operates the vessel to support Offshore Renewables and Inspection, Repair & Maintenance (IRM) activities for clients operating in US waters. Recently, Helix contracted the Shelia Bordelon to support the rapidly expanding wind farm industry offshore the U.S. East Coast.

Designed as a fuel-efficient intervention vessel, the Shelia Bordelon features an NOV 50-ton active heave compensating crane with 3,000 meters of wire, a mezzanine deck with internal offices, centralized online survey suite, offline data processing space and two Triton 200HP ROVs with high spec survey capabilities.

With over 25 years of IRM expertise, Helix Robotics Solutions is well equipped to service clients' light construction and renewables projects.



» M/V Shelia Bordelon. (Photo credit: Bordelon Marine)

MACGREGOR TO SUPPLY SELF-CONTAINED TRACTION WINCH SYSTEMS FOR GUANGZHOU MARINE GEOLOGICAL SURVEY

MacGregor, part of Cargotec, has been selected to supply two self-contained traction winch systems for a geological survey drilling vessel owned by Guangzhou Marine Geological Survey (GMGS), a subsidiary of China's Ministry of Natural Resources, together with HongHai Marine. HongHai Marine is MacGregor's partner in China, focusing on MacGregor deck machinery integration and service in the fishery and oceanographic markets.

The order was booked into Cargotec's 2022 second quarter order intake. The vessel is scheduled to be delivered in the third quarter 2024.

Solution requirement and advantages

With the design of a 20-foot container footprint as a requirement, MacGregor's scope of supply encompasses a system designed for 20 ton / 140 m/min (2.33 m/sec) lifting capability, and high-

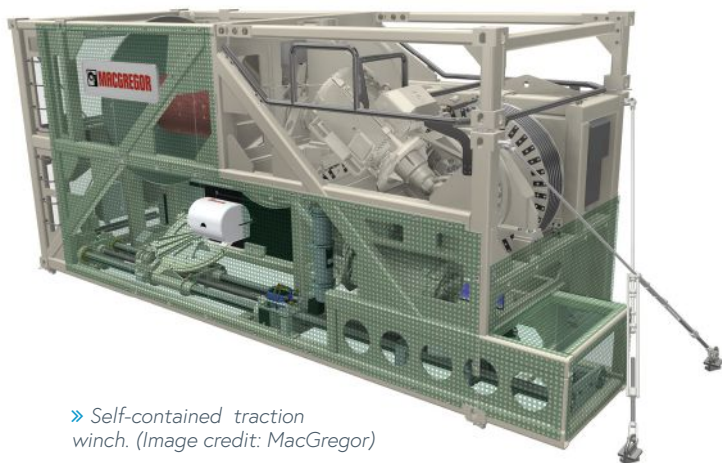
speed performance of 14 ton / 200 m/min (3.33 m/sec). The self-contained traction winch has the ability to perform active heave compensation on the fly at 140 m/min. The containerized system has everything installed on the unit, and only needs the main power from the ship to be ready to operate. The operator can manage the system either from the local operation panel on the winch, wireless radio remote control or from an additional control panel located where it is needed.

The setup is with a low noise active frontend with an ability to regenerate power to the ship or use the built-in air brake resistors to get rid of generated power during lowering. The self-contained traction winch system is set up to have 13,800 m of 17 mm wire or EOM cable. A wire outlet possibility from 0 to 180 degrees sideways, and -10 degrees to 80 degrees horizontal plans giving the operator a high flexibility for arrangement and placing of the self-contained system onboard.

MacGregor was selected due to the compact design, technical advantages and proven track record in meeting the required quality standards.

"The good cooperation between MacGregor and HongHai Marine provides users with a solution for the deck control support system of scientific research vessels, which is recognized by customers and the market," said Duan Qiujia, General Manager, HongHai Marine.

"We are very pleased to continue the long-standing relationship with HongHai Marine, and proud to deliver high quality equipment for this key project to GMGS. This verifies the quality of our products and skills of our experienced team," said Jan Erik Pedersen, Senior Vice President, Offshore Solutions Division, MacGregor.



» Self-contained traction winch. (Image credit: MacGregor)

EIVA ACQUIRES SENSORSURVEY FOR SURVEY SOLUTION TESTING PARTNERSHIP

EIVA recently announced the acquisition of SensorSurvey, an experienced Danish hydrographic survey company and long-term survey partner of EIVA. The two companies are now taking the next step forward in bridging efforts to both strengthen EIVA's product suite and SensorSurvey's ability to leverage advanced survey solutions for clients.

"By bringing our long-time partner SensorSurvey into the EIVA family, we can involve them even more in development and testing of new features and solutions for hydrographic surveys and subsea inspections. This kind of product testing in real-life projects with experienced surveyors is a vital part of EIVA's software and hardware solution development," said

Jeppe Nielsen, CEO of EIVA and new chairman of the board for SensorSurvey.

This increased teamwork will benefit the development and testing of a variety of survey and inspection solutions. These range from autonomous USV survey capabilities in NaviSuite Kuda, EIVA's hydrographic survey software, to photogrammetry visualizations in NaviSuite Mobula, EIVA's ROV control and inspection software.

SensorSurvey
Hydrographic opmåling



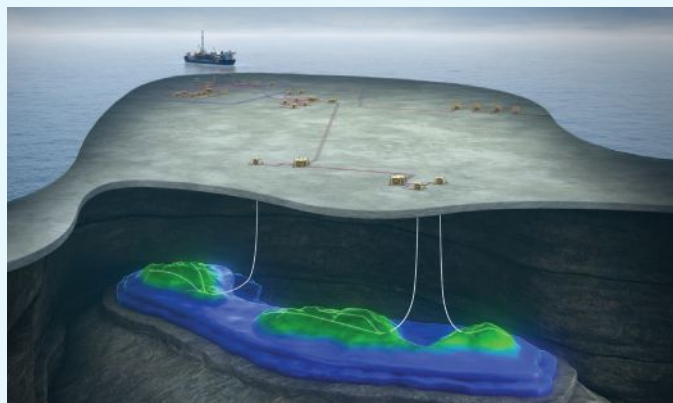
EIVA

AKER SOLUTIONS AWARDED SIGNIFICANT CONTRACT FOR THE TRELL & TRINE FIELD DEVELOPMENT

Aker Solutions has been awarded a contract from Aker BP to provide the subsea production system for the Trell & Trine field development, located in the Alvheim area of the North Sea. The development concept is a subsea tie-back to the Alvheim FPSO, using existing facilities and infrastructure.

Aker Solutions will deliver a subsea production system including three horizontal subsea trees, two manifolds, control systems, close to 30 kilometers of subsea umbilicals, as well as associated equipment and installation work. The work will start immediately with final deliveries scheduled for the first quarter of 2024.

"This award continues our long-standing collaboration with Aker BP and Subsea 7 in the Aker BP Subsea Alliance. The partnership enables Aker Solutions to engage early in the field development process, optimizing design solutions and contributing to a positive final investment decision. We look forward to continuing our alliance with Aker BP and Subsea 7, with a continued focus on safe, efficient, and reliable operations," said Maria Peralta, executive vice president and head of Aker Solutions' Subsea business.



» Work will start immediately with final deliveries scheduled for the first quarter of 2024. (Image credit: Aker BP)

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TDI-BROOKS CONTINUES OFFSHORE WIND MOMENTUM ON THE US EAST COAST

TDI-Brooks continues to drive forward in an emerging market, performing marine site investigations for several of the offshore wind operators on the US East Coast. "TDI-Brooks operates four research vessels on the spot market with two US-flagged research vessels dedicated to the wind farm market on the East Coast. Our specialty is the survey, geotechnical and benthic components of these wind farm projects," said Dr. Jim Brooks, President and CEO of TDI-Brooks.

In April 2021, TDI-Brooks re-mobilized R/V Brooks McCall and R/V EMMA McCALL to Fall River, MA to perform several different Wind Farm projects located south of Long Island, New York and south of Nantucket and Martha's Vineyard. These projects are on-going through December 2022.

The geotechnical component along cable routes and within lease blocks consisted of deploying a variety of tools including their Feritech FT550 electric and TDI-Brooks designed pneumatic vibrocorer (pVC) systems along with their Datem Neptune 5,000 (N5K) and 3,000 (N3K) cone penetrometer test rigs (CPT). The benthic components were mostly ROV transects and grab sampling.

The geophysical projects consisted of side scan sonar, TVG magnetometer, multibeam, USBL, parametric sub-bottom profiler and 2D ultra high-resolution (UHR) with single and multi-channel seismic systems to provide detailed seabed and shallow sub-surface data.



