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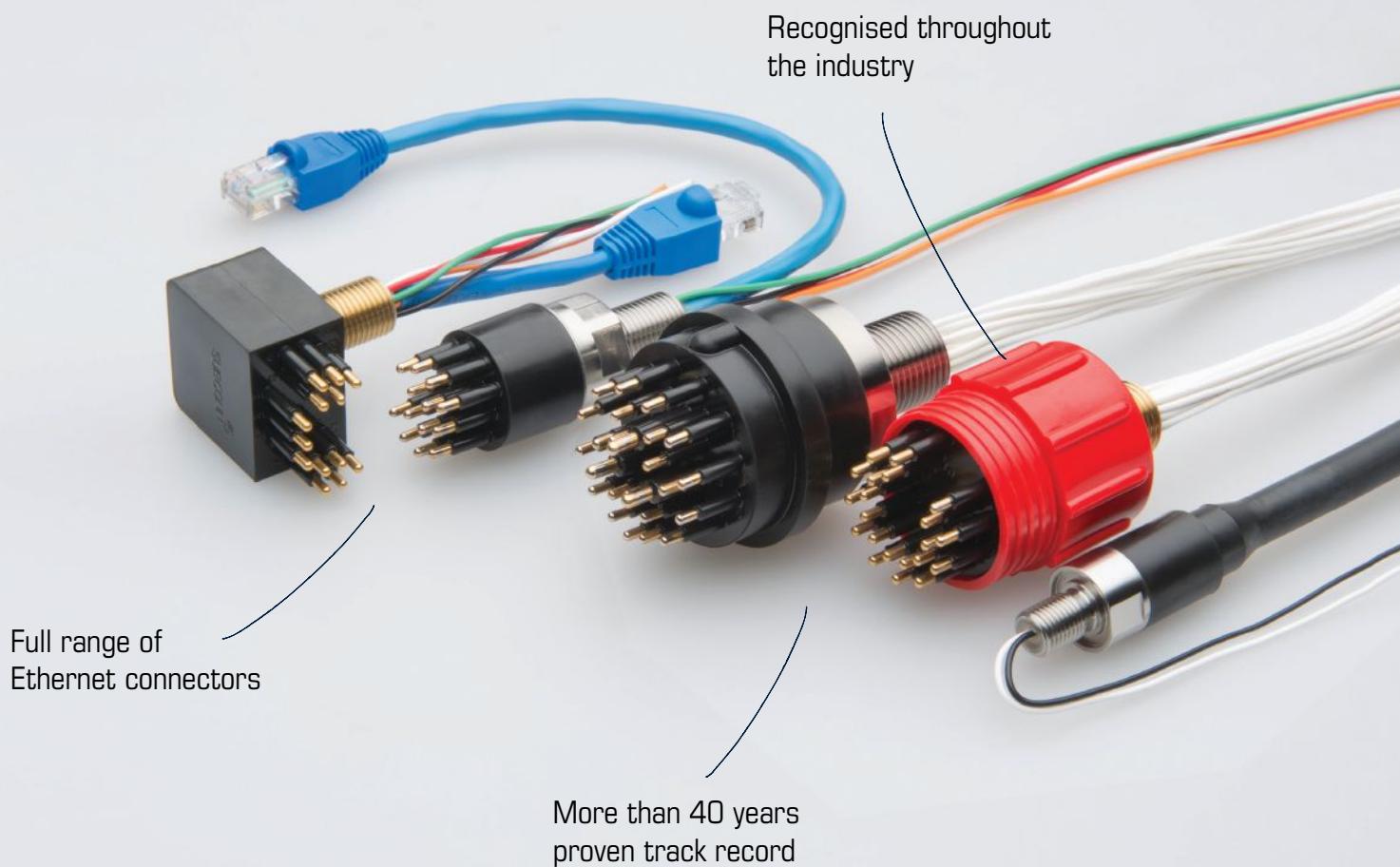
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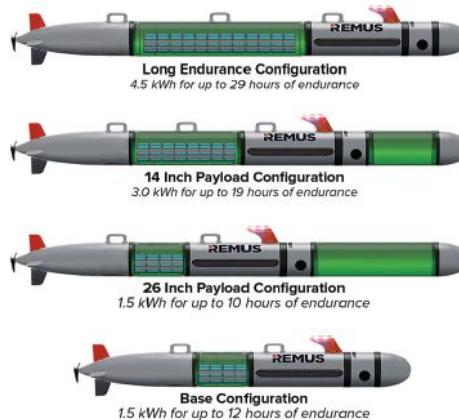
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The REMUS 300 is the newest Unmanned Underwater Vehicle (UUV) built on the REMUS Technology Platform. Open architecture is the platform's backbone, allowing for rapid integration of new payload modules and software while decreasing risk with development, schedule and cost. Combined with advanced core electronics, modularity, and flexible energy options, the REMUS Technology Platform allows REMUS UUVs to keep up with the speed of innovation through rapid spiral integration. This platform is scalable across all UUVs, from small class to extra-large class.

The REMUS 300 represents a generational leap in technology and is the culmination of 20 years of UUV development and feedback from customers worldwide. Building on the trusted, portable design of the small class REMUS 100, the REMUS 300 maintains the 7.5-inch diameter, increases modularity, can go to depths of 305 meters, and offers flexible



payload and energy options. The REMUS 300 can be reconfigured for different missions, from an 80-pound base configuration to a 130-pound long-endurance configuration. Balancing flexibility with portability, users can choose payload and energy modules that maximize mission efficiency with improved lithium-ion batteries and battery management software for up to 29 hours of endurance. Blind-mate module end caps allow for easy swapping in the field, adhering to IPX4 water resistance standards and

allowing for quick vehicle turnaround. The REMUS 300 software is built on DDS middleware and is designed to be Unmanned Maritime Autonomy Architecture (UMAA) compliant, while maximizing Modular Open Systems Architecture (MOSA) principles.

Today, over 500 REMUS UUVs are in operation in 22 countries worldwide. Living up to a legacy that includes the REMUS 100 (aka MK18 Mod 1 Swordfish UUV), REMUS 600 (aka MK18 Mod 2 Kingfish UUV and LBS-AUV), and the deep-diving REMUS 6000, the REMUS 300 marks a new era in UUV design with the scalable REMUS Technology Platform that will allow for continuous evolution. To learn more, visit:

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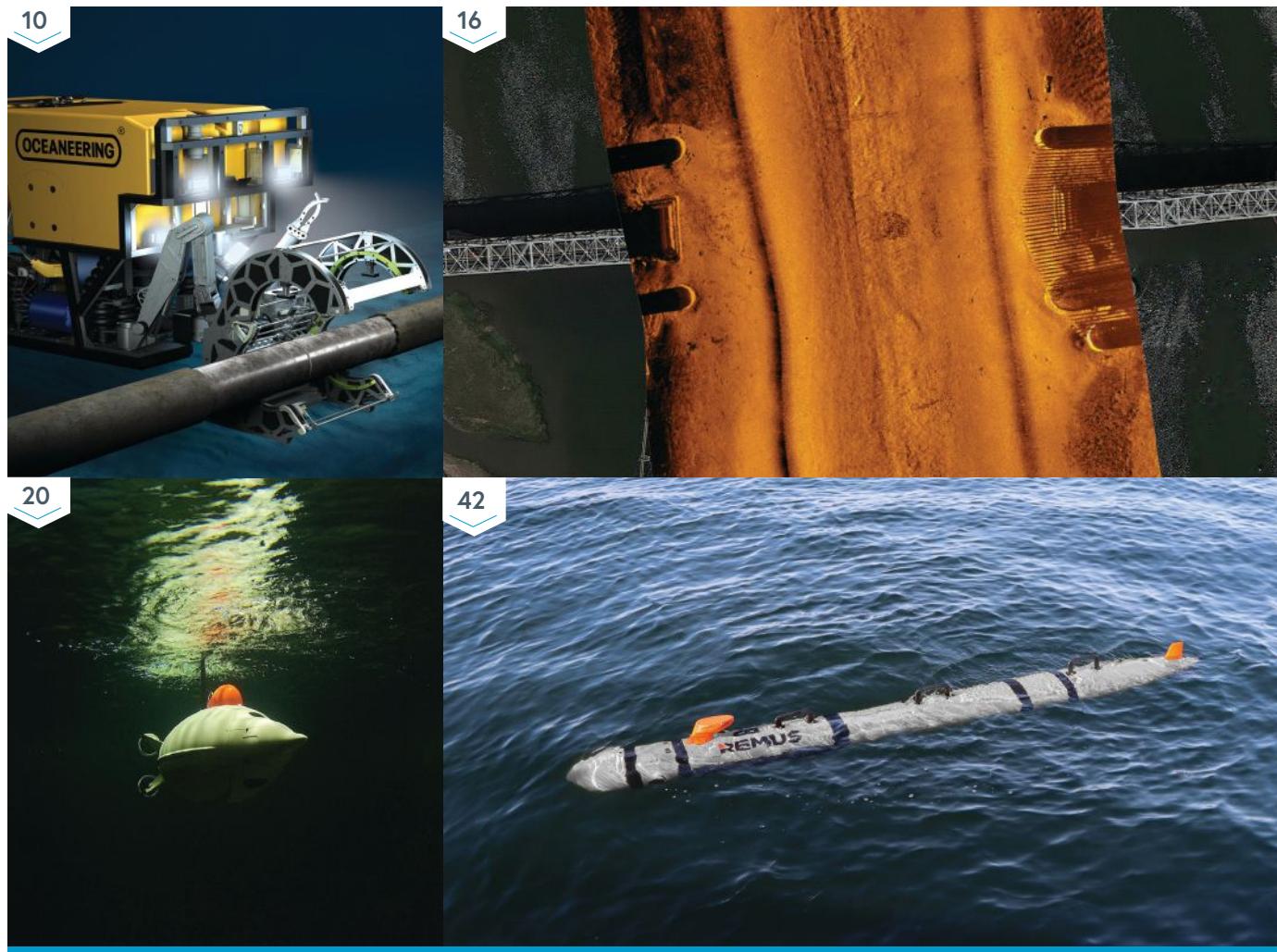


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Oceaneering's high speed, high current Isurus™ Work Class ROV monitors a subsea inspection at a monopile performed by a crawler tool. (Image credit: Oceaneering)

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FULL STEAM AHEAD

ED FREEMAN

Editor, ON&T

Now in Q4 of this bizarre and challenging year, a brief moment of pause. Not one of somber reflection but rather recognition, of how transformative 2020 will prove as we, the ocean industries, continue to navigate these troubled times.

The pandemic—I'll give wide berth to the "C" word—forced us to recalibrate. Almost overnight, our promotional calendars were thrown into disarray as one conference after another was either postponed or canceled. This was, in every way, disruptive. After all, our sector is social; we like industry events; we enjoy networking; and we covet our dockside demonstrations.

Dutifully, we retreated to our screens and embraced a surge of webinars and online gatherings. We overcame choppy internet connections and AV delays to establish new ways of working. Those in the field incorporated ever more stringent safety protocols and procedures. In short, we adapted—and continue to adjust—to a new normal, a set of restrictive circumstances that feels increasingly like an entrenched interim.

Although unsettling, there is much cause for optimism. While the impacts of a turbulent year continue to unfold, there are defiant maxims—clearly manifest over the past months—that point towards prosperous horizons.

Collaboration Spurs Resilience

One hallmark of 2020 will be the "together we're stronger" mindset. The sense of community among the ocean and offshore industries has always been pal-

pable, but uncertainty has further fueled a collective approach to "business as usual." With all hands on deck, this month we profile some of the more stalwart captains of industry—including Oceaneering, EdgeTech, EvoLogics, and Hydroid, among others—whose pioneering ocean technologies help us chart new frontiers.

Adversity Prompts Innovation

Press releases announcing virtual product launches, contract awards, and breakthrough research are all symptomatic of a creative and active marketplace. With certain promotional channels and activities sidelined, we seek innovative media platforms—many of which entice us further into a digital realm. The audience may not have changed, but the way we consume content has shifted considerably.

Ocean Tech Needs Talent

Ocean technology is only as effective as the astute professionals that design, manufacture and deploy the diversified range of smart products and services that enable us to explore marine environments. While the decade cast off in stormy seas, 2020's legacy will reflect the professionalism and determination that ensures safe passage.

It's a combination of these three things—collaboration, innovation and talent—that underpin MTS' Awards & Honors Program each year and, once again, we are delighted to present the ON&T Young Professional Award to an MTS member, 35 years old or younger, who has consistently shown leadership in a marine technology field. This year, our

congratulations go to Hannah Toerner, whose contribution to ocean science and technology belies her years. Following her time as an active student ambassador for MTS, Hannah's work has significantly contributed to the development of a composite material derived from recycled plastic and glass fibers, the properties of which make it an eco-friendly and cost-effective resource for coastal infrastructure.

There is much to celebrate as we approach 2021.

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EvoLogics

SAVANT SUBSEA SOLUTIONS

TOP STORY

Snake Robot Tested to Go on Watch in the Deep Sea

...and more

TELEFUNKEN

Robot T-Teamer Scales - Integrated Dual Head

...and more

SCIENCE & TECHNOLOGY

Five Deep Expedition Embarks on Second Dive

...and more

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MITIGATING DISASTER: REMOTE PIPELINE INSPECTION TECHNOLOGIES

By Thomas Aas Sæthre, Integrity Management and Data Solutions, Oceaneering International; John Kelly McDowell, Director of Technology, Integrity Management and Data Solutions, Oceaneering International; Matt Smith, Director of Emerging Technology for Brazil, Oceaneering International

Often referred to as the arteries of the offshore oil and gas industry, subsea pipelines serve as essential logistical infrastructure to support and connect offshore E&P assets. Potential weaknesses can trigger catastrophic consequences. Therefore, the design, construction, and management of such assets are fundamental considerations when trying to calibrate operational efficiency with operational integrity. Once in service, however, the predominant motivation for subsea pipeline inspection tends to mirror the base requirements decreed by the various regulatory bodies. As such, historically, *in-situ* inspection practices have tended to be more of a reactionary measure within the accepted parameters of risk.

However, as oil and gas developments continue to venture further offshore and into deeper waters—environments with extreme operating conditions and operating envelopes—the role of our subsea network of pipelines, flowlines, and risers becomes ever more critical. Newly discovered remote oil fields not only require the construction of specialized rigs but also the capacity to ensure distant subsea completions and failsafe tie-ins. Deepwater risers, especially flexible risers, are subject to extreme levels of stress from hanging weight and internal pressure, and can undergo hard-to-detect corrosion, such as stress cracking.

Ongoing structural integrity concerns associated with pipelines are only further exacerbated in the age of decommissioning—that is, the phased process of retiring aging offshore oil and gas assets, which include pipelines, wellheads, platforms, power cables, etc. As the number of decommissioned and partially decommissioned wells increase, ongoing monitoring for pressure containment and leak detection becomes that much more imperative.

The need for more diligent pipeline integrity, inspection, and monitoring has never been greater. But while the argument for a more proactive approach may seem clear, subsea investigation is a complex operation. It requires the mobilization of highly skilled personnel, expensive equipment, and significant topside support. Subsea inspection and intervention have required the deployment of tethered ROVs from supply vessels, but this financially weighty model is unlikely to stimulate a more preventative mindset when it comes



REMOTE MONITORING STATION

to building a more comprehensive and detailed program of ongoing pipeline inspection.

However, there are breaking advances in ocean technology that have the potential to rewrite the offshore services playbook over the coming years.

REMOTE INSPECTION SERVICES

The development of ROV systems and services to support offshore exploration remains an important part of what we do at Oceaneering. We started out in the 1960s as a diving company before becoming a market leader in ROV technology today. ROVs can be used for operations where it is not safe for human divers to go. Removing personnel from hazardous environments remains a top focus for our technological developments. Now, thanks to advances in high quality data and communications available offshore, we can keep crews onshore, running operations from remote command centers. The benefits are immediate, reduced POB (Personnel on Board); a dramatic reduction in CO₂ emissions; reduced HSE risk for workers; optimized efficiency, and the opportunity for real-time global collaboration.

The advent of remote services presents a pivotal juncture for pipeline inspection and



» Illustration depicting an overview of a remotely operated survey operation. (Image credit: Oceaneering)

maintenance, and speaks to our company mantra, *Connecting What's Needed with What's Next*. *What's Needed* is a safe, and efficient means of proactively surveying the performance and integrity of critical assets; *What's Next* is a new wave of fully integrated marine robotics that allows us to mitigate risk and harvest offshore energy resources in the most sustainable fashion possible. Many of these applications include challenges beyond those that are typical for industrial robotics, such as hazardous zone rating and ingress protection for splash zones.

This transition is being fueled by a culmination of complementary technological advances, including enhancements to wireless communication systems; battery and propulsion capacity; navigation and dynamic positioning capabilities; and advances to control systems, sensors, and subsea audiovisual instrumentation. In short, ocean technology is nudging us toward an inflection point and encouraging offshore asset owners to incorporate a more risk-based, proactive inspection philosophy.

Oceaneering introduced its remote piloting technology in 2004 using a satellite link in

the North Sea. Continued advancements have allowed us to offer a variety of remotely operated solutions. Earlier this summer, Oceaneering's achieved 150,000 hours of remotely operated survey (ROS) operations with 99% uptime with no client operations or vessel downtime. We continue to see a clear shift toward an integrity management mindset and expect this trend to only continue.

Whether from a CAPEX or OPEX perspective, the business case for such technology is compelling: By investing in cutting-edge marine robotics, like resident ROVs and AUVs, asset owners can feasibly perform more frequent inspections designed to safeguard against fault, and thereby extend the life of their existing assets and reduce the installation costs associated with future ones.

SUBSEA RESIDENCY

Extending the reach and capacity of unmanned subsea vehicles—and ultimately automating the way we work offshore—centers around our ability to leverage recent advances in control and command systems. To this end, Oceaneering has spent several years perfecting our subsea resident vehicle

offering and has taken a leading stance to bringing these platforms to the commercial market. Our current portfolio includes the Liberty™ E-ROV, a self-contained, battery-powered work class ROV with a dedicated communications buoy, to our Freedom™ Autonomous Subsea Vehicle, which combines the features of an ROV and an AUV into one vehicle, providing a new level of flexibility and efficiency for tasks like pipeline survey, seabed survey, close visual inspection, and light intervention activities.



» Oceaneering employees remotely monitor operations from an onshore remote operations center in Houston, Texas. (Photo credit: Oceaneering)

The Freedom™ vehicle boasts a working range of 200 km, a working depth rating of 6,000 m, speed of 6 knots, and subsea deployments of up to 6 months. With its extensive reach, it is ideal for servicing pipeline assets and can recharge and transfer data via a subsea docking station. Enhanced functionality and mobility were key criteria in the product development process and have resulted in a versatile vehicle that can quickly transfer between fields to support other assets as needed. In September 2020, Freedom™ completed an autonomous docking test using Equinor and Blue Logic's Underwater Intervention Drone (UID) docking station at our Tau, Norway, testing facilities.

Freedom™ is capable of inspecting miles of flowlines and remote wellheads as it flies around the field. The vehicle, like our Liberty™ E-ROV system, can be remotely piloted from an onshore remote operations center (OROC) while in tethered or free-swimming mode. While in autonomous mode, free of the tether, through-water communications allow the vehicle to be flown in real-time.

We are also busy diversifying our ROV fleet to incorporate the latest innovations for near-surface inspection and maintenance such as UWILD (Underwater Inspection in Lieu of Drydocking). Oceaneering has developed the Isurus™ ROV for high current areas like those near offshore wind installations and near-surface inspection. It can achieve up to 5 knots in forward and reverse. The system combines optimized hydraulic and propulsion packages with a hydrodynamic design

to meet the requirements of challenging environments.

TOOLING THE FLEET

Beyond the vehicles themselves, Oceaneering can deploy leak detection sensors from our subsea vehicles to monitor pipeline assets against potential loss of containment. In addition, Oceaneering has several specific inspection tools for subsea risers. Neptune™, for example, is being used to detect annular flooding in deepwater flexible risers, which is a key driver of stress corrosion cracking.

Our Neptune™ system, with a depth rating up to 3,000 m, is an ROV-deployed ultrasonic testing tool designed to examine welds, subsea pipelines, risers, and tubular structures. It boosts HSE programs by substituting diver-completed missions. Given that it is operated by an inspection or work class ROV, it can be launched from the offshore installation without the support of a diving support vessel, which dramatically reduces operational costs. Neptune is ROV-deployable and can perform high resolution wall thickness mapping, time-of-flight diffraction (TOFD), and phased array weld inspection using multi-element, depth-rated transducers. Neptune's hardware and software were developed in-house to allow real-time data to be transferred topside via an ROV umbilical. The high-definition mapping and weld inspection capabilities of the Neptune™ system provide valuable engineering information, ensuring accuracy of life expectancy calculations.



» Oceaneering's Freedom™ autonomous subsea resident vehicle in the water at Oceaneering's dedicated testing lab at Tau, Norway, in July 2020. (Photo credit: Oceaneering)



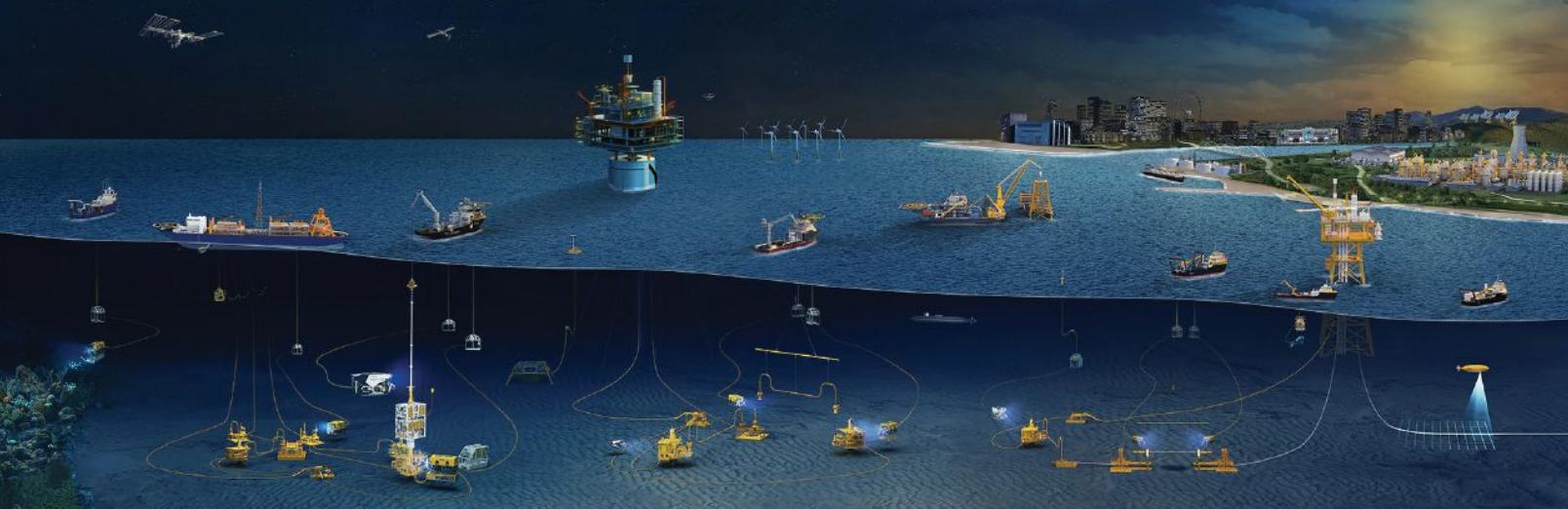
» The Liberty™ E-ROV subsea resident vehicle mobilized offshore Norway. (Photo credit: Oceaneering)

Oceaneering is also developing a high-energy subsea computed tomography (CT) tool. This tool will provide high-resolution 3D reconstructions of complex subsea structures such as flexible risers. While still in development, we expect this tool to be able to detect several potential failure modes that are not detectable *in situ* by any other non-destructive method.

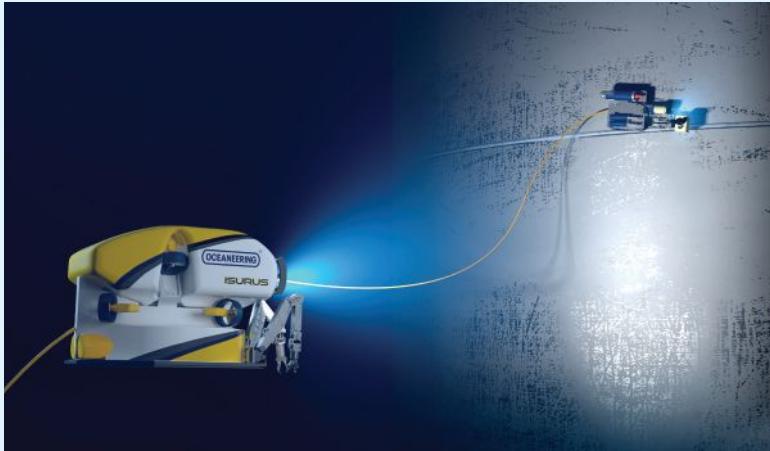
THE ROUTE TO AUTONOMY

When it comes to the integration of this new generation of subsea inspection devices for pipeline integrity management (and indeed other subsea assignments) the notion of true autonomy—powered by Artificial Intelligence (AI) and the IoT—is an increasingly tantalizing prospect for the offshore industries. AI facilitates the capacity for a machine to learn things within the boundaries of a series of set tasks. Therefore, with certain permissions, machines can react automatically to a set of variables with the most appropriate action—an ideal scenario for remote operations and pipeline intervention.

The introduction of fully autonomous subsea vehicles and systems will no doubt be a phased process among the offshore energy markets but there is no question that we are likely to see a convergence of certain technologies that will redefine what's possible. For operators, extending subsea residency not only means reducing costs, mitigating seasonal or metrological restrictions, and drastically curbing CO₂ emissions; it means enabling continuous asset integrity management. That is, pipeline inspection is no longer an event but rather an ongoing program of preventative assessment, and a means of gathering the necessary data required to fine-tune asset performance and establishing a policy of progressively robust risk-analysis.



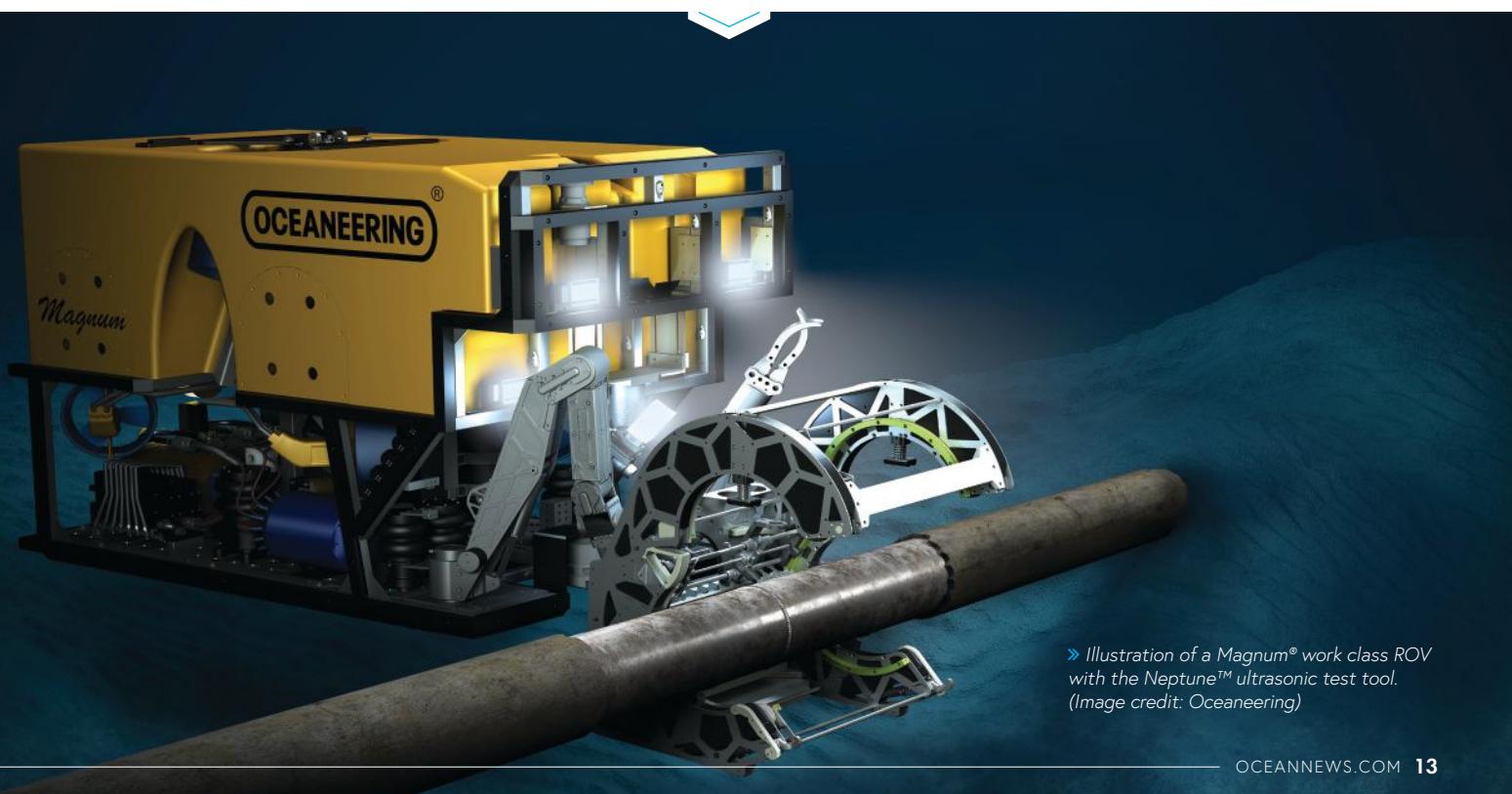
» An illustration of Oceaneering's integrated services from sea to space. (Image credit: Oceaneering)



» An illustration of Oceaneering's high speed, high current Isurus™ Work Class ROV monitors a subsea inspection at a monopile performed by a crawler tool. (Image credit: Oceaneering)



» Oceaneering's newest edition, the Isurus™ ROV, is a hydrodynamically designed work class ROV. It enables operations in high current conditions and is capable of speeds up to 5 knots in forward and reverse. (Photo credit: Oceaneering)



» Illustration of a Magnum® work class ROV with the Neptune™ ultrasonic test tool. (Image credit: Oceaneering)

WORLD'S FIRST LOGISTICS OPERATION WITH A DRONE TO AN OFFSHORE INSTALLATION



» The drone flew 80 kilometers to the Troll field took about one hour, at an altitude of approximately 5,000 feet.
(Photo Credit: Ole Jørgen Bratland, ©Equinor)

An aerial drone recently delivered a 3D-printed part for the lifeboat system from the Mongstad base to the Troll A platform in the North Sea. The operation was completed efficiently and according to plan.