» Deployment of Neptune 5000 off R/V Brooks McCall. (Photo credit: TDI-Brooks)



» Ashtead Technology has purchased an initial ten Gen 5 multiplexer systems. (Photo credit: Ashtead Technology)

ASSTEAD TECHNOLOGY SIGNS RENTAL AGREEMENT WITH RTS AND INVESTS IN NEW TECHNOLOGIES

International subsea rental equipment and solutions specialist Ashtead Technology has signed a rental agreement with Norway-based RTS, an international provider of electronic engineering equipment for the underwater industry.

Under the deal, Ashtead Technology will have access to RTS's owned equipment fleet to better support customers globally. In addition, Ashtead Technology has purchased an initial ten Gen 5 multiplexer systems which will have the capability to upgrade to Gen 6 specification. As a result, Ashtead Technology will be the first company to supply the Gen 6 product line, when available.

The Gen 5 is one of the most versatile survey multiplexer systems in the market offering accurate, flexible and robust subsea data transfer combined with user-friendly interfacing and 850 W of power capacity subsea. The systems come in innovative titanium subsea housing, ideal for challenging marine environments.

The RTS Gen 5 multiplexer systems are now available to rent throughout Ashtead Technology's nine international technology and service hubs.

Phil Middleton, Ashtead Technology's Survey and Robotics Director, said: "This latest investment demonstrates our continued commitment to the global subsea rental market by ensuring we can offer the broadest range of best-in-class subsea equipment to support our customers' projects worldwide. Furthermore, it means that we are the only equipment rental company able to supply subsea multiplexers from all leading manufacturers.

"We look forward to building a long-term partnership with RTS and working together to bring the latest innovations to our customers."

Tore Hafte Staalesen, RTS Managing Director, said: "We are delighted to partner with Ashtead Technology which demonstrates their ongoing commitment to leading edge technology and innovative solutions that deliver robust performance, reliability and differentiation to their customers. This new rental agreement is an important strategic opportunity for RTS as we continue to grow our business internationally in all key energy markets."

FUGRO DEVELOPS INNOVATIVE SITE INVESTIGATION SOLUTION FOR ARKLOW BANK WIND PARK IN IRELAND

Fugro has successfully completed fieldwork on a geotechnical site investigation for SSE Renewables' Arklow Bank Wind Park Phase 2.

This offshore wind park will support Ireland's climate action target of producing 7 GW of offshore wind energy by 2030 and is located approximately 6 to 13 km off the coast of Ireland, in an area known for its unpredictable metocean conditions. Fugro developed a bespoke casing system designed for the offshore site conditions to enable survey work to be completed with minimal downtime. The acquired Geo-data will be used to understand the site's subsurface conditions and support foundation designs and installation.

Fugro also engineered a full suite of purposely designed conductor casing handling devices to remove manual

intervention, improving health and safety of deck crew and ensuring deployment efficiency within the short slack water windows.

Laboratory testing is currently underway, building on the site testing completed in Fugro's offshore laboratory, allowing all acquired samples to be analyzed efficiently with the resulting Geo-data used to inform foundation designs.



» Employee preparing sample for core logging. (Photo credit: Fugro)

When complete, the 800 MW wind park will be capable of powering almost 850,000 homes with green energy and offset 830 billion kilograms of carbon emissions each year.

John O'Sullivan, SSE Renewables' Arklow Bank Wind Park Phase 2 Project Manager said: "The successful completion of this ground investigation campaign is another key milestone for

the Arklow project. It has enabled us to gain a much clearer understanding of the seabed conditions within the lease area. This enhanced site characterization greatly supports our ongoing design development works in the lead up to the first offshore energy auction."

Matthew Chappell, Fugro's Service Line Director of Site Investigations added: "By working closely and collaboratively with SSE Renewables and DEMA, who provided the Neptune liveaboard jack-up barge, we were able to deliver the perfect solution for the Arklow Bank Wind Park site investigation. Our experience in marine operations and geotechnical surveys allowed us to develop an innovative solution for the site conditions and is certainly something we're proud of. Our Geo-data will not only reduce project risk and uncertainties but will help inform future developmental phases of the project."

ROTECH SUBSEA SETS UP ENTITY TO SERVICE TAIWAN'S OFFSHORE WIND SECTOR

A series of successful cable trenching and seabed levelling campaigns in Taiwan's offshore wind sector has led Aberdeen-based Rotech Subsea to establish a new entity in the country. With three spreads of its cutting-edge CFE equipment active in country presently, the company has secured works well into 2023.

With an impressive track record in Taiwan, dating back to 2019, in June 2022 Rotech Subsea successfully completed its latest major scope of work in the country. Having been contracted by a leading international marine infrastructure player to assist with de-burial & cable trenching operations on a key offshore wind farm, Rotech mobilized its

TRS1LD jet trencher in early May 2022.

The state-of-the-art TRS1LD tool was deployed by ship's crane into water 30-55 m deep to carry out de-burial of wet stored export cable sections, export cable remedial burial works, inter-array cable remedial burial works, and inter-array cable backfill works. With outriggers and clump weights set up forward and aft of the trenching tool and connected with running lines to control orientation, the TRS1LD remained suspended above the seabed/cable to complete all trenching operations.

The vessel's DP positioning system was used to move the trenching tool along the cable

routes with USBL transponders fitted to the tool providing accurate data on the location of the tool at all times. Trench depth was monitored real time using a tool-mounted sonar imager with the client carrying out their own survey to confirm that the completed trenching ops met the required specifications.



» The TRS1LD jet trencher was mobilized in early May 2022. (Photo credit: Rotech)

CORRELL GROUP SECURES CONTRACT FROM SEAWAY OFFSHORE CABLES

The Correll Group, Electrical Engineering Division, has been successful in securing a contract with Seaway Offshore Cables for the termination and testing of the 58 inter-array and 7 offshore export subsea cables for the Changfang and Xidao Offshore Wind Farm (CFXD).

CFXD is located in the Taiwan Strait, approximately 11 km off the coast of Fangyuan Township, Changhua County on the Taiwanese west coast.

The first phase of Changfang will involve the installation of ten 9.5 MW turbines in 2022. The second phase is scheduled for 2023, and will involve the installing a further 47 turbines with a total capacity of 446.5 MW. The final phase of the project will involve the installation of five 9.5 MW turbines for the Xidao wind farm in 2023.

Upon completion, the wind farm will consist of 62 Vestas V174-9.5 MW turbines with a combined capacity of 589 MW. A network of approximately 73 km of 66 kV inter-array, buried, subsea cables will be used to connect turbine strings.

The offshore wind farms are expected to begin commercial operations in the first quarter of 2024. Together with the Formosa 1 & 2 and Yunlin projects, CFXD will provide clean energy to nearly 1.75 million homes in Taiwan each and every year for the next 20 years.

Sam Dowey, Managing Director at Correll, commented: "We are delighted to have been awarded this project and to be again working in close partnership with Seaway 7. The Changfang and Xidao project is expected to generate 5,300 jobs and TWD 9.2 billion (US\$302.6 million) in economic value for Taiwan.

Correll has extensive experience working on many of the most significant offshore wind farms in South East Asia, and we are proud of our role in supporting the overall growth and development of the Taiwanese offshore wind sector."



» JDR's state-of-the-art facility in Hartlepool, UK. (Photo credit: JDR)

JDR SELECTED BY SEAWAY 7 FOR ENBW HE DREIHT IN GERMANY

JDR, owned by the TFKable Group, has been awarded a contract by Seaway 7 ASA to supply 66 kV subsea array cables for the EnBW He Dreiht offshore wind farm (OWF) in Germany.

JDR will supply 100 km of 66 kV array cable that will connect the 64 wind turbines at the 900 MW offshore wind farm. JDR won the contract through a competitive tender due to its strong technical capabilities and breadth of offshore experience providing cable products and services to 50 offshore wind projects to date.

The EnBW He Dreiht offshore wind farm is located within the German Exclusive Economic Zone of the North Sea, around 85 km north of the Borkum Island and 95 km west of the Helgoland Island. The wind farm is currently one of the largest energy transition projects in Europe and will also be the first to use turbines with a capacity of 15 MW each. The project is scheduled to be operational by 2025.