"Development is rapid, and we see a huge potential within drone technology that could transform the way we operate, both under and above the sea surface. Equinor aims to lead the way in utilizing new technology on the Norwegian continental shelf," says Arne Sigve Nylund, Equinor's VP for Development and Production Norway.

"Drones could reinforce safety, boost production efficiency and contribute to lower CO₂ emissions from Norwegian oil

and gas. Drones will also play a role as we shape new energy solutions on the Norwegian shelf," Nylund continues.

The flight spanning around 80 kilometers to the Troll field took about one hour, at an altitude of approximately 5,000 feet. The flight was a test, the world's first of its kind, where an actual freight operation was conducted over a lengthy distance to an operating offshore installation. The drone was a Camcopter s-100 model, manufactured by Schiebel.

This type of drone has been thoroughly tested and has logged around 70,000 flying hours from other types of operations within the defense and coast guard services. The drone is more than four meters long and

weighs in excess of 100 kilograms. It has a cruising speed of more than 150 km/h and it can carry cargo weighing up to 50 kilograms.

The operator of the drone is the Sandnes-based company Nordic Unmanned, a leader in drone services in Europe. Equinor and the drone operator have enjoyed good cooperation with the Civil Aviation Authority, Avinor Air Navigation Services and the Norwegian Communications Authority in completing this ground-breaking transport operation.

"Over the longer term, we expect to see new infrastructure for logistics and support operations, which can reinforce what we already have within vessels and

helicopters," says Alena Korbovà Pedersen, who heads the work on developing logistics solutions in Equinor.

"If we are to develop the logistics solutions of the future on the Norwegian shelf, where drones could play an important role, we must cooperate across all of the industry's players; operating companies, suppliers, the authorities and the trade union and safety interests," Pedersen added.

In addition to conducting logistics operations, airborne drones can also be used for inspections and observations of the technical condition of our offshore installations and onshore facilities.

They have extremely advanced camera equipment and can be used in search and rescue operations, for example to locate people who have fallen into the sea, or for early detection of pollution on the sea. These abilities were also tested during the flight.

Drones will also play a role in new energy solutions on the NCS. Drones can inspect wind turbines, deploy equipment to be used by personnel performing maintenance and repairs, and they can deliver critical parts, fast. Using drones will also enable us to avoid some vessel lifts that can be both more costly and leave a greater environmental footprint.

The fact that we chose a 3D-printed part for our first drone transport offshore was a very natural choice. 3D printing is another rapidly growing technology that will transform the way we work.

The part we transported was a diesel nozzle holder—a critical component in the lifeboats on Troll A.

The part is no longer manufactured and is difficult to obtain. Therefore, the part was re-designed and modelled in 3D before an advanced metal 3D printer produced a replica in a sturdy, industrial alloy, Inconel 718. The part was manufactured quickly, and was delivered safely and efficiently to Troll A, Norway's largest gas producer.



» The Camcopter s-100: the drone is more than four meters long and weighs in excess of 100 kilograms. (Photo Credit: Ole Jørgen Bratland, ©Equinor)

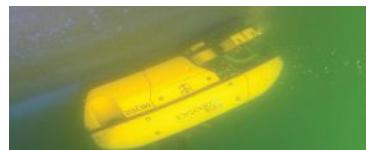
How Shipshape is Your Hull?
Take Control of Your Environment

The SeaRobotics SR-HullBUG is a semi-autonomous underwater vehicle designed for hull cleaning. It features a yellow hull with "SeaRobotics" branding and a complex internal mechanical structure visible through a clear protective cover. The vehicle is shown from a side-on perspective, highlighting its compact design and integrated tools.

Keep your vessel at sea, not the shipyard.

The gains associated with proactive hull grooming are immediate, both in terms of a vessel's efficiency and environmental footprint. The SR-HullBUG is a field-tested semi-autonomous ROV that uses light brushes to eliminate the early signs of biofouling and prolong periods between costly drydocking. The system's sophisticated capture and filter system enables operators to safely remove effluents and invasive species in portside waters.

Cleaner seas need cleaner hulls.



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HIGH FREQUENCY SONAR IS KEY TO UNMANNED MARINE SURVEY



By Richard Hill

*International Business Development,
EdgeTech*

EdgeTech started out as a division of EG&G Marine Instruments and, in 1995, adopted its current name as a tribute to the late Dr. Harold Edgerton, a marine technologist who, besides being one of the founders of EG&G, was a pivotal figure in the development of sonar technology and underwater imagery.

Legacy is important to the team here at EdgeTech, and no doubt Dr. Edgerton would have been fascinated to see how far we—as an industry—have come over the past few decades. Today, EdgeTech represents the gold standard for side scan sonars, sub-bottom profilers, bathymetry packages, and AUV and ROV-based sonar systems. In addition to our comprehensive line of underwater survey products, EdgeTech also produces reliable USBL systems, transponder beacons, a comprehensive range of acoustic releases and rope less fishing gear, and customized underwater acoustic command and control systems.

Our client roster is equally diverse. We partner with customers from a broad range of industries—including the global offshore energy, fishing and aquaculture, scientific, and defense markets—to leverage recent advances in sensor technology and integrate ever smarter technologies to their individual exploration activities.

UNMANNED SYSTEMS FOR MARINE SURVEY

More recently, one area of particular focus at our testing site in Massachusetts—a state-of-the-art facility that houses a number of test pools and tanks, pressure test chambers and two custom research vessels for sea trials—has been the development of high frequency sonar systems. Central to this endeavor has been the growing interest in—and adoption of—Unmanned Surface Vehicles (USVs) and Unmanned Underwater Vehicles (UUVs) for specific types of marine research and underwater mapping.

Whether it be the deployment of remotely piloted systems or operations of a more autonomous nature, the world of robotics is able to provide turnkey solutions for some of the more persistent challenges that commercial survey operators face: first, how to chart hard-to-reach and potentially hazardous waters—that is, environments unable to offer safe passage to traditional survey vessels or divers; and second, how to satisfy end-user demands for multilayered real-time data analyses as efficiently as possible.

We collaborate closely with manufacturers of unmanned systems so are excited about the shifting dynamics of this fast-paced industry. Breakthroughs in sensor capabilities and control systems have redefined the marine survey toolkit, and other industries are also beginning to accelerate their use of robotics to reduce overheads, curb CO₂ emissions, and prioritise HSE concerns.

MPES: THE BEST OF BOTH WORLDS

But USVs and UUVs are only as effective as their payloads. And that's where the work at EdgeTech comes in. Having listened to the unfolding needs of the marine science community, we have developed a new game-changing sonar frequency combination—850kHz and 1600kHz—optimized for compact USVs/UUVs operating in shallow water or in close proximity to the seafloor. The new high frequency combination delivers high resolution side scan sonar imagery at both frequencies, as well as optional bathymetry at 850kHz.

Historically, swath bathymetry systems have been categorized into one of two groups: Phase Discrimination Bathymetric Sonars (PDBS), which are based solely on interferometric techniques, and Multi Beam Echo Sounders (MBES), which utilize



» An unmanned system runs survey lines in the Bahamas following the destruction of Hurricane Dorian in September 2019. Breakthroughs in robotics and sensor technology offer a safe and efficient means of charting hard-to-reach and potentially hazardous waters. (Photo credit: Morgan & Eklund)

beamforming techniques. This distinction has become increasingly blurred over time. This new hybrid approach, our "MPES" platform, capitalizes on the capacity of both technologies while overcoming the limitations of each.

The new frequency pair is available in EdgeTech's 2205 hosted platform product line of solutions. The EdgeTech 2205 is a compact, extremely flexible and configurable sonar system for integration on 3rd party underwater and surface vehicles. This modular unit can be custom configured to suit application, to collect side scan sonar imagery, sub-bottom profiles and bathymetric data, singly or in concert with one another. The system is provided as a complete package where the 2205 electronics are enclosed in a pressure vessel, or alternatively the core electronics can be provided as boards mounted onto a chassis so the customer can integrate the system into their vehicle's dry electronics area. Two transducer arrays are provided for the side scan sonar and bathymetry that can be mounted on the vehicle where there is a "clear view" of the seafloor. (Sub-bottom profiler transmit and receive are separate from the side scan/bathymetry arrays.) The system can operate independent of the hosted platform by simply storing the data or it can be configured to autonomously interoperate with the vehicle during its mission.

MULTIPLE PHASE MEASUREMENTS

Our unique MPES technology is what forms the basis for all EdgeTech bathymetry products such as the 6205s for surface vehicles and the 2205 for AUV/ROV vehicles. EdgeTech's MPES technology uses ten array channels to derive up to nine phase difference measurements per side, and these multiple phase measurements provide several benefits when resolving for the seafloor soundings.

First, the increased channel count provides additional information to acquire mean and standard deviations for each sample so as to statistically filter out dual echo (or multi-path) contaminated samples, and so ensure that the data collected are much cleaner and more robust.

Second, the high channel count in each transducer allows beamforming (like MBES systems) to take place to help focus the energy at nadir to create a denser data set in this region. EdgeTech's MPES was the very first of its kind to produce clean, wide swath coverage (out to 12x water depth) while maintaining real acoustic data at nadir with a data density that remains almost constant from nadir to the outerswath. Coverage within the nadir region of the sonar swath is crucial to capitalizing on the efficiency gains of PDBS systems, or equivalent but more costly dual head MBES systems.

Finally, traditional MBES systems receive the side scan or backscatter data from one of their relatively short receive arrays used to infer the bathymetry data. This short receiver naturally has a very wide beam, and so often produces low resolution imagery.

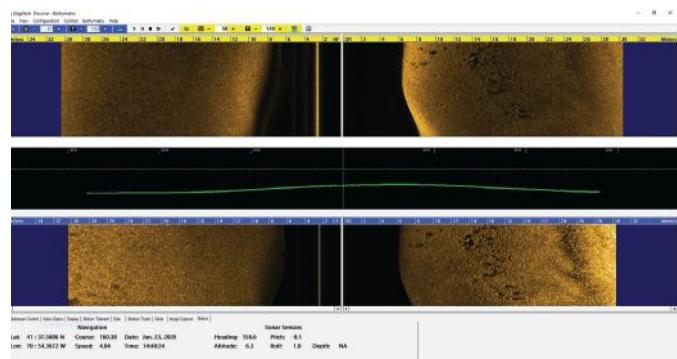
EdgeTech's next generation MPES transducer design, which includes dedicated full length transmit and receive arrays for both high and low frequencies, enables operators to collect ultra-high resolution and accurately geo-referenced side scan imagery without interference or loss of resolution. This additional piece of information is key for shallow water surveys as it can mean the difference between deleting data as water column noise and recognizing it as a real object.

With the integration of EdgeTech's Full Spectrum® CHIRP technology signals, the MPES sonar is able to exceed the IHO SP-44, NOAA, and USACE specifications for Feature Detection and Bathymetric Point Data Uncertainty.

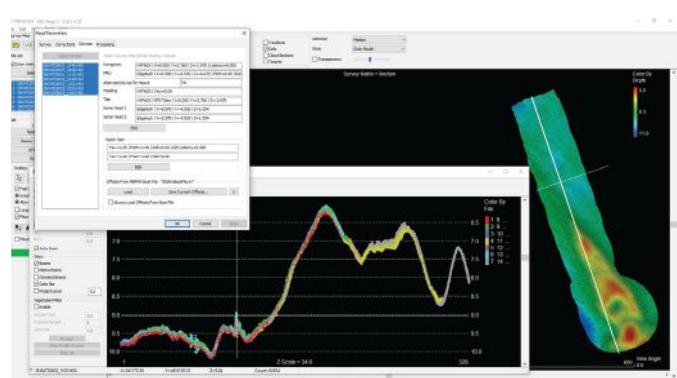
The new 2205 850/1600kHz system is now available for integration.



» Bridging the Gap: EdgeTech's new sonar frequency combination (850kHz and 1600kHz) optimized for compact USVs/UUVs operating in shallow water, so ideal for the inspection of submerged infrastructure. (Image credit: EdgeTech)



» EdgeTech's DISCOVER BATHYMETRIC Acquisition Software package provides an intuitive way to control, store, and display bathymetric and dual frequency side scan sonar data. (Image credit: EdgeTech)



» 850kHz bathymetry data results from a 2205 sonar Sea Acceptance Test (SAT), presented using HYPACK®, that illustrates the robust match between soundings from overlapping survey lines, and the preservation of small sized seabed debris. (Image credit: EdgeTech)

As one recent customer noted: "The frequency combination is a great selection because a user can get full high-resolution side scan sonar at 1600kHz over 30 meters per side, while getting wider coverage from the 850kHz and its coregistered bathymetry at the same time and which includes nadir gap coverage."

No doubt, Dr. Edgerton would have been pleased to hear this.



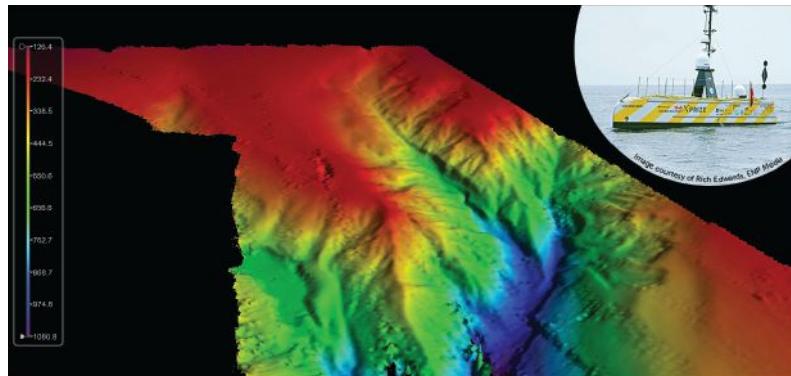
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TELEDYNE CARIS AI SOFTWARE ONBOARD SUCCESSFUL UTAS USV MISSION

*Teledyne CARIS Mira AI and Onboard software ready
to take on future uncrewed survey missions*

Teledyne CARIS, a Teledyne Technologies company, played an integral role in a recent ground-breaking uncrewed offshore survey mission in the Atlantic Ocean. Teledyne CARIS' Mira AI and CARIS Onboard software were used on the vessel to enable autonomous survey and real-time processing operations. The mission's Uncrewed Surface Vehicle (USV) built by SEA-KIT mapped over 1,000 square kilometers of the ocean floor in 22 days, while being continuously monitored via satellite communications at its Remote Operations Center in Essex, UK. A specialized team comprised of the GEBCO-Nippon Foundation Alumni Team operated the survey equipment and provided quality control of the data from various 'work-from-home locations' around the world.