John Price, Sales Director at JDR, said: "Germany is an important location for us, and we continue to see great potential here as the offshore market grows from strength to strength. We're proud to be part of a project that is pushing the boundaries of offshore wind by increasing megawatt capacity. This very much aligns with our values as a company because we are always looking at ways to innovate our solutions to future-proof the industry. We're also delighted to continue to build on our long-standing relationship with Seaway 7 by providing technical expertise and subsea solutions to support in the success of He Dreiht."

Florent Menet, He Dreiht Project Manager at Seaway 7 ASA added: "We selected JDR due to its reliability, having worked with the company previously. We especially know their ability to provide robust solutions on time, which is very valuable in adding to the expertise surrounding a project such as this."

The cables will be manufactured at JDR's state-of-the-art facility in Hartlepool, UK, before being installed on the project in 2025.

PRYSMIAN GROUP REACHES KEY TECHNOLOGY MILESTONE WITH 525 KV EXTRUDED CABLE

Prysmian Group has reached a key technology milestone in the field of Power Transmission, thus confirming its preeminent role and commitment to support the energy transition.

The world leader in the cable industry announces the successful development and testing of the first 525 kV extruded submarine full cable system for High Voltage Direct Current (HVDC) applications.

This breakthrough innovation in cable technology will enable a massive increase of the maximum transmission capacity of bi-pole systems up to more than 2.5 GW, which is more than double the value achieved with 320 kV DC systems currently in service. The one-year prequalification testing was carried out per international standards including CIGRE TB-496 and witnessed by a third-party certification body.

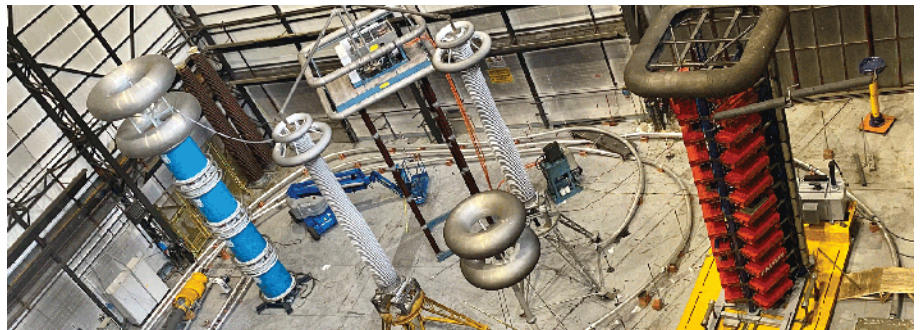
"Prysmian Group has always been at the forefront in the development of innovative and advanced technological solutions for power grids, namely land and submarine cable systems for HVDC applications," Valerio Battista, CEO Prysmian Group. "This new milestone confirms our commitment and prominent role in the development of power grids infrastructure, key for the energy transition," he concluded.

HVDC cable links are key components of sustainable energy systems, to transmit large bulks of electricity over long distances, often across or between countries. This achievement will put Prysmian Group in a unique position to support the forthcoming tenders for submarine interconnectors aimed at granting efficiency, flexibility and reliability of power grids.

"On the heels of the successful industrialization of 525 kV HVDC underground cables for the 3 German HVDC links projects, we are ready to extend this innovative technology for submarine cable systems to enable our customers in the continuous effort towards the energy transition by further reducing the costs of offshore wind and minimizing the environmental impact," said Hakan Ozmen, EVP Projects Business Unit.

For this new voltage class of submarine cable systems, the company leveraged an extensive and in-depth knowledge of materials and the capability to improve manufacturing processes, thus successfully facing the challenge of optimizing a reliable industrial process with strict technological parameters and providing an entire system of cable and accessories—including flexible factory joints, rigid repair joints and sea-land joints—with the best dielectric properties.

"We are proud to lead the industry towards the milestone of 2 GW submarine power transmission, being capable to offer the industry best suite of advanced HVDC and HVAC cable systems, including our proprietary P-Laser and MI-PPL technologies," added Srinivas Siripurapu, Chief Innovation and R&D Officer.



» Prysmian leveraged an extensive and in-depth knowledge of materials for this new voltage class. (Photo credit: Prysmian)

MAMMOET PROVIDES EFFICIENT HANDLING OF SUBSEA CABLE

Subsea cables provide critical communications and power links for offshore assets, but handling and installing these giant lifelines can be anything but simple—as in the case of a new subsea cable for an offshore project in Saudi Arabia.

The challenge was to load in the 1,300 t cable basket for transpooling cable onto an offshore service vessel, which required specialist support from Mammoet to meet the installation schedule.

The cable basket arrived on a barge, where it then needed to be loaded in and the empty basket loaded back out on the barge. However, the height difference between the

barge and the quay, meant that thorough engineering across disciplines was needed to ensure a smooth, efficient load in operation.

Mammoet engineers created a detailed plan, which included a bespoke 50 m ramp, designed to accommodate the elevation difference whilst bearing a total load of over 1,500 t. The result was a pathway for 18 lines of self-propelled modular transporters (SPMT) to roll onto the barge, lift the basket and roll off onto the jetty. The spooling operation was then performed with the basket being rotated by the SPMTs, whilst typical spooling auxiliary equipment was used to manage the cable between the basket and the installation carousel. With time of the essence, the

Mammoet team worked in day and night shifts as the SPMTs were rotated.

This allowed loadout to happen sooner, moving the empty cable basket by SPMTs back onto the barge via the ramp. In total, load in, transpooling and load out was undertaken in far fewer days than the original timeframe given.



» The cable basket arrival by barge. (Photo credit: Mammoet)

PEACE COMPLETED CONSTRUCTION FROM PAKISTAN TO FRANCE

PEACE Cable International Network Co., Ltd (PEACE Cable) has completed the construction and laying of PEACE submarine cable infrastructure in Pakistan together with Cybernet Internet Services (Cybernet), the leading Internet and data communication network service provider.

The Pakistan-Egypt segment of PEACE has achieved final splicing, thus enabling connectivity from Karachi, Pakistan to Marseille, France ready for service.

The PEACE Pakistan-Egypt segment connects Karachi, Pakistan and Zafarana, Egypt, spanning a total length of 5,800 km. The landings of Karachi and Zafarana were completed in March and December 2021 respectively. In addition, the Mediterranean segment of PEACE linking Marseille, France, to Abu Talat, Egypt, a 3,200-km long project, has also achieved RFS in March 2022. Therefore, the route from Pakistan to France of PEACE cable system is now fully constructed well and ready for use.

In 2019, the landing agreement was signed by Cybernet and PEACE Cable. Cybernet, the landing partner of PEACE in Pakistan, has built the country's state-of-the-art, Cable Landing Station in Karachi, which will allow global carriers, Content Delivery Networks (CDNs), content providers and virtually all IT-enabled firms to tap into the submarine cable capacity at easily accessible interconnect points across Pakistan. Cybernet has the most robust fiber optic network across the country which will also facilitate access and boost business opportunities for PEACE in the Asian region.

Through the deployment of the PEACE submarine cable system, Pakistan will have access to high-speed, large-volume internet bandwidth with express connectivity to France. With its ultra-low latency design, this cable will reduce latency between Pakistan and France to 92 milliseconds. This will improve the response time of Internet-based applications and experience of Pakistani users

while providing much-needed redundancy to Pakistan's Internet infrastructure. The increased capacity will finally make it possible to provide ultra-fast bandwidth connections across Pakistani citizens, with speeds comparable to those in cities such as Hong Kong, Singapore and New York.

The PEACE Cable System, connects Asia, Africa and Europe, with its stronghold connecting Pakistan, France, Egypt, Kenya. The whole system deploys a state-of-the-art "system-within-a-system" and adopts advanced ROADMs powered by WSS and Flexible Grid, providing PoP to PoP solutions. PEACE has a capacity of up to 96T for Pakistan - Egypt segment and 192T in the Mediterranean segment from Egypt connecting to France. Meanwhile, PEACE is now under construction for the Singapore extension, which will extend the coverage of the PEACE cable system to Southeast Asia and continue to enhance the value of the PEACE cable system's network resources, forming a major Asia-Europe interconnection channel by connecting Singapore, the Southeast Asian international circuit transfer center, and France, the European transfer center.



FIBERSENSE AND SX ANNOUNCE EXPANSION OF ALLIANCE

FiberSense and Southern Cross Cable Network (SX) have announced a further expansion of the world leading subsea cable monitoring capability in FiberSense's DigitalAsset™ Marine.