The SEA-KIT USV surveyed a predominately unsurveyed area at the southwestern edge of the UK Continental shelf. The image displays the initial results following a fully automated processing workflow. Final processing is currently being completed using CARIS HIPS software to



» Initial results following the SEA-KIT USV's automated survey of over 1,000 square kilometers of the UK's Continental Shelf.

produce the final deliverable for the survey.

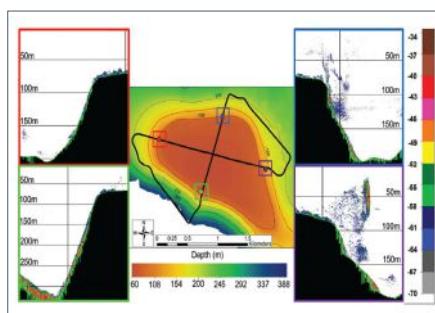
The success of the Teledyne CARIS tools in the UTAS project demonstrates its software capabilities to support uncrewed surveys in the future and the crucial role it will play in The Nippon Foundation-GEBCO Seabed 2030 project. Seabed 2030 is an ambitious effort between GEBCO and The Nippon Foundation to complete the global mapping of the ocean floors in the next 10 years.

"Teledyne CARIS is uniquely positioned to underpin Seabed 2030 goals through its AI capabilities, web services and automated data processing workflows," said Andy Hoggarth, VP, Sales and Marketing at Teledyne CARIS. "The success of this first leg is a tribute to the strong leadership of SEA-KIT and the unique capabilities and insights of all of the member organizations— we are delighted to play a part in this mission."

ASL ANNOUNCES THE 2020 ACOUSTIC ZOOPLANKTON FISH PROFILER AWARD WINNER

ASL Environmental Sciences has announced Dannielle Eager as the winner of the fifth annual Acoustic Zooplankton Fish Profiler (AZFP) early career scientist award. Dannielle is currently studying at the University of Plymouth at Devon, UK at a postgraduate level in the school of Biological and Marine Science.

Dannielle's research will focus on the influence of dynamic seamount oceanography on pelagic biota in the tropical Indian Ocean, with support from the Garfield Weston Foundation, Bertarelli Foundation and the University of the Highlands and Islands. In contrast to surrounding waters, seamounts support high biodiversity and high predator-prey interactions which are driven by oceanographic processes. These energetic processes, which have recently been identified as turbulent internal waves, aggregate zooplankton over seamount summits, sustaining an abundant schooling



» The spatial distribution of biota over Sandes seamount from a research cruise in November 2019 showing multibeam bathymetry (center) and seamount backscatter data.

fish community which is preyed on by sharks. While oceanographic measurements enable the identification of the prevailing oceanographic regime, the AZFP will provide the critical "missing link" whereby we could relate the incidence of internal waves to the schooling of fish and their predation through single target detections.



» Dannielle Eager,
the winner 2020
AZFP early career
scientist award.

The awarded AZFP (38/125/200/455 kHz) will be incorporated into an intensive fine scale multi-disciplinary survey being carried out over a four-week period in March 2021 at a seamount where large aggregations of biota have previously been identified. A full complement of moored and vessel-mounted instruments such as ADCPs, thermistor strings and fisheries echosounders will be used to define the fine-scale energetic oceanographic and biological processes with coincident *in situ* plankton sampling and towed cameras for fish and shark validation. The ultimate aim of the project is to link the oceanographic processes to the aggregation of zooplankton, fish schooling and predatory behavior of sharks with the AZFP as it measures the high spatial and temporal resolution of acoustic backscatter throughout the water column.

WHOI AND MASSTECH TEAM UP FOR D'WORKS MARINE TECHNOLOGY INITIATIVE

Massachusetts has long been known as a center of invention and technical innovation and, more recently, has gained attention for its vibrant marine robotics startup community. Now startup companies, entrepreneurs, and others in the Commonwealth who work in the marine robotics and related technologies sector, including artificial intelligence (AI) and machine learning, will have a new partner to help them develop products and technologies and bring their ideas to market.

The Woods Hole Oceanographic Institution (WHOI) and the Massachusetts Technology Collaborative (MassTech) are teaming up to make WHOI's unique mix of resources available through the D'Works Marine Technology Initiative to accelerate the pace of marine technology innovation.

"Our goal is to help move ideas from the concept stage to at-sea operations as efficiently as possible," said James Bellingham, Director of WHOI's Center for Marine Robotics (CMR). "To do this, we're making WHOI's specialized facilities and expertise available to the entrepreneurial community."

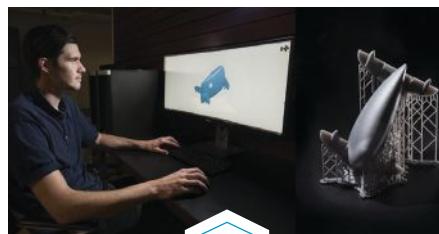
The Innovation Institute at MassTech has seeded the D'Works Innovation Fund via CMR for qualified companies to access WHOI facilities, as well as technical and engineering support, building on a previous US\$5 million grant to support the construction of DunkWorks Advanced Manufacturing and Rapid Prototyping Center and several other new test facilities at WHOI. Applications will be accepted beginning August 26 on a rolling basis through the fall, with the first awards expected to be announced by September 30.

"WHOI's work at the leading edge of oceanographic research is based on a combination of deep understanding of the ocean and how it works," said WHOI Deputy Director and Vice President for Research Rick Murray. "WHOI is pleased to work with the MassTech to support the growth of marine robotics, AI, and related technologies that will benefit from WHOI's state-of-the-art testing facilities. In turn, we expect that marine research will also advance through the innovative ideas tested by entrepreneurs."

"The funding for the D'Works initiative will expand access to WHOI's world-class facilities, helping grow new startups and further strengthening our state's position as the number one region in the world for marine

and blue tech innovation," added Carolyn Kirk, Executive Director of MassTech. "What sets Massachusetts apart is not only our top R&D facilities, but also the talented researchers and innovators that can help entrepreneurs grow their business."

D'Works funding is intended to support the use of critical fabrication and testing equipment and facilities by startups,



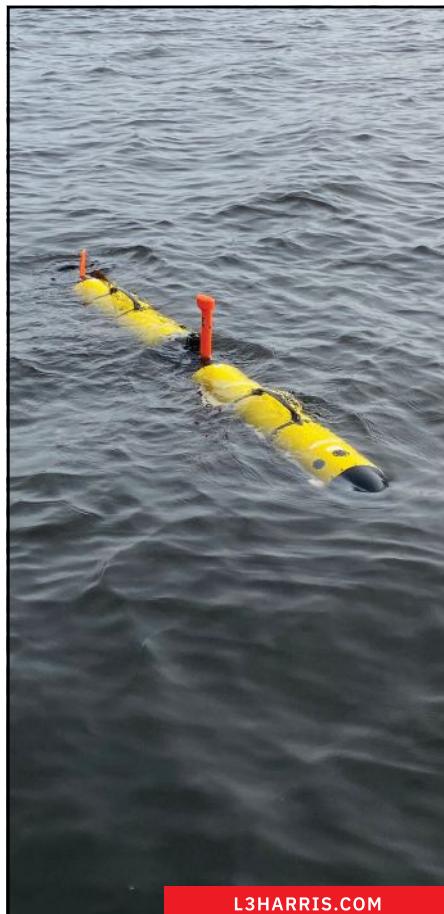
» Advanced tools at WHOI's DunkWorks rapid prototyping facility are among those available to startups, entrepreneurs, and others who receive funding through the new D'Works innovation fund. (Photo Credit: Tom Kleindinst, ©Woods Hole Oceanographic Institution)

entrepreneurs and innovators to develop marketable robotic devices, vehicles, AI, or sensors for use in the marine environment.

Accepted D'Works Innovators are not limited to shore-based testing. Through the program, startups may also make use of WHOI's coastal research vessel Tioga and small boat fleet, scientific dive program, and offshore infrastructure at the Martha's Vineyard Coastal Observatory.

"Our ideal applicant has a prototype for what they believe to be a working technology in the pre-scaling stage," said Leslie Ann McGee, CMR assistant director. "This fund is for those innovators or technologists who need access to facilities like we have at WHOI but don't have the funding for a larger, traditional project at WHOI."

For more information regarding the application process, visit: <https://www2.whoi.edu/site/marinerobotics/home/innovation-fund/>



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| FEATURE |

EvoLogics: TWENTY YEARS OF INNOVATION

This year, the company's 20th, marks an important milestone for EvoLogics. Founded in 2000, the team started out with a mission to develop failproof underwater communication systems for the transmission of critical subsea data, instrumentation capable of performing in the most demanding of weather conditions and sea states.

Perfecting acoustic communications—even in calm waters—is a multilayered challenge; there are several variables that can interfere with transmission, including multipath propagation, fading, delays, and bandwidth limitations. But in the age of data-driven decision making and accountability, malfunction or delay—especially in the dynamic world of the

» *PingGuin's propulsion system is driven by four horizontal thrusters in a X-shaped configuration, with three vertical thrusters for additional mobility and speed, allowing the AUV to position and hover with absolute precision throughout the water column. (Photo credit: EvoLogics)*

maritime and offshore industries—is not an option.

EvoLogics took its lead from nature, more specifically dolphins. It took eight years of dedicated research and observation to fully understand how these "chatty" mammals are able to use acoustic signals to communicate so effectively, and then translate the secret to advanced underwater signal processing and decoding into a commercial solution for offshore operators. This breakthrough gave way to the development of EvoLogics' patented Sweep-Spread Carrier (S2C) technology, which has been the basis for much of the company's product development since.

BIONIC INSPIRATION: S2C TECHNOLOGY

Today, thanks to its bio-inspired S2C platform, EvoLogics is able to offer a comprehensive ecosystem of tools for underwater communication, positioning, navigation and monitoring. This includes several series of underwater acoustic modems and modular positioning systems (USBL, LBL, SBL), as well as a framework for developers in both networking and hardware design.

EvoLogics' underwater acoustic modems use self-adaptive algorithms that adjust the S2C parameters to maintain the highest bit rate possible in variable conditions, helping it perform multiple communication

tasks, support several data management options, and network with other subsea assets. Modern applications range from data retrieval from subsea sensors and navigating unmanned underwater vehicles to deploying complex underwater sensor networks for continuous monitoring and exploration.

S2C technology can also pinpoint the positioning of underwater assets, so it is ideal for the tracking and navigation of offshore equipment, including Autonomous Underwater Vehicles (AUVs) and other Remotely Operated Vehicles (ROVs). Switching between positioning and communication modes is not necessary as positioning data is calculated simultaneously with acoustic transmissions. This dual functionality opens up new possibilities for an array of at-sea applications.

The networking possibilities range from point to point relaying and message broadcasting to more advanced networks that include ad hoc networking with neighborhood discovery, path finding and relaying of delay sensitive and delay tolerant data. In addition to maximizing underwater networking capabilities, S2C technology can also interact with other instrumentation with similar configurations, which includes surface, air and underwater assets.

More recently, as the Internet of Things enables evermore intelligent cooperation between subsea assets and sensors, the

development of autonomous vehicles for marine survey and support operations has become an increasingly important part of EvoLogics R&D focus. The result—a fusion of failsafe communications and pioneering marine robotics—is PingGuin.

PENGUINS: THE NATURAL CHOICE

As the name suggests, EvoLogics once again turned to nature for inspiration; Adélie penguins, to be precise, which have been of particular interest to Dr. Rudolph Bannasch—one of EvoLogics' co-founders—who has been studying these Antarctic residents since the 1980s. His research, both in the field and the test facilities in Berlin, has revealed how spindle-shaped flow bodies, modeled on these agile swimmers, are able to achieve ultra-low drag coefficients in water. Or, in other words, how these penguins make the perfect blueprint for a long-range Autonomous Underwater Vehicle.

The PingGuin AUV was developed as part of a collaborative R&D project known as MUM (Modifiable Underwater Mothership), which is run by thyssenkrupp Marine Systems and funded by the German Federal Ministry for Economic Affairs and Energy. Launched in 2017, the MUM initiative represents an exclusive partnership between thyssenkrupp Marine Systems, ATLAS ELEKTRONIK, EvoLogics, the University of Rostock, and the Technical University of Berlin. The founding principle of MUM was to devise a new class of large modular unmanned underwater system for various subsea applications, including the exploration of remote areas.

PingGuin is an AUV that boasts exceptional maneuverability; its penguin-like shape and

contours deliver maximum hydrodynamic efficiency. The propulsion system is driven by four horizontal thrusters in a X-shaped configuration, with three vertical thrusters for additional mobility and speed, allowing the AUV to position and hover with absolute precision throughout the water column. PingGuin can also take up a stationary position on the seafloor thanks to a unique anchoring system and, naturally, has a grip-like "beak" mechanism to enable docking.

PingGuin is intended for use as a multifunctional communication node, and as part of a self-coordinated AUV swarm that enables adaptable positioning and communication scenarios for the MUM system. Each vehicle is equipped with a built-in streamlined EvoLogics USBL modem for underwater data transfer and positioning, which also features



» PingGuin is intended for use as a multifunctional communication node, and as part of a self-coordinated AUV swarm: Each vehicle is equipped with a built-in streamlined EvoLogics USBL modem for underwater data transfer and positioning. (Photo credit: EvoLogics)

an integrated atomic clock for precise synchronization of the acoustic network.

When hovering, the AUVs are able to form a relay to transfer data from mobile or stationary MUM modules. A PingGuin can operate as a surface node and transfer data over Wi-Fi, radio, or optional GSM to a support vessel or onshore station. Thanks to its GNSS antenna and acoustic modem, the surface node can perform geo-referencing of other underwater assets deployed within the modular MUM network. For operations that require accurate LBL positioning, a group of PingGuin AUVs would use the anchoring function and become seafloor nodes performing as the LBL baseline. Using AUVs as the LBL baseline would eliminate the need to recover seafloor nodes when the LBL coverage area needs to be repositioned.

NEXT STEPS

PingGuin's first live demonstration was in June, in Kiel, Germany, when the AUV underwent a series of successful tank tests and open water trials to assess its mobility, communication and positioning. The team at EvoLogics is now finalizing the advanced functionality of the AUV to conduct further sea trials. The progress to date is indicative of the degree of investment being made right now to bring novel robotics to the forefront of how we automate the way we work at sea.