The announcement follows SX's recent activation of their new Southern Cross NEXT

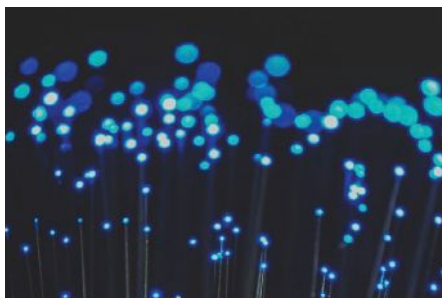
submarine cable connecting Australia, New Zealand, the USA and the Pacific Islands.

NEXT utilizes DigitalAsset™ Marine coverage on the shore-end network, all the way from the cable landing station to the first repeater.

FiberSense can identify and pinpoint threats across the cable front haul section, continuously along the cable and in real-time. This enables a variety of response mechanisms from Automatic Identification System (AIS) messaging to coast guard intervention, and ship to shore radio. Once activated, the FiberSense DigitalAsset™ Marine system detects and locates a vessel. An alarm is posted in real-time if any anchoring event or other aggression event is detected and several mitigation strategies are employed

in order to avert a break. In tandem with AIS integration, FiberSense can aid in assigning culpability, the benefit being that FiberSense still works even if AIS is deactivated.

Additionally, FiberSense has developed a world leading capability to detect when a section of cable is uncovered on the ocean floor or is suspended above the ocean floor and is strumming, in real-time by location to meter accuracy. An exposure or strumming event makes the cable much more vulnerable to external damage or a cable fault. In addition to protecting submarine telecommunications and power cable infrastructure, FiberSense is also able to detect and classify earthquake and tsunami events and the material public benefit this will provide at scale.





» Bathymetric, geophysical, and geotechnical information is being used to plot the safest and most sustainable cable route. (Photo credit: Interconnect Malta)

INTERCONNECT MALTA LAUNCHES SURVEYS FOR MALTA POWER CABLE

Recently, the 60-meter vessel Urbano Monti sailed out of the Grand Harbour to start surveying a 600-meter-wide corridor of seabed along the proposed interconnector route, which extends circa 100 kilometers from Baħar iċ-Ċagħaq to Marina di Ragusa, in Sicily. The maximum seabed depth of this route is expected to be 160 meters.

The PMRS is essential for the development of Malta's second interconnector, because it will provide bathymetric, geophysical, and geotechnical information to plot the safest and most sustainable route of the submarine cable. It will also provide the required data to design the cable burial methods and physical protection for the overall electrical scheme.

Interconnect Malta designed the preliminary route to avoid sites of ecological importance as well as bunkering, aquaculture, touristic, fishing, and trawling areas, and other restricted zones. To ensure effective redundancy, the design also keeps this cable as far away as technically possible from Interconnector 1, the first subsea electricity cable between the two countries energized in 2015.

The Italian surveying company Fugro S.p.A, was contracted to conduct the PMRS earlier this year, following an international call for tenders. It will be using the offshore survey vessel Urbano Monti, which is equipped with state-of-the-art positioning,

multibeam echo-sounder, side scan sonar, sub-bottom profiler, magnetometer, ROV, gravity coring, cone penetrometer, sample collecting and other equipment necessary to carry out a high-quality survey according to the project requirements.

Nearshore survey works started in Sicily last week using a smaller vessel, whereas nearshore surveying at Baħar iċ-Ċagħaq, Malta will commence shortly. Depending on weather conditions, the offshore survey will continue until mid-October. The contractor will then proceed with data analysis and reporting.

Interconnect Malta recently also issued other calls for tenders for this project's front-end engineering design (FEED) and for the environmental impact assessments (EIA) required as part of this development's applicable permitting processes in Italy and Malta. Thereafter, the company will issue a call for tenders for the Engineering, Procurement and Commissioning of this new interconnector.

Apart from augmenting security of supply to meet present and future electricity demand, Interconnector 2 will also provide the necessary reserve capacity to accommodate the energy output intermittency of Malta's ever-increasing share of grid-connected renewable energy sources, contributing to the country's climate objectives, for a better quality of life.

CINTURION, GRID TELECOM CONFIRM COOPERATION FOR TEAS

Cinturion Corp Ltd. and its Landing Partner in Greece, Grid Telecom announced they are advancing their ongoing cooperation for the landing of TEAS—Trans Europe Asia System in Greece.

Cinturion is building TEAS to bring advanced data transport solutions, creating a telecommunications corridor

between India, the Middle East and Europe. Grid Telecom, a wholly owned subsidiary of the Independent Power Transmission Operator of Greece (IPTO) operates and develops an advanced open-access fiber network throughout Greece which is also a major data gateway to Southeast Europe. The partnership of Cinturion and Grid Telecom is providing

TEAS customers with carrier neutral open-access interconnection with leading edge connectivity and international reach across the European continent and beyond.

TEAS is the first dual path cable system of its kind, to provide geographically diverse routes that create a new protected data corridor between East and West.

SECURITY AND DEFENSE EXPERTS PRIORITIZE INVESTMENTS IN OCEAN TECH AND WORKFORCE DEVELOPMENT

In late August, SENEDIA, the alliance for defense tech, talent, and innovation, hosted the eight edition of Defense Innovation Days 2022, a three-day national convening that unites national security experts and policymakers with defense industry leaders to develop innovative solutions for the U.S. military and its next-generation workforce.

On the agenda were some of the nation's most influential voices on national security and defense, including Senate Armed Services Committee Chairman Senator Jack Reed, Secretary of the Air Force Frank Kendall, Secretary of the Navy Carlos Del Toro, and Chief of Naval Research RADM Lorin Selby.

The event serves as an opportunity for defense companies, both small and large, to gain insights into how they can more effectively compete for defense contracts, access resources to spur innovation, build a talent pipeline that will fuel their growth, and highlight their innovative technology.

MEETING OF MINDS & PRIORITIES

"The defense industry has a shared mission of protecting our nation and supporting our men and women in uniform," said Molly Donohue Magee, Executive Director of SENEDIA. "Defense Innovation Days is an opportunity to showcase the latest technologies, share best practices with a focus on collaboration to advance mission critical priorities of our military, and increase access to opportunity and economic growth for business."

Senator Reed kicked off the event from the exhibition hall on Monday evening and was joined by Secretary Kendall. Both provided insights, toured displays, and met with businesses

that provide a range of products and solutions, from engineering services to technology innovation.

"We have to continue acquisition reform, invest in innovation and scalable technology, implement new industrial base policies, and leverage the capabilities of our allies," said Reed.

Secretary Kendall reinforced the urgency facing the industry and our national security infrastructure: "We need to accelerate change, or we will lose," he said. "Industry has enormous capacity, and I want industry to help us solve our problems."

Technical sessions covered challenges for national security, such as climate resiliency and cybersecurity. They also focused on opportunities facing the industry through the lens of both security and the economy, including the development of strategic partnerships that will increase innovation, fortify U.S. maritime dominance, and inspire a new wave of talent to pursue the high-wage, high-growth, high-demand careers that the approximately \$900 billion a year defense sector has to offer.

KEY TAKEAWAYS

- The U.S. needs to accelerate innovation and scale up solutions. Investment in robust research and development is an essential piece of this strategy.
- Government is increasingly looking to and relying on industry to help solve problems, and to break down barriers for those looking to do business with government agencies. We need to get better about sharing best practices and making it easier to collaborate.
- People are our most important resource in defense. We must prioritize workforce development and support for the existing workforce. We must also recognize that the future of work is changing, so industry must be nimbler and more flexible in meeting the needs of workers.
- We must innovate in how we do business, accelerate technology, and build the workforce for today and tomorrow.

Secretary of the Navy Carlos Del Toro spoke to the imperative to reach out to ensure a strong partnership between industry and the Department of the Navy.

"From artificial intelligence to robotics to machine learning and autonomous systems, staying ahead of the competition is and will always be a team sport. Together, we need to expand our base of capable and innovative businesses," Del Toro said, noting that in 2022, they have seen 36 percent greater engagement from companies that have not traditionally done business with the Department of Defense. "The door is open and believe me when I say that I am listening."



» Rear Admiral Lorin Selby, Chief of Naval Research, delivers a keynote address to SENEDIA members and guests on the importance of innovation and collaboration in the defense ecosystem. (Photo credit: SENEDIA)



» Secretary of the Air Force Frank Kendall and Senate Armed Services Chairman Jack Reed explore the exhibition floor, visiting more than 25 business displays as part of Defense Innovation Days. (Photo credit: SENEDIA)

The Secretary's remarks were reinforced by Rear Admiral Lorin Selby, the Chief of Naval Research; Nicholas Guertin, Department of Defense Director of Test and Evaluation; and Jimmy Smith, Director of Small Business Programs for the Department of the Navy.