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» PingGuin underwent a series of successful tank tests and open water trials in June, in Kiel, Germany. (Photo credit: EvoLogics)



KONGSBERG AND MASSTERLY TO EQUIP NEW VESSELS WITH AUTONOMOUS TECHNOLOGY

Kongsberg Maritime and Massterly (a Kongsberg Wilhelmsen joint venture) have signed contracts with the leading Norwegian grocery distributor ASKO to equip two new vessels with autonomous technology, and to manage their operations at sea. With Norwegian companies delivering around 60% of the investment, this is a major milestone for the growth of sustainable maritime operations in Norway. The fully electric ships will replace 2 million kilometers of truck transport, saving 5,000 tons of CO₂ every year.

ASKO—currently transporting their cargo by more than 800 trucks daily—is committed to sustainability and is investing heavily in new technologies such as electric and hydrogen-powered vehicles. At present, road transport is the single mode of transportation to link their warehouses on the western side of the Oslo fjord with their distribution center on the eastern side. The new RORO (Roll on, Roll off) vessels will replace the current solution with a zero emission transport alternative.

"We have a clear ambition to be climate neutral and have set ambitious goals, including being a self-sufficient provider of clean energy and having 100% emission-free transport by 2026. These innovative ships are key to fulfilling that ambition and will form an essential component of a zero-emissions logistics chain linking our facilities," explains Kai Just Olsen, Director, ASKO Maritime. "Fully electric trucks will take the cargo between the warehouses and the ports of Moss and Horten, and in shipments of 16 the trailers will be transported across the fjord on the battery-driven vessels. This solution is cost effective, sustainable and will remove trucks from a heavily trafficked road."



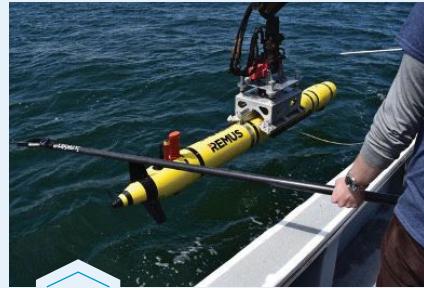
» One of the new unmanned vessels for ASKO, to be equipped and operated by Kongsberg Maritime and Massterly.

ENOVA has supported the project—including the required port infrastructure—with 119 MNOK, in line with the Norwegian society's commitment to reduce emissions and transfer transport from road to sea where feasible.

Kongsberg Maritime has a proven track record as an enabler for sustainable maritime logistics, and this ability has been further strengthened through the partnership with Wilhelmsen. The vessels will be equipped with the technology required for zero emission and unmanned operation by Kongsberg Maritime, while Massterly will ensure ship management and safe operations from their shore-based Remote Operations Centre. The two vessels will initially operate with a reduced crew, before moving towards unmanned voyages.

Egil Haugsdal, President, Kongsberg Maritime, said: "When we teamed up with Wilhelmsen to form Massterly, this was exactly the kind of project we wanted to enable. By working together with us to bring autonomous, electric solutions into everyday use, ASKO are helping to achieve a sustainable, safer future for maritime operations while also demonstrating the efficiencies these technologies can deliver."

Thomas Wilhelmsen, CEO of Wilhelmsen Group, added: "The ASKO contract illustrates how Massterly is key in making autonomy a reality for short-sea shipping. We are proud to be the world's first ship management company to operate unmanned vessels for commercial use. Now we are one step closer to our goal of enabling sustainable trade: through cost effective, safe, and environmentally friendly logistics."



» REMUS model 100. (Photo credit: Hydroid)

ADL EMBEDDED SOLUTIONS (ADLES) ASSISTS PROJECT RECOVER

Project Recover (www.projectrecover.org) is a nonprofit organization dedicated to bringing home America's missing in action (MIAs). Scanning the seabed for sunken military assets is an arduous undertaking and relies on the expert support of several partners, one of which is the Scripps Institute of Oceanography.

To carry out these subsea missions, the Scripps team deploys Hydroid's REMUS model 100 and 600 UUVs equipped with ADLES' 3800PC SBCs (ADLE3800PC). In the data acquisition process, the SBC performs multiple tasks, including sensing, reacting to that intelligence, and modifying behavior; If, for example, the embedded computer discovers interesting data during a routine search, it has the capability of guiding the UUV to the new location and hence deviating from the preprogrammed route.

The ADLE3800PC SBC is designed specifically for applications in rugged environments and has an extended temperature range of -40°C to +85°C. The SBC meets stringent size, weight, and power (SWaP) requirements, and also boasts a fifteen-year lifecycle support with availability through 2030.

Since 1993, Project Recover has located more than 50 US WW2 aircraft and has plans to further expand repatriation efforts in 2021.

For a more detailed look at how Scripps and ADLES are helping to advance the important work done by Project Recover, visit: <http://bit.ly/adles>



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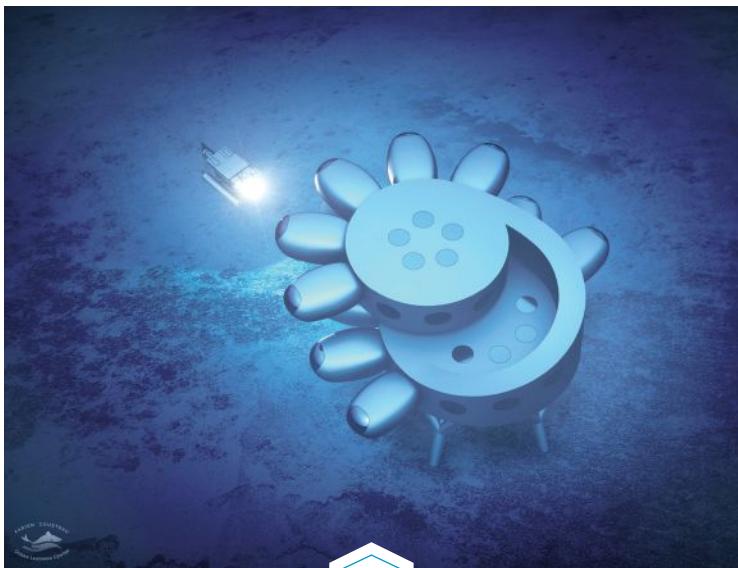
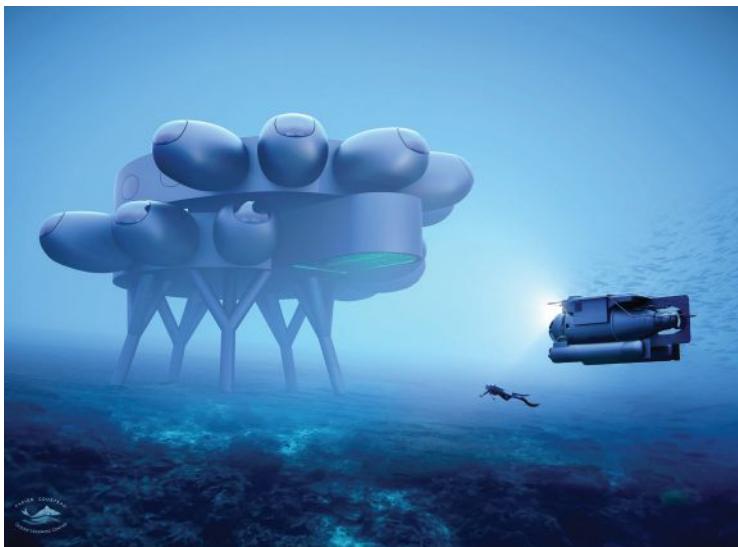
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» Proteus, a subsea research facility off Curaçao, will be capable of accommodating 12 visitors at a time. Fabien Cousteau Ocean Learning Center (FCOLC) is the organization behind the project, headed up by the grandson of legendary sea explorer Jacques. (Photo credit: FCOLC)

When it comes to studying our oceans, we tend to focus on the smart instrumentation used to retrieve data and imagery from below the waterline, such as sensors, samplers, and seafloor mapping systems. Some devices, like gliders, are deployed on extended subsea missions, while others, like drifters and buoys, lead a more permanent life at sea. But what if we could take residency one step further and create a seabed facility to house oceanographers and marine scientists as they go about their research?

Sounds like science fiction, right? Not according to Fabien Cousteau, the grandson of fabled sea explorer Jacques, who recently announced plans to build Proteus™, a state-of-the-art subsea research facility. Or, as he puts it, an International Space Station, underwater.

Subsea Laboratory

Cousteau's interest in subaquatic life was piqued early—his upbringing afforded a somewhat unique vantage point from which to embrace ocean science and technology—but he relishes in the fact that so many mysteries remain. The Fabien Cousteau Ocean Learning Center (FCOLC) is the organization behind Proteus, and insists that the democratization of ocean science is a present-day imperative; to this end, the platform will be made available for academics, private companies, scientists and nongovernmental organizations around the world involved in ocean exploration and research.

While novel, there is precedent: Aquarius, at a depth of 19 meters, is currently the world's only underwater marine laboratory, located nine miles off the Florida Keys. Aquarius was the stage for Mission 31, a June 2014 expedition that saw Cousteau and his team break the record for the longest period spent underwater (eclipsing Jacques' 30-day record by one day). The crew's research yielded twelve scientific studies and 9,800 published academic articles and ultimately showed how immersion—days rather than hours to explore, study, watch, listen and learn from marine environments—can help us better plan human activities in the ocean. What's more, it provided proof of concept for Proteus.

Proteus, located 18 meters below the surface of the biodiverse waters off Curaçao, will be eight times larger than Aquarius with a 372-square-meter floorplan capable of accommodating 12 visitors at a time. Satisfying our appetite for real-time discovery, Proteus will take us beyond datasets thanks to a state-of-the-art audio-visual studio designed to capture never-before-seen footage and livestream events across the globe. The hope is that such facilities will prove scalable over time, and that additional seafloor bases will be added in the future.

Unlocking the Ocean's Potential

Studying the shifting nature of our seas is clearly a scientific priority in the age of climate change, but it is also key to helping us responsibly leverage the natural resources found in marine environments. There is a firm belief that work conducted at Proteus will give rise to disruptive scientific breakthroughs in critical areas such as medicine, genetics, and sustainable energy.

This pioneering approach to advancing ocean science and technology could have profound impacts on the way we plan further offshore exploration. How long might it be before we establish similar facilities in deep-sea trenches? It might sound like something out of a Hollywood script, but this model of underwater investigation may transform our reach and understanding. The challenges, not to mention costs, of operating deep-sea research are well documented, so establishing a pathway to "in-situ residency" is a tantalizing prospect to say the least.

For more information: www.fabiencousteauolc.org/proteus

INTERMOOR LAUNCHES NEW REMOTE POSITIONING HUB

InterMoor has launched its new Remote Positioning Hub (IM-RPH). The IM-RPH is an innovative positioning system, that allows survey professionals to send navigation commands to an offshore vessel, from the comfort of their onshore base. InterMoor's Survey and Positioning Department recently embarked on their second remote positioning trial for a North Sea operator.

Providing remote access, the IM-RPH offers:

Real-Time Access

Surveyors can control the navigation in real-time from their onshore facilities. Protected by secured firewalls, data circulates between the vessel and the onshore offices, whether it is positioning data or video/audio feeds. Sent from onshore, the commands are received offshore 0.8 seconds later.

Optimization Of Project Resources

By reducing the number of survey crew offshore, the system allows not only personnel cost reduction but also minimization of project delays that could happen due to travel hindrances (including COVID-19 quarantines) or weather events.

A Hybrid Solution

With a suitable communications infrastructure, projects can be executed fully remotely. However, the IM-RPH also offers a hybrid solution, whereby shifts can be split. Personnel in the field can provide positioning services during the day and a technician onshore can provide positioning services at night.

Reactivation Of Skills And Experience

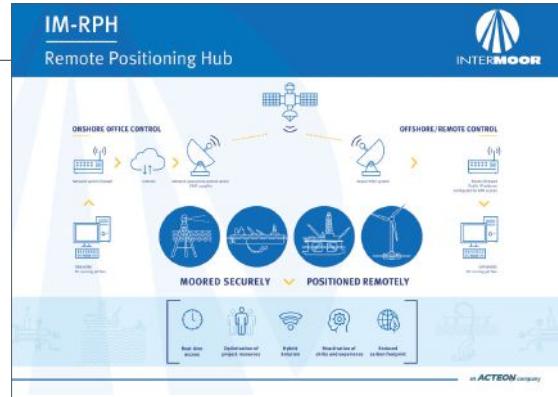
If a senior manager or subject-matter expert, who is generally onshore-based, needs to provide specialist insight into a live project, they can do so from onshore rather than having to go offshore, thereby reactivating that skill and making full use of their experience. It allows highly skilled personnel to be easily brought into a project for feedback and expert insight.

Reduced Carbon Footprint

Reducing the number of offshore survey crew eliminates the carbon emissions from helicopter rides as well as transportation to ports and airports to send them there. It also reduces the carbon footprint from other resources (such as food and board) that would need to be used to accommodate personnel during their stay.

The new IM-RPH allows InterMoor to provide positioning services to their clients remotely. It applies to various types of projects, from heading control to drillship positioning and can be transferred to rig moving, mooring projects and other sectors like renewables such as floating wind.

Steven Strathie, InterMoor's Survey and Positioning Manager commented: "This new remote positioning hub bridges the gap between offshore positioning operations and onshore support and was achieved as part of a collaborative effort between InterMoor survey & positioning, Acteon IT and our clients. To do so during these challenging times shows a willingness to adapt our services and to present our clients with options in executing their own projects."



» The Remote Positioning Hub reduces the need for survey personnel offshore, helping to reduce HSE risks and CO₂ emissions



» InterMoor's remote command center

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(UMV)

The advertisement features a sleek, cylindrical tracking beacon labeled 'xeosBeacon' with a stylized 'E' logo. The device is set against a backdrop of a turbulent sea under a dark sky. A prominent red stamp on the device reads 'PROVEN in the world's harshest environments'. At the bottom, a red banner displays the website 'www.xeostech.com'. The Xeos Technologies logo, which includes a globe icon and the company name, is located in the bottom right corner.

HST CENTRALIZES MISSION-CRITICAL DATA WITH BAREFLEET AND CREWSMART

Reygar Ltd., the leading provider of innovative remote monitoring and reporting platforms to the offshore wind industry, and CrewSmart, an end-to-end management tool for compliant, effective fleet operations, have announced a collaboration to provide an integrated system for High Speed Transfers (HST), an established Crew Transfer Vessel (CTV) operator supporting the offshore energy industries.

Vessel operators are investing in expanding their fleet and operational capabilities in response to increased demand for CTVs to meet Europe's burgeoning offshore wind capacity. Central to facilitating this rapid expansion is the extent to which these vessel operators are able to digitalize their operations.