PIVOTAL MOMENT

Rear Admiral Selby focused on the importance of innovation—from government and industry alike.

"We are at a pivotal moment in history and the time is now to find ways to strengthen deterrence, to continue to build the capable systems needed for today, and to focus on what will be needed next," he said.

Guertin discussed how his organization is transforming test and evaluation to enable delivery of the world's most advanced warfighting capabilities. "We are the key to weapon systems that work," he said, "delivering them at the speed of need."

Smith addressed the business leaders in the room, focusing on the importance of small business in the defense ecosystem.

"We are in the business of providing capabilities to the warfighter, and small businesses are the key to doing that," he said.

The importance of expanding the pool of supply chain companies working with DoD and fortifying, growing, and diversifying the workforce, from cybersecurity and climate change to the manufacturing industrial base, was emphasized throughout. Trade and industrial skilled workforce development was detailed in the breakout Department of Defense summit: "Building the Shipbuilding Workforce to Meet National Security and Supply Chain Priorities."

"The number one thing that keeps me up at night is the workforce—in the immediate, where attrition rates are double what they were before COVID, but it's also the workforce of the future. We need generations of people interested in returning to manufacturing careers to support defense and national security," said Deborah Rosenblum, assistant secretary of defense for Industrial Base Policy (PTDO).

For more information, visit www.senedia.org.



GENERAL DYNAMICS ELECTRIC BOAT AWARDED \$236.2 MILLION CONTRACT MODIFICATION FOR SUPPORT OF OPERATIONAL SUBMARINES

General Dynamics Electric Boat, a business unit of General Dynamics, has been awarded a modification of the previously awarded U.S. Navy contract for engineering, technical, design, and planning yard support for operational strategic and attack submarines.

The contract modification has a value of \$236,182,606. Work will be performed in Groton, Connecticut; Kings Bay, Georgia; Bangor, Washington; Pearl Harbor, Hawaii; North Kingston, Rhode Island; and Newport, Rhode Island, and is expected to be completed by September 2023.

"The shipbuilders of Electric Boat are proud to continue our role providing lifecycle maintenance and modernization support to the U.S. Navy's operational submarine fleet in keeping with our mission to provide sailors with the advantage that helps protect our nation," said Kevin Graney, president of General Dynamics Electric Boat.



» General Dynamics Electric Boat's operational HQ in Groton, Connecticut. (Photo credit: General Dynamics Electric Boat)

U.S. MARINE CORPS AWARDS BAE SYSTEMS \$88 MILLION CONTRACT FOR ACV-30 TEST VEHICLES

The U.S. Marine Corps has awarded BAE Systems a \$88 million contract to build multiple ACV-30 Production Representative Test Vehicles (PRTVs). Once delivered, the PRTVs will undergo a period of testing prior to a full-rate production decision.

The ACV-30 mounts a stabilized, medium caliber Remote Turret System manufactured by KONGSBERG. The 30 mm RT-20 is a remotely controlled and operated weapons system that enhances crew protection. The remote turret eliminates the space requirement of legacy lethality systems. It provides more space to transport troops or mission essential equipment and reduces weight for better mobility.

"We are committed to equipping the Marine Corps with the best technology available to provide them with a decisive edge," said John Swift, vice president of amphibious programs at BAE Systems. "We have carefully chosen proven industry partners who are equally committed to ensuring Marines have the capabilities to dominate on the battlefield."

The ACV represents the optimum balance of sea/land mobility and survivability, with future growth potential. The ACV was born out of a combination of BAE Systems' amphibious vehicles legacy and Iveco Defense Vehicles' long history of producing more than 30,000 multi-purpose armored vehicles.

"The unmanned KONGSBERG RT-20 medium caliber turret is designed to meet the current and future needs of the Marine Corps as they move forward in implementing the future operating



» The ACV-30's Remote Turret System is manufactured by KONGSBERG. (Photo credit: BAE)

vision known as Force Design 2030," said Scott Burk, president of KONGSBERG Protech Systems USA. "The fielding of this vehicle system provides the Marines with a low risk, and operationally proven solution."

The ACV-30 is one of four variants in the ACV Family of Vehicles. BAE Systems is under contract for a personnel variant (ACV-P), a command variant (ACV-C), and a recovery variant (ACV-R).

In addition, BAE Systems has received task instructions from the U.S. Marine Corps to complete a study of incorporating a Command, Control, Communication and Computers/Unmanned Aerial Systems mission payload into an Amphibious Combat Vehicle (ACV) variant.

SEEBYTE BY DASA TO DEVELOP FUTURE CREWED-UNCREWED TEAMING CONCEPT

SeeByte, a global leader of smart software solutions for uncrewed maritime systems, has been selected by the Ministry of Defence's Defence and Security Accelerator (DASA) to design and develop a proof-of-concept solution

to improve communication and understanding between operators and uncrewed maritime systems.

The new concept will include tailoring the volume and content of messages received

and predicting vehicles' actions between communication updates. Most importantly, the engine will present any variation detected between the predicted and actual actions of the vehicle executed in-mission. This ultimately creates a higher level of trust between the software and the operator.

With limited or inconsistent communications, it can be exceedingly challenging for an operator to follow mission progress and this results in low confidence in the system with

frequent mission aborts. When communication isn't present, using a system like this will allow an autonomous system to clearly explain its actions to the operator and provide accurate predictions on the current mission.

"Being selected to develop a system as stimulating as this is extremely exciting for everyone involved. We are in a good position to take this technology forward as part of our existing programs of work, and to receive relevant customer and end-user feedback along the way," said Alastair Cormack, SeeByte's Commercial Manager.



» Concept impression displaying asset progress, predicted path and actual GPS location. (Image credit: SeeByte)

DAMEN NAVAL AND ROLLS-ROYCE WILL SUPPLY MTU NAVAL GEN-SETS FOR F126

Damen Naval and Rolls-Royce business unit Power Systems have signed a contract to deliver 16 mtu diesel generator sets for the four new F126 Frigates for the German Navy.

The onboard power of each F126 vessel will be provided by four mtu Series 4000 variable speed gensets. These high performance gensets are the most environmentally friendly naval gensets Rolls-Royce has ever produced: They meet the requirements of the IMO III emissions directive thanks to state-of-the-art mtu selective catalytic reduction (SCR) systems. The agreement also includes an Integrated Logistics Support (ILS) package. It is the second F126 contract awarded to Rolls-Royce; earlier this year Damen Naval chose the company to supply the automation solutions mtu NautIQ Master and mtu NautIQ Foresight.

Paul Röck, Director Sales Governmental at Rolls-Royce business unit Power Systems, said: "We are extremely proud to once again be chosen by Damen Naval as partner in this very important and prestigious project. Our advanced sustainable solutions for both power and control of the F126 vessels will play a key role in ensuring the frigates' reliability, efficiency, and operational success."



» The German Navy's F126 Frigate. (Image credit: Damen/Rolls-Royce)



» The mtu diesel gensets meet the requirements of the IMO III emissions directive. (Image credit: Damen/Rolls-Royce)

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AMERICAS

OCEANS

Hampton Roads, VA » October 17-21
<https://hamptonroads22.oceansconference.org/>

ACP Offshore WINDPOWER

Providence, RI » October 18-19
<https://cleanpower.org/offshore-windpower-2022/>

Offshore Wind Executive Summit

Galveston, TX » November 8
www.offshorewindsummit.com

Floating Wind USA

San Francisco, CA » November 8-9
<https://events.reutersevents.com/renewable-energy/floating-wind-usa>

TMA BlueTech Week

San Diego, CA » November 14-18
www.tma bluetechnology.org/bluetechnology-week

SPE Brazil Subsea Symposium

Rio De Janeiro, Brazil » November 29-30
<https://subsea-symposium.spebrasil.org/>

Floating Wind Solutions

Houston, TX » Jan 30 – Feb 1, 2023
<https://floatingwindsolutions.com/>

Oceanology Int'l Americas

San Diego, CA » February 14-16, 2023
www.oceanologyinternationalamericas.com

EUROPE

ICOE - OEE

Basque Country, Spain
 » October 18-20
<https://icoeoe2022donostia.org>

Deep Sea Minerals

Bergen, Norway » October 26-27
<https://events.geonova.no/event/deepseaminerals/>

Offshore & Floating Wind Europe

London, UK » November 2-3
events.reutersevents.com/renewable-energy/offshore-floating-wind-europe