Christopher Monan, COO, HST, said: "HST has commissioned an integrated system to deliver complete oversight over our fleet and personnel compliance, as well as to stay on top of vessel health. Having a central point of access for fleet-wide performance and operational reporting has significantly cut our administrative burden across the board—enabling crews to focus on maximizing 'time on turbine' whilst empowering the shore team to expand our operational capabilities with innovative new vessels like the HST *Ella*, a hybrid Chartwell 24."

Christian Adams, Managing Director, CrewSmart, added: "Crew managers have one of the hardest jobs in the industry—a challenge which is compounded as an operator expands. CrewSmart is designed to support them by adding flags and safeguards around ongoing crew and vessel compliance, streamlining the process of allocating the right crew to the right vessels and the right vessels to the right projects."

BareFLEET and CrewSmart's integrated reporting function also supports HST's aim to be as open and communicative as possible with its clients, a positive relationship building exercise that the firm believes is key to its ongoing success.

» Innovative new High Speed Transfers (HST) vessels enable crews to focus on maximizing 'time on turbine' whilst empowering onshore teams to expand their operational capabilities. (Image Credit: HST Ltd.)

Christopher Monan continued: "Accessed via CrewSmart's vessel diary feature, BareFLEET's reporting allows us to demonstrate to our clients where we add the most value. We can provide evidence to illustrate which conditions our vessels operate best in, how these conditions effect the vessel, and demonstrate our safety record in a clear, concise manner. This data not only allows us to make informed operational decisions around which vessels to deploy to which projects, but also improves our understanding of our suitability to tender to specific projects."

Chris Huxley Reynard, Managing Director, Reygar Ltd, said: "While BareFLEET was initially created to drive operational and commercial efficiencies for vessel operators, a key feature of the platform that has emerged over the last couple of years is how it allows leading operators like HST to respond directly to their end customer's priorities. We are able to support HST's focus on operator-to-project owner transparency by creating client-specific reporting templates that bring each company's KPI's front and center."

"The BareFLEET system also leaves HST well placed to bring innovative new vessels into the fleet. For example, HST have commissioned the largest battery bank option for its new Chartwell 24, HST *Ella*, and our vessel health and performance monitoring function will support HST in demonstrating that it is possible to eradicate fuel burn in ports and when moving between turbines by relying on electric propulsion alone—this will cut emissions, engine noise, and fuel costs."

EVAC'S CATHELCO MGP SYSTEM SUPPORTING OIL SPILL RESPONSE VESSEL

A new multi-purpose oil spill response and towage vessel being built for the Kuwait Oil Co will be installed with a Cathelco marine growth prevention system (MGPS) to prevent biofouling and corrosion in seawater pipework. The system is manufactured by Cathelco, part of the Evac Group since 2018.

The 60-meter vessel is currently under construction at

the Uzmar Shipyard in Turkey with delivery scheduled for Q4 2020.

It will be equipped for towing services, area surveillance, offshore firefighting, logistics support, and search & rescue around Kuwait and in international waters.

To protect the pipework against marine growth and corrosion, copper and ferrous

anodes will be installed in five sea chests, connected to a control panel. In operation, the copper anodes produce ions which prevent the larvae of barnacles and mussels from settling and creating blockages in engine cooling and firefighting systems.

At the same time, the ferrous anodes produce ions which create a protective coating on the internal surfaces of pipes

to mitigate corrosion. More commonly, in the case of ships with steel pipework, the anti-corrosive function is achieved using aluminum anodes. The concentrations of copper ions are around 2 parts per billion, effective in preventing marine growth from settling, but having no effect on the wider marine environment after discharge.



CSA: 50 YEARS OF OCEAN SCIENCE

CSA Ocean Sciences (CSA) opened its doors in 1970 with a clear mission—to advance ocean science by designing and implementing comprehensive marine environmental programs in partnership with commercial, academic and government organizations.

The last five decades have certainly been transformative. From the corporate headquarters in Stuart FL, the company has grown the business to incorporate a network of strategically located regional hubs to better serve the emerging needs of the ocean industries with multidisciplinary field survey and recognized subject matter expertise. The group currently runs offices in Tampa (FL), Houston (TX), Houma (LA), Salinas (CA), and Newport (RI), as well as affiliates in Australia, Brazil, Cyprus, Qatar, Singapore, and Trinidad.

CSA's geographical expansion is matched by an equally notable resume of international field experience; over the years, the firm has successfully completed thousands of specialized projects for a diverse range of over 600 clients from both the private and public sectors.

Underpinning CSA's programmatic approach is a trinity of ocean science—impact assessment, risk and compliance, spill response, and marine habitat studies; *operation excellence*—metocean, hydrographic, geospatial, and geotechnical survey; and *cutting-edge technology*—a proprietary web-based data portal, EDGSONLINE, and an expansive portfolio of ruggedized deck equipment, advanced marine robotics (including a growing fleet of ASVs for inshore, nearshore and offshore surveys), and fully equipped research vessels.



» CSA's R/V *Dolphin*, a multipurpose vessel specially configured to support marine geophysical survey. (Photo credit: CSA)

NEW OFFSHORE FRONTIERS

The company's enviable track record of servicing traditional offshore operators around the world—in particular, oil and gas, subsea telecoms and defense interests—has helped position CSA as a sure pick among entrants to the emerging marine renewables space. Prospects include the rapid scaling of U.S. offshore wind in the country's northeast (CSA recently launched and mobilized its R/V *Dolphin* to the region to satisfy growing demand for turnkey survey operators) and the deep-sea mining exploration activities in the central Pacific Ocean, both of which rely heavily on statistically robust and scientifically stringent marine environmental expertise.

When asked about CSA's humble beginnings, CEO Kevin Peterson pauses for a brief moment of nostalgic reflection but insists that, in his own words, "we are just getting started."

"Each day of every project motivates us to sharpen our subject matter expertise and facilitate an ever more progressive understanding of the marine environments. Our growth, typified by long-standing

commercial relationships, is directly attributable to our staff's diverse expertise and genuine passion for ocean science."

SAFETY FIRST

CSA uses a Safety and Environmental Management System (SEMS) approach to safety administration that guarantees adherence to the strictest international quality assurances and quality controls (QA/QC) and Health, Safety, Security, and Environment (HSSE) requirements. In 2019, CSA was presented with *EHS Today's* 2019 America's Safest Companies Award in recognition of this ongoing commitment to a "safety first" culture, an accolade reserved exclusively for operators that demonstrate transformational EHS leadership and innovative solutions to safety challenges and training programs.

So, what does the future hold for ocean science, especially amid the unique challenges of 2020? Mr. Peterson was quick to respond:

"We are making the future right now—by leveraging breakthrough technology such as our rapidly growing ASV fleet and advanced deep ocean survey systems, we are gathering essential scientific data at a rate never seen before. Our oceans are home to boundless opportunity, and it is up to us to make sense of the swathes of data to better manage marine resources in a sound, responsible way."

For more information, visit
WWW.CSAOCEAN.COM

EQUINOR AND BP IN STRATEGIC PARTNERSHIP FOR U.S. OFFSHORE WIND MARKET



Equinor has entered into an agreement with BP to sell 50% non-operated interests in the Empire Wind and Beacon Wind assets on the U.S. east coast for a total consideration before adjustments of US\$ 1.1 billion. Through this transaction, the two companies are also establishing a strategic partnership for further growth within offshore wind in the U.S.

Currently Equinor holds a 100% interest in both the Empire Wind lease, located off the coast of New York State, and the Beacon Wind lease, located off the Massachusetts coast. The transaction is in line with Equinor's renewable strategy to access attractive acreage early and at scale, mature projects, and capture value by de-risking high equity ownership positions.

Equinor will remain the operator of the projects in these leases through the development, construction and operations phases and it is anticipated that the wind farms will be equally staffed after a period of time.

"We look forward to working with BP who share our strong ambition to grow in renewable energy. Our partnership underlines both

companies' strong commitment to accelerate the energy transition and combining our strengths will enable us to grow a profitable offshore wind business together in the U.S.," says chief executive officer in Equinor, Eldar Sætre.

"This transaction with BP demonstrates Equinor's ability to create value from developing offshore wind projects. Over the past decade Equinor has built world-class technical expertise in offshore wind. This has enabled us to access and high-grade wind acreage, resulting in a material, high-quality project pipeline. Optimizing equity and bringing in new partners allow us to realize value, increasing our financial flexibility to fund further growth," says executive vice president for New Energy Solutions in Equinor, Pål Eitrheim.

Through this partnership Equinor and BP will consider future joint opportunities in the U.S. for both bottom-fixed and floating offshore wind and will leverage relevant expertise to jointly grow scale. As the partnership develops, both companies hope to expand this cooperation further in a market that is forecast to grow to between 600 and 800 gigawatts (GW) globally by 2050.

Equinor has already set ambitions to grow its renewables capacity to 4 to 6 GW by 2026 and 12 to 16 GW by 2035, and has recently announced its expectation to accelerate these ambitions. Equinor is working to build scale in core areas—the North Sea, the United States and the Baltic Sea—while securing growth options in other selected markets for both bottom-fixed and floating offshore wind.

BP's acquisition of the interests in Empire Wind and Beacon Wind has an effective date of 1 January 2020 and is expected to close in early 2021, subject to customary conditions including purchase price adjustments and authority approval.

About The Assets

Empire Wind is located 15-30 miles southeast of Long Island and spans 80,000 acres, with water depths of between 65 and 131 feet. The lease was acquired in 2017 and is being developed in two phases with a potential total installed capacity of more than 2 GW.

Beacon Wind is located 60 miles east of Montauk Point and 20 miles south of Nantucket and covers 128,000 acres. The lease was acquired in 2019 and has the potential to be developed with a total capacity of more than 2.4 GW.

The turbines used at each site are each expected to have an installed capacity of more than 10 megawatts.

Power generation from each site will be sufficient to power more than 1 million homes.



» Pål Eitrheim (left), executive vice president for New Energy Solutions in Equinor, and chief executive Eldar Sætre

About The Partnership

Equinor and BP are creating a strategic partnership in offshore wind in the U.S. covering both current and potential future projects.

The partnership will leverage both companies' expertise in order to expand and scale the business over time.

The transaction marks the first step in the partnership, where Equinor will remain the operator in the development, construction and operations phase for both assets with secondment participation from BP.

It is anticipated that the wind farms will be equally staffed after a period of time.

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UNITY AWARDED CONTRACT EXTENSION BY UK OIL & GAS OPERATOR

Aberdeen-headquartered Unity, Europe's largest provider of well integrity technology, services, and engineering solutions, has been awarded a three-year contract extension, by a UK oil and gas operator, to continue its work on three northern North Sea platforms. The contract, worth an annual six figure sum, has two additional one-year extension options.

Unity provides well integrity, wellhead maintenance and associated support services for the three assets. This includes surface wellhead and Xmas tree integrity services, plus the supply of personnel, equipment and technology, including Unity's range of retrofittable QV wellhead parts. Unity will also support the client's abandonment and decommissioning work on two of the platforms using its knowledge of the wellheads and associated infrastructure.

Gary Smart, CEO at Unity said: "Unity's flexible and adaptable approach will continue to support our client's requirements as it moves forward into a phase of decommissioning with its assets. Wellhead decommissioning is a natural extension to our production integrity and maintenance service, and our experience of all types of surface well equipment ensures we have the expertise to add value to the process.



» Unity's range of retrofittable wellhead parts and their provision of decommissioning expertise will feature as part of this key contract

"We hold contracts with leading operators to provide services on over one thousand wells and have built a successful track record of decommissioning support work in the UKCS and Europe. Projects have included well inspection, plug setting, isolation verification, on-site machining and the safe removal of Xmas trees and tubing hangers. Unity's technology solutions, such as our Surface Intervention System, may also be used to enhance efficiency."

This contract award comes on the back of similar recent business wins at Unity, spanning both the oil and gas and utility sectors.

Unity, along with Pragma, Well-SENSE and ClearWELL are part of Aberdeen-based FrontRow Energy Technology Group.

FIFTH & FINAL MARINET2 CALL OPENS FOR FREE OFFSHORE RENEWABLES TESTING

The final call for the EU-funded MaRINET2 project opened on September 1, targeted at offshore energy technology developers who are looking to test their device or components. The project offers fully-funded access to a world-leading network of testing and research infrastructures in Europe.

Open until 16 October, the fifth and final call will grant access to a number of research and testing facilities, for developers of offshore wind, wave and tidal energy systems and components. Applicants should check the list of available facilities to see which ones are being offered under this call.

So far, MaRINET2 has awarded almost €5 million in free testing access, across a network of 57 world-leading research



facilities in Europe. The project's objective is to accelerate the progress of the European offshore renewables sector towards full-scale industrialization.

Initially scheduled for June 2020, the call timetable has been postponed due to COVID-19-related delays. An updated timetable, and a webinar recording to assist candidates with their application and share updates on the process, are available on the project website.

MaRINET2 Project Coordinator, Dr. Jimmy Murphy, University College Cork said: "As we open the final call, I am delighted with the success of the project to date. This sector has demonstrated its resilience in the face of the COVID-19 crisis and is poised to play a big role in Europe's energy mix. Providing

developers with access to some of the world's best test facilities and expertise is a big part of kick-starting this new European industry."

Christophe Maisondieu, MaRINET2 Access Coordinator, Ifremer added: "Hundreds of projects have already benefitted from the MaRINET2 and MARINET programs and the project team is looking forward to working with a new set of developers under this last call. Putting new technologies through their paces is essential to produce reliable, effective machines, and to reduce project risks."

An open call for virtual access to data sets and a free-of-charge training program are also available through the project.

SIEMENS GAMESA AND ACTEON COLLABORATE FOR VIRGINIA OFFSHORE WIND PROJECT

Siemens Gamesa, an industry-leading offshore wind turbine manufacturer and operations and maintenance provider, has entered into an agreement with Acteon, a marine and subsea solutions provider, to jointly provide a fully integrated offshore wind turbine operations and maintenance (O&M) package for the Coastal Virginia Offshore Wind pilot project. It is the first offshore wind project installed in U.S. Federal waters.

Siemens Gamesa and Acteon will work together to fully optimize the wind turbine service and Balance of Plant O&M work scopes to provide cost effective and integrated asset management services at the 12-MW, two turbine installation. Bundling the above water and sub-sea Balance of Plant services with the wind turbine service results in a reduction in turbine downtime for planned maintenance activities and a lower cost of energy.

"We are utilizing our advanced experiences across our global offshore presence to be the first OEM to package these capabilities for the U.S. offshore market," said Michael Hughes, Head of Americas Offshore Operations, Siemens Gamesa Renewable Energy. "By delivering the full O&M package, we provide numerous benefits such as a streamlined and optimized maintenance plan during the most ideal weather periods, full utilization of the project's existing O&M workforce and more efficiently share the projects logistical assets across these work scopes. Ultimately driving down the cost of offshore wind energy," added Mr. Hughes.

Optimizing the use of the logistical assets will be of utmost importance for overall project economics. This partnership enables Siemens Gamesa to optimize the use of required vessels, while reducing the amount of downtime for the turbine.

Siemens Gamesa will utilize its own technicians for performing the above water Balance of Plant inspections, while Acteon will support the subsea general visual, marine growth and anode inspection. This will utilize a low-logistics inspection class remotely operated vehicle (Seatrionics VALOR) providing a complete overview of the structural integrity of the asset.

Tim Eyles, Vice President, Acteon said, "Acteon's integrated solutions team is proud to be working with Siemens Gamesa to offer a new business model for offshore wind asset integrity whereby, as a joint-effort, Siemens Gamesa will provide all above waterline asset integrity inspection and Acteon Group companies TerraSond, Seatrionics, Deepwater, and Clarus, will inspect the subsea components. This partnership will ensure that our customers experience safe optimized inspection scheduling and more efficient resource utilization."

The Coastal Virginia Offshore Wind pilot project is owned by Dominion Energy. It is located approx. 27 miles/43.5 km offshore. Both Siemens Gamesa SWT-6.0-154 offshore wind turbines are safely installed, with first power expected to be generated shortly.



» Both Siemens Gamesa SWT-6.0-154 offshore wind turbines are safely installed

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JOTUN SIGNS HULL SKATING SOLUTION CONTRACT WITH MSC



» The Jotun HullSkater uses magnetic wheels to cling to vessel hulls and remove individual bacteria and biofilm before macro-fouling is able to take hold.

Jotun has announced its first commercial Jotun Hull Skating Solutions (HSS) contract for container vessels. The agreement was signed with Mediterranean Shipping Company (MSC), a global container shipping and logistics leader.

MSC, a company committed to investing in decarbonizing its operations, will install the Jotun HullSkater, a specialized hull grooming ROV, and the high performance SeaQuantum Skate antifouling coating on the 14,000 TEU MSC EVA later this year. HSS will then proactively work to ensure an "always clean" vessel hull—free of biofouling—to deliver optimal efficiency, reduce fuel costs and significantly lower CO₂ emissions.

Proactive Approach

Jotun unveiled HSS to the market in March this year. Designed to help shipowners combat the most severe biofouling challenges, it combines advanced marine robotics with

proactive condition monitoring, high-end technical service, and performance and service level guarantees. Jotun operators control the HullSkater via a 4G connection, conducting cleaning and inspections in line with individual vessel schedules developed through a proprietary algorithm and big data.

It is a unique proactive cleaning solution and delivers significant results. This, as Alberto Genovesi—Marine Global Key Account Manager, Performance Coatings, Jotun—explains, instantly appealed to MSC's desire to invest in game-changing innovative technology.

Win-Win For Industry

"MSC is not only a market leader, but it is also leading the way in terms of exploring innovative new solutions to meet the IMO's goals of decarbonizing shipping," he comments. "We have worked with them as

a partner to provide premium anti-fouling coatings to their advanced fleet over many years and knew that HSS would chime with their ambitions to deliver both improved environmental performance and enhanced efficiency and cost control for business stakeholders. HSS is a clear win-win in that respect."

MSC EVA will install HSS at GWD Guangzhou Shipyard in China later in 2020, at the same time as it undergoes class renewal and scrubber installation. The vessel's flexible sailing pattern, with exposure to differing water temperatures and environments, exposes it to a significant biofouling challenge.

Jotun believes that if all ships facing such challenges adopted the HSS proactive approach—cleaning hulls before biofouling takes hold and therefore eliminating associated drag and fuel consumption—maritime CO₂ emissions could be reduced by at least 40 million tons per year.

Sustainable Vision

"We are acutely aware that the shipping industry needs to adopt innovative solutions to meet ambitious environmental goals," states Giuseppe Gargiulo, Head of Newbuildings, MSC Mediterranean Shipping Company. "We believe HSS will help solve the problem of biofouling, equating to strong benefits for the natural world—through reduced emissions and decreased spread of invasive species—and better results for our business, customers and society. This is the embodiment of what we're looking to achieve at MSC."

"Clean hulls are only one piece of the jigsaw when it comes to delivering a more sustainable shipping industry, but a central piece, nonetheless. MSC is committed to exploring and trialing new scalable solutions to minimize overall environmental impact, for both our business and the shipping industry as a whole."

The Jotun HullSkater, which utilizes magnetic wheels to cling to vessel hulls, works to remove individual bacteria and biofilm before macro-fouling grows. At such an early stage, fouling can be removed without damage to coatings. This not only delivers peak performance but minimizes the need for reactive cleaning, helping ship owners to cut costs, mitigate environmental risk, and optimize fleet flexibility.



» MV Dove, C-Innovation's subsea inspection, maintenance and repair ROV, was deployed to complete the installation of several stem clamps for BP in the GoM.

C-INNOVATION COMPLETES STEM CLAMP INSTALLATION ON BP's MAD DOG SPAR

C-Innovation, LLC (C-I), an affiliate of Edison Chouest Offshore (ECO) and its family of companies, has completed the installation of several stem clamps for BP beneath the Mad Dog Spar in the Gulf of Mexico, utilizing its subsea inspection, maintenance and repair (IMR) remotely operated vehicle (ROV) vessel, *MV Dove*.

Throughout the planning process, several risks were mitigated for C-I and BP assets by modifying the ROV. This included armoring with Lexan polycarbonate, design of new manipulator mounting subframes to extend the reach of the manipulators by 12 inches and installation of enhanced manipulator controls systems. The project was a success and completed 10 days ahead of BP's schedule.

Ryan Combs, Project Manager at C-Innovation, said: "C-I was engaged by BP early in the project lifecycle to provide input into

the design of the subsea hardware and installation capabilities of the ROV, which would face limited access to the installation location beneath the facility. The C-I project team engaged with the ROV operations groups, offshore managers and tooling group in order to evaluate the risks involved with the execution of the project and ultimately secured a successful outcome."

Adam Kluge, BP ARP, added: "C-I overcame some complex demands with a challenging method of installation in very tight working quarters within the structure and did so safely, with great skill, in half the anticipated timeframe. The success of the execution was directly attributable to excellent teamwork and communication throughout each phase. We are very fortunate to work with C-I on our projects. They contribute an excellent work ethic, great interpersonal skills and are adept at creating a team out of a group of individuals."



» The self-elevating platforms Sea Giant and Skate 3D were transported on and dynamically assembled from the *Amberjack*.

Fugro has completed a multidisciplinary site characterization for the prestigious Male' to Thilafushi Link project, the planned bridge between Male' City and Thilafushi in the Maldives.

Fugro accelerated mobilization from the UAE to the Maldives ahead of global COVID-19 lockdowns to ensure that this project of national importance could meet the Ministry of National Planning, Housing and Infrastructure's (MNPFI's) ambitious delivery schedule.

FUGRO COMPLETES CRUCIAL SITE CHARACTERIZATION IN MALDIVES

Fugro applied innovation and ingenuity to maintain delivery during a time of unprecedented restrictions on global shipments. The Maldives were locked down just as the project was mobilizing but Fugro used their self-propelled jack-up barge *Fugro Amberjack* as the designated in-country quarantine facility, meaning offshore personnel could work whilst safely isolated. They also mitigated the risk of further delays by mobilizing the marine geophysical vessel *Fugro Mapper* from India to acquire geophysical data.

Fugro implemented its *Transformer Model* of working, whereby the self-elevating platforms Sea Giant and Skate 3D were transported on and dynamically assembled from the *Amberjack*. This execution strategy enabled safe and rapid delivery of multiple drilling assets into the project area, providing MNPFI with an unparalleled rate

of Geo-data acquisition in water depths between 0 m and 46 m and in challenging metocean currents. When MNPFI and their engineering consultancy were unable to mobilize their intended supervision teams offshore due to the lockdown, Fugro's data delivery platform, Gaia Books, meant they could monitor the acquired Geo-data remotely in near real time.

Chris Arnott, Fugro's Country Manager for the UAE, said: "Despite the Covid-19 crisis, our team completed 4 weeks ahead of schedule thanks to their determination and ingenuity in difficult circumstances, utilizing marine assets designed, owned and maintained by Fugro for exactly this type of challenging marine environment. MNPFI can now proceed on schedule with their landmark national development and we look forward to further opportunities to support the project."

CHARLES RIVER ANALYTICS AND TELEDYNE GAVIA ANNOUNCE AUTOMATED TARGET RECOGNITION OPTIONS FOR GAVIA VEHICLES

Teledyne Gavia, a global leader in the manufacture of autonomous underwater vehicles (AUVs), has introduced Charles River Analytics' AutoTRap Onboard™ AI-based object detection software as a new capability onboard their Gavia marine vehicles. As underwater operations become more complex and dangerous, AI tech has emerged as the clear solution for delivering the consistent and accurate results that have proven elusive until now due to the challenges of ever-changing marine environments. Enter AutoTRap Onboard—a smart, real-time automated target recognition (ATR) app offered by Charles River Analytics.

The new partnership with Teledyne Gavia expands the boundaries for underwater unmanned sonar operation. Now, operators can acquire Teledyne Gavia's best-in-class unmanned underwater vehicles with AutoTRap Onboard software inside.

"AutoTRap Onboard automatically detects and identifies target objects in real time," said Dr. Arjuna Balasuriya, Senior Scientist at Charles River Analytics. "This product saves time and money—operators don't have to bring the vehicle to the surface, download its data, and then send it back down for further investigation (if necessary). With Teledyne Gavia, we offer our customers a better experience, giving them confidence that the area is clear and it's safe to operate."

Bob Melvin, Vice President of Engineering at Teledyne Marine Systems, added, "Our customers have been asking us for a reliable way to carry out seafloor surveys, such as mine hunting. AutoTRap Onboard makes finding these targets of interest much easier and builds higher levels of confidence in AI systems."

In environments that are challenging for target detection, AutoTRap Onboard has demonstrated excellent detection rates and false positive rates; identifying truncated conical objects on a rocky volcanic seafloor with a 90% probability of detection.

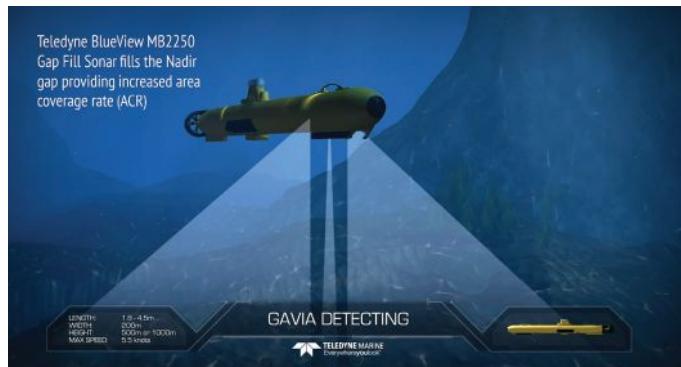
AI software must perform as expected despite constant variations in the deployment environment. AutoTRap Onboard has been designed with a versatile architecture that is robust across different environments, new sensor types, and changing mission goals.



» Operators pictured deploying a Gavia AUV in rough seas. (Image credit: Teledyne)



» AutoTRap Onboard analyzes the data obtained from side scan sonar in real time, as visualized here. (Image credit: Teledyne)



» AutoTRap Onboard adds to the diverse customization options already available to Gavia users, such as the MB-2250 multibeam profiling module. (Image credit: Teledyne)

AutoTRap Onboard includes:

- **Target Detector and Target Classifier** – Novel machine learning algorithms that process sonar images to detect, classify, and localize targets of interest.
- **Target Library** – Collection of trained targets. The Target Detector searches for these targets in the sonar image.

AutoTRap is part of the rich suite of ATR products offered by Charles River Analytics.

"Our commercial partners and customers—like Teledyne GAVIA—have various autodetection and recognition needs. Some must locate and classify objects on the seafloor (e.g., shipping containers lost at sea), while others must find or track objects on the ground, in the sky, or in space," explained Dr. Elaine B. Coleman, Vice President of Commercialization at Charles River Analytics. To detect the wide range of objects relevant to ocean surveys, AutoTRap Onboard can learn new objects by training on new target profiles as they are added to the Target Library.

Charles River Analytics develops leading-edge software by combining agile innovation with robust engineering, applying experience derived from decades of designing solutions for austere environments. Our ATR app is developed, integrated, and deployed on market-leading AUVs offered by Teledyne Gavia. Customers can now leverage our joint expertise.

EMPOWERING

our new generation electric manipulator



Seaeye eM1-7

more powerful more intelligent more future-flexible

world leader in electric underwater robotics

J&S SUBSEA IN CONTROL FOLLOWING MANAGEMENT BUYOUT

The Aberdeen based subsea controls engineering division of SEA, a subsidiary of the independent technology group Cohort plc, has undergone a management buyout as it looks to grow its core business in the North Sea European energy sector.

Since the divestment completed, the company has reverted to a new version of its original trading name, J&S Subsea Limited. The business is now wholly owned and managed by the senior leadership team, led by Matt Blair. All 17 personnel have been retained and the firm has plans to expand its engineering and production workforce in the coming months.

J&S Subsea is a global subsea energy controls company for new and recertified equipment. The business will continue to focus on refurbishing, designing, manufacturing and engineering controls for the energy sectors and providing operational support where required.

Its Legacy Locker repository subsidiary business is also part of the MBO and will continue to offer its clients options from its range of refurbished capital equipment. The online resource takes existing, unwanted equipment and recycles or re-engineers assets to provide a cost-efficient and optimized solution as well as offering options for sale rather than scrappage.

The company also has plans to move to a new facility in the Aberdeen area that will allow them to support current operational requirements as well as giving options for expansion and new opportunities.

J&S Subsea Executive Chairman Mr. Blair said: "We would like to thank SEA for all their support through the last few years and wish them the best for the future. We are well positioned to build on our reputation and experience

in subsea controls and operational engineering support to drive the business forward in the UK Continental Shelf as well as overseas. As businesses engage further in the energy transition, the number of subsea campaigns in the North Sea are on the rise. It's our strategy to focus on supporting these projects and demonstrate the value we provide with our responsive, safe and high-quality solutions.

"We are aiming to continue and expand our areas of expertise in the upcoming years and will achieve this by building organically and strategically while continuing to deliver a first-class experience to our clients."

The transaction was supported by law firm Addleshaw Goddard and corporate finance advice was provided to the management buy-out team by Dow Schofield Watts in Aberdeen.

Dow Schofield Watts partner, Tom Faichnie, said: "The subsea division is a successful and profitable business whose skills in helping clients to extend asset life will be very much in demand in the years ahead. The transaction gives the experienced management team autonomy of the business to take it forward to the next stage of its growth."



» J&S Subsea's Exec Chairman Matt Blair, Engineering Director James Morris and Business Development Director, Simon Smith



» The Panther XT ROV can accommodate a wide range of tooling with a 'plug and go' simplicity.

PIPELINE INSPECTION IN GULF OF MEXICO WITH SAAB SEAEDGE PANTHER ROV

Global survey and ROV services operator, ACSM, chose an electric Saab Seaeye Panther XT ROV for recent pipeline inspection in the Gulf of Mexico. The Panther inspected 261 pipelines totalling 2,340 km in four fields in the Gulf of Mexico (GOM), at depths ranging from 15 to 130 meters, in a less than 10-month project duration.