Int'l Wind Congress

Berlin, Germany » November 7-8
<https://windcongress.com/>

Marine Autonomy & Technology Showcase

Southampton, UK » November 8-10
<https://noc.ac.uk/news/marine-autonomy-technology-showcase-2022>

Offshore Energy

Amsterdam, The Netherlands
 » November 29-30
www.offshore-energy.biz/offshore-energy-2022

Wind Power Finance & Investment Summit EU

London, UK » December 6-7
<https://windfinancesummit.com/>

Subsea Expo

Aberdeen, UK
 » February 21-23, 2023
www.subseaexpo.com

OTHER REGIONS

Asia-Pacific Decommissioning & Abandonment

Kuala Lumpur, Malaysia » October 4-5
<https://offsnet.com/da-apac>

Mediterranean Offshore Conference

Alexandria, Egypt » October 18-20
www.moc-egypt.com

ADIPEC

Abu Dhabi
 » October 31 - November 3
www.adipec.com

Telecoms World Asia

Bangkok, Thailand » November 2-3
www.terrapinn.com/conference/telecoms-world-asia/index.stm

Asia-Pacific Deep Sea Mining Summit

Singapore » December 12-13
www.asia.deepsea-mining-summit.com

IEEE Underwater Technology

Tokyo, Japan » March 6-9, 2023
https://conferences.ieee.org/conferences_events/conferences/conferencedetails/49729

SubOptic

Bangkok, Thailand
 » March 13-16, 2023
www.terrapinn.com/exhibition/suboptic

2022

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	CONTENT FOCUS & PRODUCT/SERVICE
OCTOBER Editorial: Sept. 19 Ad: Oct. 06	» OFFSHORE ENERGY Offshore & Floating Wind Europe / November 2-3 Int'l Wind Congress / November 7-8  Floating Wind USA / November 8-9 TMA BlueTech Week / November 14-18	Editorial Topics: Sector Diversification, Seabed IMR, Sensor Innovation, HSSE, Decommissioning, Oil Spill Response, Renewables Product Focus: Marine survey, oil spill response, renewable energy technologies, geotechnical services
NOVEMBER Editorial: Oct. 17 Ad: Nov. 03	» UNDERWATER IMAGING	Editorial Topics: Bathymetric Mapping, IMR, Habitat Characterization, Acoustic Sensing Product Focus: Observation ROVs, AUVs, cameras, lights, diving innovation, tracking & positioning systems, optical and acoustic sensors
DECEMBER Editorial: Nov. 14 Ad: Nov. 18	» THE FUTURE OF OCEAN TECHNOLOGY Oceanology Int'l Americas / February 14-16 Subsea Expo / February 21-23 Floating Wind Solutions / January 30 - February 1	Editorial Topics: Special Edition

2023

JAN/FEB Editorial: Jan. 20 Ad: Feb. 10	» OFFSHORE EXPLORATION US Hydro / March 12-16 Int'l Partnering Forum / March 28-30	Editorial Topics: Offshore Infrastructure Development, Exploration of Deep-Sea Resources, ESG, Geotechnical Services Product Focus: Submersibles, AUVs, Lights, Cameras, Deck Handling Equipment, Research Vessels, Samplers
MARCH Editorial: Feb. 20 Ad: Mar. 10	» UNCREWED VEHICLES Ocean Business / April 18-20	Editorial Topics: Remote Marine Survey, Seafloor Mapping, Harbor Security, Long-Range Ocean Research, Coastal Monitoring Product Focus: USVs, AUVs, LARS, UAVs, Sonars, Propulsion and Positioning Systems
APRIL Editorial: Mar. 20 Ad: Apr. 7	» MARITIME DEFENSE & SECURITY	Editorial Topics: Coastal Surveillance, Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW), Search & Rescue, Submarine Cable Infrastructure & Protection Product Focus: USVs, XLUVs, AUVs, ROVs, Amphibious Vehicles, MCM, ASW
MAY Editorial: Apr. 14 Ad: May 5	» GREEN ENERGY TRANSITION	Editorial Topics: Offshore Wind Infrastructure & Supply Chain, Subsea Batteries, Wave Energy Systems, At-Sea Automation, CCS Systems, Hydrogen Product Focus: Offshore Turbines, Supply Vessels, Underwater Batteries, Subsea Connectors, Submarine Cables, Renewable Energy Systems
JUNE Editorial: May 22 Ad: June 9	» UNDERWATER SENSOR TECHNOLOGY & IMAGING	Editorial Topics: Underwater Navigation, Marine Archaeology, Environmental Coastal Monitoring Product Focus: ROVs, Lights, Cameras, Manipulators, Towed Arrays
JULY Spotlights: June 27 Ad: July 7	» UNCREWED VEHICLES BUYERS' GUIDE 	Editorial Topics: Special Edition
AUGUST Editorial: July 24 Ad: Aug. 11	» OCEAN OBSERVATION, DATA, & COMMUNICATIONS	Editorial Topics: Oceanography, Meteorology, Remote Sensing, Telemetry, Data Processing, Seafloor Mapping, Cloud-Based Data Storage Product Focus: Marine Observation Systems, Buoys, Drifters, Marine Research Vessels, Subsea Nodes, CTD, Acoustics, Biosensors

JAMES FISHER RENEWABLES AND SCANTECH OFFSHORE CHAMPION NORTH AMERICAN OFFSHORE WIND WITH VP APPOINTMENT

Two James Fisher companies, James Fisher Renewables (JF Renewables), trusted technical and operations solutions provider to the offshore renewables industry, and ScanTech Offshore, leading service provider to the global energy market, recently announced the appointment of Barry Craig to Vice President Renewables – North America. The move will enable both businesses to support US offshore wind growth ambitions, by driving the identification of key strategic opportunities and local partnerships, in a bid to help accelerate the global energy transition.

The appointment is an integral part of the two companies' renewables strategy. For ScanTech it follows significant development of its existing product portfolio for the US, with its focus on adhering to the highest emissions standards for swift, compliant deployment. While JF Renewables, which has led the charge in construction and development of over 17 GW of offshore wind installed capacity in under 14 years, is primed to apply its supply chain expertise 'across the pond.'

Joining James Fisher and ScanTech 14 years ago as part of an acquisition, Mr. Craig has worked in a variety of operations

and project management roles. Located in Boston, he will be focused on the integration and deployment of sustainable solutions for energy projects, such as bubble curtains.

Wayne Mulhall, Managing Director at JF Renewables said: "With all eyes on the US as it races to meet its 30 GW by 2030 offshore wind target, the timing of this appointment couldn't be better. Having established ourselves as a key player in the European renewables space, we are well placed to bring our learnings across the pond in support of a global transition towards cleaner energy.

"We are excited to enter this next phase of growth and are confident that with Barry at the helm, we can begin to grow market awareness in the region. This appointment marks an important first step to achieving our longer-term ambition of becoming fully embedded in-country to bolster the local offshore wind supply chain."

The urgency for accelerated project development in the US is growing amidst the backdrop of unique regulatory challenges such as the Jones Act and local content requirements.

Commenting on his appointment, Barry Craig said: "We're entering the US at a pivotal moment; and I couldn't be more excited for what's to come. It is a fantastic opportunity for both ScanTech and JF Renewables to establish ourselves as serious players in the US market. In a region that takes local content very seriously, having boots on the ground will enable us to stay one step ahead when it comes to finding facilities, building relationships with local partners and establishing a base from which to recruit and grow in step with industry demand."



» Barry Craig, Vice President Renewables, North America.



GREENSEA SYSTEMS EXPANDS FOOTPRINT BY OPENING THIRD LOCATION IN SAN DIEGO, CA

Marine technology specialist, Greensea Systems Inc., is to open a third location to accommodate its growing workforce and support strengthening its presence on the US West Coast. The new office, located



» Greensea's third location in Southern California. (Image credit: Greensea)

at 4901 Morena Blvd, San Diego, California, provides ample room to accommodate the local team, new hires, as well as a spacious production area. It also allows Greensea to take advantage of the technology hiring pool found in Southern California in anticipation of further expansion.

Chelsea Allen, VP Operations, said: "This particular location provides the space that Greensea needs to grow in the area. We are now supporting multiple projects with military customers in San Diego and

being geographically close is undeniably a game changer. The space we chose is flex space, providing us with the needed shop space to support the hardware requirements of the projects and programs in the area. Greensea is rooted in collaboration and we believe the future of ocean robotics is rooted in it as well. This space provides an opportunity to strengthen that collaboration with our West Coast vendors, partners and customers."

"Having a location in San Diego also gives us better access to a pool of very talented employees. We already have a number of full-time employees working remotely in the area, who are very excited about a brick-and-mortar location opening up, and we expect to double our headcount here within the next year."

Greensea also has offices in Richmond, Vermont, and Plymouth, Massachusetts.

AQUATERRA ENERGY APPOINTS NEW RENEWABLES DIRECTOR

Aquaterra Energy, a leader in global offshore engineering solutions, has appointed Anne Haase as Renewables Director to drive the offshore renewable energy arm of the business.

Anne will focus on delivering a defined growth strategy that predominantly targets the global offshore wind and green hydrogen markets. Headquartered in Norwich, operating globally, she will bolster the skills and expertise of the existing renewables team and identify further opportunities for the business. Anne brings over 25 years of energy industry experience gained from senior leadership, operational and commercial roles within Engineering and Industrial organizations, such as Petrofac and Bilfinger, as well as supporting major developers and operators across key stages of wind and hydrogen projects.

Anne Haase, Renewables Director at Aquaterra Energy, said: "I'm delighted to join such a passionate team of talented individuals. Aquaterra stood out for me because it is totally committed to delivering engineering solutions that really make a difference, as we transition to a greener world. The offshore wind and hydrogen sectors need to have the resources and expertise in place to meet its goals - we are here to help and are creating practical solutions for complex problems which can fast-track time to first operation. Working with this experienced team, together, we will create workable solutions and support career opportunities within our growing offshore energy business."

The appointment follows the company being selected to pioneer a renewably-powered offshore platform in Trinidad. Aquaterra Energy, alongside project partners, is also developing an industrial scale offshore green hydrogen production concept, through the deployment of an electrolyzer system on a converted jack-up rig in the North Sea.

James Larnder, Managing Director of Aquaterra Energy, added: "Anne's background and deep sector knowledge means she's uniquely positioned to deliver the next phase of our offshore renewables growth. Her leadership skills and ambition will put

our wind and hydrogen offering on the global stage. We've already secured a partnership to develop an innovative concept for offshore green hydrogen production, and we hope to capitalize on new market opportunities across the globe."

» Anne Haase, Renewables Director
Aquaterra Energy



OCEANTOOLS CELEBRATES 25 YEARS OF INNOVATION

OceanTools celebrated its twenty fifth anniversary on September 1, 2022.

The company is now a world-leader in the production of subsea video cameras and lighting systems, manufactures the most sophisticated dye and leak detection system on the market, and designs and builds advanced subsea pressure housings.

Speaking of the company milestone, company founder Kevin Parker said: "OceanTools has come a long way since I cobbled together the industry's first PC based video overlay system on my dining room table in 1997. That overlay, having evolved over the years, is still in production in 2022 with several thousand units sold."

Export sales count for more than 50% of the company's turnover with markets including oil and gas, scientific research, renewables, defense, and trawling.

Innovation has been at the heart of OceanTools since its conception. The prolific product development team utilize the latest advances in engineering to ensure their place as market leaders in underwater technology.

Brian Hector, Technical Sales Manager at OceanTools, said: "At OceanTools we harness all the latest technologies available to ensure our products lead the way and will continue to do so for the next 25 years which makes it a very exciting company to be a part of."

VERLUME STRENGTHENS LEADERSHIP TEAM

Verlume, a specialist in intelligent energy management and energy storage, has bolstered its leadership team by appointing a chief commercial officer, Andy Martin, and making two internal promotions to CTO and COO for Paul Slorach and Jonny Moroney, respectively.

The Aberdeen-based battery systems provider for harsh environments has appointed Andy Martin to the new role of chief commercial officer, where he will be responsible for developing and implementing commercial strategies across the underwater, offshore and onshore sectors.

With almost three decades of commercial, sales and business leadership experience in the offshore wind and communications industries, Mr. Martin joins from the Offshore Renewable Energy Catapult where he was business development lead for the operational performance directorate.

Within the wider leadership team, Paul Slorach moves to the role of CTO, following around eight years managing Verlume's business development activities. As part of his new role, Mr. Slorach will lead the company's strategy for technology development, identifying and creating new market spaces for the decarbonization of energy production, ensuring market alignment and continued innovation.

Jonny Moroney moves from his current role of operations director, following almost eight years of operational and project management experience at Verlume, to COO. Mr. Moroney will manage organizational operations in line with Verlume's growth



» Left to right: Paul Slorach, Andy Martin, Jonny Moroney, Richard Knox

strategy, coordinating all business functions to ensure that company goals are achieved.

Richard Knox takes the new title of CEO, previously being managing director of Verlume. Mr. Knox's primary duties remain the same.

Verlume CEO Richard Knox said: "Since setting up the business in 2013, I have always been proud of the caliber of our team. As we reach a new stage and grow Verlume at pace, it will be our people that define our success.

It is for that reason that we have chosen to solidify the core of our leadership team, to build a solid foundation that will allow us to lead the business towards capitalising on the growing energy transition opportunities, particularly in offshore wind."

The company recently scaled up its manufacturing facility with a move to a new operations facility in Dyce, which is six times the size of its previous operational base.

STR INVESTS £1 MILLION IN NEW TECHNOLOGY AND INNOVATION CENTER OF EXCELLENCE

Subsea Technology and Rentals (STR), a leading global provider of specialist survey and inspection rental equipment, products and data enabling services to the offshore energy market, is celebrating the launch of its global technology and innovation centre of excellence after investing £1 million into the facility to drive its innovative solutions and support its growth plans.

The 30,000-square-foot facility in Great Yarmouth, UK will be the home to the businesses' standalone technology and innovation team responsible for STR's research and development of its technical solutions and products.

The purpose-built facility features state-of-the-art engineering and product development suites, mechanical and

electronic assembly and testing areas supported by the recruitment of 19 new employees bringing the Great Yarmouth headcount to 53.

The firm has experienced rapid growth during 2022 following the earlier announcement of investment from Baird Capital to support the firm's growth with further plans to expand and strengthen its capabilities.

STR COO Scott Johnstone said: "The launch of the new technology and innovation centre of excellence is a fantastic addition to the STR group offering. Through combining state of the art facilities with our experienced team and in-house technologies we will be better positioned to support our customers. We have a team

with extensive knowledge in their field and as a company we have a proven and impressive track record of providing leading edge solutions and in-house products across the offshore energy market for more than 20 years."



» STR Chief Operating Officer Scott Johnstone

OCEANEERING FORMS INSPECTION TECHNOLOGY COLLABORATION WITH INNETIQS

Oceaneering International has formed a collaboration agreement with InnetiQs GmbH (IQ) to explore and develop advanced inspection solutions for the offshore and onshore energy markets.

This collaborative agreement combines IQ's advanced inspection technologies for subsea pipelines, risers, and structural assets with Oceaneering's global operations and ability to provide cost-effective, in-depth inspection and cleaning methods that lessen exposure risks to personnel. This agreement also ties into our current integrity management systems and Inform™ software suite of predictive analytic solutions.

Work is underway to help evolve the development of IQ's state-of-the-art Splash Zone Scanner. This breakthrough solution combines multiple inspection methods and cleaning capability into a single scanning system to deliver a combined result not currently available in the industry.

Integrating the results of parallel methods delivers a level of confidence to evaluate asset integrity in the splash zone area that is a game changer in this critical area of an offshore installation.

"The collaboration between IQ and Oceaneering will improve processes



and capabilities and provide an avenue for enhanced inspection applications in all major regions from topsides, subsea, and the splash zone," said Eric Heuring, Sr. Director for Integrity Management and Digital Solutions, at Oceaneering. "Combining IQ's advanced technologies with Oceaneering's global operations and integrated service capabilities amongst business segments, including Integrity Management, Subsea Robotics and Offshore Projects, allows us to provide our clients with enhanced services to help better manage asset health."

Andreas Bönisch, CEO of InnetiQs, said: "We are excited to work with Oceaneering to build up a unique synergy to expand and deliver next generation advanced technology solutions that meet client needs, cover current inspection gaps, and make inspections less complex, more efficient, and more robust. This will ultimately enable clients to have more confidence in plant integrity and its fitness for purpose."

PETROSAFE AND ABL GROUP ENTER EGYPTIAN OIL AND GAS PARTNERSHIP

Petroleum Safety & Environmental Services Company (Petrosafe), which is one of the Egyptian General Petroleum Corporation (EGPC) companies, has signed a memorandum of understanding (MoU) to collaborate with ABL Group on safety and environmental solutions for the Egyptian oil and gas sector.

Under the MoU, energy and marine consultancy ABL Group will provide marine and engineering consulting to diversify and develop Petrosafe's offering in improving occupational health, safety, and environmental protection for petroleum sector companies in Egypt.

"We are delighted to enter this partnership with Petrosafe. We will apply our experience and services to promote the highest levels of safety and environmental compliance across Egypt's petroleum industry. We have

worked for many years with companies associated or part of EGPC, so this is a strong continuation of a long-standing relationship," said Tamer Gamil, ABL's country manager in Egypt.





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Nortek excels in the development and manufacture of acoustic Doppler instrumentation. Doppler Velocity Logs (DVLs) are used for subsea navigation. Acoustic Doppler Current Profilers (ADCPs) are used to understand physical processes in the ocean, rivers, lakes and laboratories. We pride ourselves on being innovative in product development and production processes. Nortek provides solutions to engineers and scientists by offering real-time data collection and support from our responsive technical team.

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 🌐 www.DeepWaterBuoyancy.com
 📄 Dan Cote, Sales Manager

DeepWater Buoyancy Inc. is the world's largest producer of subsea buoyancy products for the oceanographic community and has a vast product line of buoyancy solutions for offshore oil & gas, energy and technology companies. This product portfolio has been built over the course of 40 years serving these industries. Though products are offered for shallow water applications, the company specializes in deepwater, providing solutions to depths of 6000 meters and beyond.



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Cathx Ocean design and manufacture advanced subsea imaging and precision measurement systems for subsea operations. Designed to meet stringent technical, operational and integration requirements associated with various subsea applications and vehicle types, Cathx Ocean's systems offer precision, reliability and peace of mind. Products include advanced still imaging, colour laser point cloud and video systems, designed to deliver precision subsea data in a way that allows automation for subsea vehicle operations. The range includes the Hunter system (AUV Imaging and Laser), the Scout system (Observation Class ROV Imaging and Laser Profiling), the Pathfinder system (Work Class ROV Imaging and Laser Profiling) and the Prowler I & II systems (Towed Vehicle Imaging Range and Scale Measurement).



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For over 30 years, DeepSea Power & Light has provided high-quality and innovative products to the oceanographic community. The company's expertise and product line has grown to include underwater video systems, lighting solutions, pressure relief valves, and lasers.

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SIDUS Solutions LLC, 'SIDUS' is a worldwide company that designs, manufactures and installs systems in the most extreme of environments. SIDUS products include Cameras, Pan & Tilts, Lights and Lasers for use in hazardous areas for and SUBSEA, serving the, energy, scientific, military, nuclear, and shipping industries. Engineering experience makes us the perfect choice for application specific surveillance systems to provide end to end safety and security. SIDUS provides complete integration, design, documentation, and commissioning for all systems. From sea-floor observation platforms, to surveillance systems on drilling rigs, or sonar deployment systems - SIDUS is a field proven solution.

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Established 1957, South Bay Cable designs, manufactures and tests specialized Electro-Optical-Mechanical Cables for use in demanding marine environments. Our cables tackle stringent customer requirements which include ROV Tether and Umbilical Cables, Towed Array Cables, Mux BOP Control Cables, Video Inspection, Faired Cables and a host of other customer-specific applications.

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Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry products such as the **5500 Series, SC, MC, LP, FAWL/FAWM, NANO, TC, Rubber Molded**, etc. Birns Aquamate is the only manufacturer to guarantee compatibility with other uw connectors. Birns Aquamate also specializes in fast turn-around for custom design of special connector solutions. All connectors are manufactured under DNV ISO 9001:2000 certification. Dealers in Canada, Brazil, UK, Belgium, Holland, Norway, Germany, South Africa, Holland, Italy, and China.

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EdgeTech designs, manufactures and sells industry-leading side scan sonars, sub-bottom profilers, bathymetry systems and combined sonar systems. Additionally, the company produces world class underwater actuated and transponding solutions including deep sea acoustic releases, shallow water and long life acoustic releases, transponders, reliable USBL acoustic tracking and positioning systems, and custom-engineered acoustic products.

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MetOcean Telematics provides complete end-to-end telematics services, with a focus on niche MetOcean solutions. As a prominent Iridium Satellite Value-Added Reseller (VAR), MetOcean provides Iridium telemetry for your products and solutions to ensure data is transmitted quickly and reliably. Equipped with the ISO 9001 certification, MetOcean has a long history of assisting customers with integrating Iridium hardware into a range of devices and applications, from Unmanned Surface Vehicles and Autonomous Underwater Vehicles to Buoys and Profiles, and our team understands the challenges you face when deploying your device. When it comes to reliable, global satellite coverage at sea, choose MetOcean.

TRANSDUCERS



AIRMAR TECHNOLOGY CORPORATION

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AIRMAR Technology is a leading developer and manufacturer of acoustic and ultrasonic sensing solutions. We push the boundaries of ultrasonic technology to develop advanced products that withstand the harshest ocean environments while reliably facilitating data gathering from surface to full ocean depth. Our comprehensive suites of marine, oceanographic and survey transducers, plus our WeatherStation® instruments, deliver performance that meets the most challenging mission requirements. Ideal applications include shallow and deep-water survey, sub-bottom profiling, navigation, fisheries research, aquatic habitat assessment, underwater scientific applications and more. Customization of transducers for specific marine applications is available.

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General Dynamics Mission Systems' family of Bluefin Robotics products consists of autonomous unmanned underwater vehicles (UUVs) and related technologies for defense, commercial, and scientific customers worldwide. Their core autonomous product line includes Bluefin®-9, Bluefin®-12, Bluefin®-21, and subsea power technologies. General Dynamics offers a full range of modular, free-flooded UUV platforms and products, integrated with over 70 different sensors on more than 100 vehicles. We design, develop, deliver, and provide operations and sustainment support for UUVs worldwide to research institutes and industry, providing UUVs and auxiliary equipment to the United States' and International Navies for various defense applications.



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International Submarine Engineering Ltd. (ISE) is a world leader in the design and integration of autonomous and remotely operated robotic vehicles and terrestrial robotics. Over our 40+ years in business, we have accumulated a great deal of expertise in the design, manufacture, and maintenance of: Autonomous Underwater Vehicles (AUVs), Remotely Operated Vehicles (ROVs) for subsea operation, Human Occupied (HO) submersibles, Customized systems for the offshore oil industry, Customized systems for the Military-Naval sector, Hydraulic, pneumatic, and electric robotic manipulators, Teleoperated and autonomous robotic systems, Robotic systems for nuclear industry applications, Communications and real-time control system.



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L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. The company provides advanced defense and commercial technologies across air, land, sea, space and cyber domains. L3Harris develops autonomous, lightweight Unmanned Undersea Vehicles (UUV). L3Harris has established itself as the leader in man portable UUVs, providing highly capable vehicles to a wide array of military, commercial and research customers. With over 15 years experience in the underwater field, our engineers have developed a reliable and easy to use platform that is trusted to complete marine missions all around the world.



OUTLAND TECHNOLOGY

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👤 Jeff Mayfield

Offering the most rugged equipment and unsurpassed customer service, Outland Technology has been the world's leading manufacturer of underwater video, lighting and ROV equipment for over 30 years. We recognize that no two jobs are the same and specialize in products that are customizable for your specific applications.



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SeaRobotics Corporation, headquartered in Stuart, Florida, specializes in the engineering and manufacture of intelligent marine robotics, including crewless survey vehicles. Clients include major military and commercial organizations, both U.S. and foreign. Applications for SeaRobotics ASVs range from bathymetric and hydrographic surveys to coastal, harbor, and riverine surveillance. In addition to an expanding line of ASVs, SeaRobotics also designs and builds hull and tank bio-inspired underwater grooming and cleaning systems, as well as a variety of scientific sampling equipment such as box and push corers and suction samplers.

WINCHES, HANDLING, & CONTROL SYSTEMS



OKEANUS SCIENCE & TECHNOLOGY LLC

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Okeanus Science & Technology is an established provider of winches, handling systems, and custom solutions for the oceanographic and subsea industry. Proven, reliable, and cost-effective, standard and custom designed winches range from small all-electric instrumentation winches to high horsepower all-electric or hydraulic umbilical and multi-purpose oceanographic systems. Okeanus also provides a range of standard and custom designed A-Frames, over-boarding sheaves, docking assemblies, HPU's, and other auxiliary equipment. We deliver turnkey solutions to commercial, scientific, and defense clients around the world. Okeanus has offices in Houston TX, Houma LA, and East Greenwich RI.



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