ACSM chose the electric Saab Seaeye Panther on account of its versatility and ability to complete a wide range of required tasks, despite it being far smaller than other hydraulic equivalents. Considerable savings come from deploying the 700 kg Panther system, as opposed to heavier hydraulic alternatives.

The 1,000 m rated Panther's proven success comes from a design architecture that can accommodate a wide range of tooling with a 'plug and go' simplicity that makes it easy to change, maintain and repair systems—and easy to operate.

The potent thruster power can handle the large array of equipment needed for full survey work and provide the steadiness and agility needed to continue working even in strong currents when other vehicles are withdrawn from active service.

Acoustically quieter than hydraulic vehicles, means electric vehicles provide more accurate multi-beam sonar data.

The vehicle proved to be very reliable with minimal down time throughout the entire work period, says ACSM.

The ACSM Panther XT is fitted with a Kongsberg HDTV camera, Norbit Dual Head MBES, ROVINS INS, Tritech Super SeaKing sonar, Blueview multibeam sonar, Teledyne Navigator DVL, TSS 440 pipe tracking system, CTD, Laser Line, CP and five-function manipulators and booms.

NEWTEK SENSOR CONSTRUCTS LVDTS IN DIFFERENT ALLOYS

NewTek Sensor Solutions offers its LVDT Position Sensors in a range of construction materials to provide highly accurate and reliable position measurement for applications with extreme conditions. In addition to stainless-steel, NewTek uses special alloys such as Monel, Inconel, Hastelloy and Titanium to extend the reliability of its displacement sensors in challenging environments with radiation, seawater, corrosive acids as well as high/low temperatures and pressures. Materials for LVDT construction are chosen for each individual application based on parameters such as corrosion, pressure, and magnetic properties across the operating temperature range.

For example, as seawater applications demand long-term sensor reliability as hardware replacement and maintenance are expensive and time-consuming, NewTek constructs the assembly of its position sensors from either Titanium, Inconel or Hastelloy when units are fully exposed to seawater. The higher content of nickel, chromium and molybdenum in these alloys extend the sensor's chemical resistance to seawater in depths to 10,000 ft or more and with external pressures of ~5,000psi.

LVDTs operating in shallow or warm waters with high levels of oxygen can be constructed of Monel 400, a special nickel-based alloy that provides greater resistance against pitting caused by oxidation and attacks by microorganisms. A thick diameter sensor housing using this special alloy avoids corrosion for long-term operation.

Addressing applications with high temperatures and extreme pressures, NewTek constructs LVDTs with Inconel 718 that ensure reliable operation in temperatures up to 400°F (204°C) and pressures to 20,000 psi (1380 bar). For even higher temperature environments found in power generation and engine control systems, NewTek offers its LVDTs with ceramics and special core materials to meet temperature requirements up to 1000°F (538°C).



» A non-magnetic barrier can separate the LVDT coil from the core, allowing the LVDT to make measurements in corrosive or pressurized environments.

When LVDTs are used in nuclear power plants, aircraft, submarines and other applications with radiation exposure, NewTek uses radiation-tolerant and hardened materials and eliminates PTFE from its construction materials so sensors operate continuously without failure or decay.

For sensors custom designed with special alloys, the company accepts small- to large-sized orders and manufactures prototypes to spec. All products are USA-manufactured. For more information, visit <https://www.newtisksensors.com/custom-lvdt/>



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INSTALLING A SUBMARINE CABLE IN THE GREAT LAKES



By John Manock

*Submarine cable industry expert
& editor of SubCableWorld.com*



» ROV being deployed in Lake Ontario. (Photo credit: IT-International Telecom)

Last year, a unique submarine fiber optic cable system was installed in one of the Great Lakes. The project opened a new route for Internet traffic between Canada and the United States and was the brainchild of Crosslake Fibre, a Toronto-based company that currently is planning a number of submarine cable links in North America and Europe.

Telecommunications traffic between Canada and the U.S. traditionally has been based on several terrestrial border crossings, as well as submarine cables along both the East and West Coasts. This new cable was laid across Lake Ontario between Toronto and Buffalo. It runs directly into major data centers in both cities and the network ultimately connects to the NJFX cable landing campus in Wall, New Jersey, where several transoceanic cables land.

While the new cable improves the flow of Internet traffic between the two countries, the story of its installation in Lake Ontario is worthy of attention as it has a number of unique aspects. Ocean News & Technology wanted to get the details of the experience.

"The Lake Ontario cable entered service in October 2019," said Michael Cunningham, CEO of Crosslake Fibre, the project developer. "This is a 58-kilometer cable installed across the lake that forms part of a fiber optic route between Buffalo and Toronto. Due to the relatively short distance across Lake Ontario, we developed a non-repeatered cable system and were able to use a high-fiber-count cable. The submarine cable we used was supplied by Hexatronic and has 192 fiber strands. This gives us a design capacity in the thousands of Terabits per second. As the non-repeatered cable isn't powered in the way that repeatered cables are, we didn't need the traditional large cable landing station. We were able to integrate the submarine cable right into the network on either side of the lake."

"For us, this was an interesting project in that it was in the Great Lakes," said John Graham, Owner of IT-International Telecom, a leading installer of submarine cable systems and the company responsible for the installation of the Lake Ontario cable. "It was the first time we operated a cable ship on the Lakes. For the most part the Great Lakes are kind of "one-way in and one-way out." Our first hurdle was getting

up through the St. Lawrence and actually into Lake Ontario. We had to make sure that our cable ship, the *IT Intrepid*, would fit through the locks. The locks are quite narrow; they're specific to the "lakers;" the types of ships that normally operate on Lake Ontario. That was a major concern."

"We hadn't done work in the Great Lakes before," said Paul Kravis, Chief Commercial Officer, IT-International Telecom. "We'd done work in the Ottawa and St. Lawrence Rivers, but not with a cable ship. The locks were a major challenge. We had to get through six or seven of them. It was the first time a cable ship has ever gone into the Great Lakes. That was a unique part of the project. Other than that, it was a status quo type installation for us. Our procedures didn't change from freshwater to saltwater in terms of how we plowed the cable into the lakebed or things like that. There were a few extra environmental issues that we had to deal with. Porting in Toronto, for example. Clearing into a freshwater port with a cable ship was a unique situation."

One interesting hurdle for the cable laying was the fact that they were working in a tight area with respect to the borders of the two countries, which are more or less in the center of the lake. On the ocean, the cable landing points are hundreds or thousands of kilometers apart and moving back and forth across national boundaries are not usually an issue. In the Great Lakes, the situation is very different.

"There were border issues that we had to deal with," noted Mr. Graham. "We had to plan it in advance because there are stringent rules on one side, being the Coastal Trading Act (CTA) for coming into Canada, and then there is the Jones Act in the United States. These impacted the planning for the cable lay. You had to make sure your shore ends were completed before you brought guys from one country to the next. You couldn't move them back and forth across the lake, even though it's only a short distance."

Installing submarine cables in lakes is not a new thing, especially in Canada which is known for its abundance of lakes, but the Lake Ontario project was unusual because it was installed by a cable ship.

"We had done cable installations on lakes in Canada before, but never with a cable ship," added Steve Arsenault, Director, Global Subsea Solutions, IT-International Telecom. "They were done with barges and tugs. The need to use a cable ship for the Lake Ontario operation was really a function of the requirement for burial. With a barge you can bury using divers to about 10 meters. Deeper than that you need more complex diving techniques and equipment, which is not a cost-efficient technique for a project like this. As this was deeper and with the requirement for burial all the way across, we needed to bring the cable ship with the plough and the remotely-operated vehicle (ROV)."

The ploughing and the ROV operations also made the Lake Ontario cable installation different.

"The project was a 100% ploughed system," said Mr. Kravis. "We ploughed it through from Ontario to New York. It had to be directionally drilled. We had to be careful of some of the environmental conditions because it was in freshwater, so that you're not discharging oils and things like that. The fluid in the ROV is a good example. We couldn't run regular hydraulics, we had to use vegetable oil or mineral oil. That was a unique aspect of operating a cable ship in freshwater."

"The ROV operation on this job was limited to post lay inspection and burial," Mr. Kravis continued. "There were essentially about 2% of

plough-buried sections on this system. We went back with the ROV where we had plough recoveries or where we felt there were sections would benefit from additional jetting. The ROV aboard our ship was specifically designed to inspect the depth of fiber optic cables. It's all very shallow water with this project. The deepest was only 100 meters."

"The cable-laying process in freshwater is not that different from the process in saltwater," added Mr. Cunningham. "There were times, however, where we had to account for the freshwater environment, for example when we were using ROV for some of the underwater work. This is pretty standard in submarine cable installations nowadays. As the vast majority of cable installations take place in salt water, we had to take this into consideration with the ROV. The ROV's ballast is normally set for saltwater conditions, but the freshwater of Lake Ontario has less buoyancy than the saltwater of the oceans, so the buoyancy had to be adjusted to account for freshwater conditions."

"There was another aspect as we more typically operate at full ocean depths," said Mr. Graham. "We're normally in the ocean, where there are all kinds of issues when you're trying to plough on the ocean floor. As this was an ex-glacial area, however, the ploughing was fantastic. You have a lot of till, muds and sediment on the bottom that made for excellent ploughing. It was a smooth operation. The weather on the Great Lakes is an issue as storms can be violent, but we conducted this operation in the summer and had great weather."

While this was a first-of-a-kind cable installation in the Great Lakes, the operation showed that the installation of submarine cables in the Great Lakes can be done successfully.

"Every submarine cable project presents a different set of challenges and the Lake Ontario build was no different," concluded Mr. Cunningham. "In terms of a location and geography to install a cable, it's definitely one where there is a comparatively benign environment, especially compared to the ocean conditions where most submarine fiber optic cables are laid. In Lake Ontario, you have a lakebed that is relatively soft and easy to install a cable into. You don't have a lot of challenging geologic features. It's not the busiest place in the world and there's not a lot of current. The weather is not as extreme as you see in the ocean, especially in the summer when this cable was laid. So it was a very good place to install a cable from a risk point of view."



» Cable ship *IT Intrepid* sailing from Toronto. (Photo credit: IT-International Telecom)

JDR TO CONDUCT ARRAY CABLE TERMINATION AND TESTING ON MORAY EAST OFFSHORE WIND FARM

JDR, the global subsea cable supplier and servicer owned by the TFK-able Group, has agreed a contract with Boskalis to provide the termination and testing of 100 array cables and two offshore substation interconnector cables for the Moray East offshore wind farm off the coast of Scotland.

This award secures further UK content for the project and comes in addition to the supply of the 200 km of 66kV array cable and a range of termination accessories, which are currently being manufactured by JDR in its state-of-the-art facility in Hartlepool, UK. The scope of work includes the provision of technicians, tooling, and test equipment. JDR will perform procedures for the stripping of the armor protection, fitting of the permanent hang-offs, routing, cleating, electrical and fiber termination, including testing of the cables. As part of this contract JDR will also carry out Damped AC testing of the substation interconnector cables.

With the contracting of JDR for both the cable supply and the termination and testing works Boskalis will benefit from the continuity from production to installation, ensuring the integrity of the cables through final commissioning until energization. The reduction in interfaces will also ensure a slicker operation and clearer scope demarcation.

Located 22 km off the coast of Scotland in the Moray Firth, Moray East, is a 950 MW offshore windfarm that covers an area of 520 square km in water depths ranging from 37 m to 57 m. The project is being developed by Moray Offshore Windfarm (East) Ltd, a consortium of EDP Renewables (EDPR), Diamond Generating Europe (DGE) and Engie. This consortium contracted Boskalis for the supply and installation of the wind farm's inter-array cables.

Neil Brown, Head of Services at JDR, commented, "We're delighted to announce this contract win as this is our first-time providing termination and testing to Boskalis. This project win continues our increasing track record in the offshore installation market which is very important to us. It's a testament to the sheer hard work and diligence of our offshore teams who continue to produce high service levels for offshore projects such as this one."

The termination and testing works are due to commence in November 2020 and continue until mid-2021.



» The scope of work includes the provision of technicians, tooling and test equipment (Photo Credit: JDR)

OCEANTOOLS AWARDED MAJOR ORDER FOR DEEPWATER FIBER-OPTIC TERMINATION HOUSINGS

OceanTools has been awarded a significant contract for the design and manufacture of a 7,500 m depth rated fiber-optic termination housing, by a subsea telecommunications cable manufacturer, based in the Asia Pacific region. The OceanTools subsea design team collaborated with Aberdeen based start-up, Subsea Connect, to develop a pressure housing and cable termination solution which includes stress relief and water blocking functionality.

Kevin Parker, Managing Director of OceanTools said: "This contract award proves that when it comes to providing solutions for problems in the world's harshest environments, our clients realize they're in safe hands when dealing with

OceanTools' industry-leading design team. We are delighted to invoke the services of Subsea Connect and lend support to their recently formed business."



» OceanTools partnered with Subsea Connect to develop a pressure housing and cable termination solution.

Martin Dines, Director of Subsea Connect added: "We are thrilled to be involved with OceanTools on this prestigious project and we look forward to working with them on future projects."

Upon completion of the pre-production unit, it is anticipated that the delivery of this solution will lead to a series of further design work projects for additional cable sizes as well as the annual manufacture of £six-figures supply of termination housings.



» The Deep Dig-It is remotely operated and creates a deep trench for the cables by liquefying the seabed. (Photo credit: Van Oord)



» The cable was pulled ashore via a direct drill to the new transformer substation that is being built on the Maasvlakte. (Photo credit: Van Oord)

VAN OORD TRENCHER BURIES OFFSHORE WIND CABLES

Van Oord's Deep Dig-It trencher crossed the busy shipping route Rotterdam Maasmond successfully and is on its way to offshore Alpha jacket in the Hollandse Kust (zuid) wind farm area.

TenneT is building the Hollandse Kust (zuid) offshore grid to connect new offshore wind farms. Four cables will have to be buried into the North Sea seabed for this purpose. For the first 10 kilometers of the cable route, these cables will have to be buried more than 5 meters into the seabed in order to cross the busy shipping route Rotterdam Maasmond.

The Van Oord-Hellenic Cables consortium will be installing 4 subsea 220 kV AC cables that will connect 2 offshore platforms to the onshore electricity grid. The first 2 cables to the Alpha platform will be installed this year. The other 2 cables, meant for the Beta platform, will follow in 2021. The last few days the preparatory work has been completed. The cable was pulled ashore via a direct drill to the new transformer substation that is being built on the Maasvlakte. From this point, the cable with a total length of 42 kilometers to the wind zone Hollandse Kust (zuid) will be laid by the Deep Dig-It, a large remote-controlled trencher.

Van Oord's Deep Dig-It is a so-called 'Tracked Remotely Operated Vehicle' (TROV) that drives unmanned over the seabed and creates a deep trench for the cables by liquefying the seabed. At the same time, the trencher inserts the cables into the trench and seals them again into the seabed. This new trencher is one of the largest and most powerful of its kind and can bury cables more than 5 meters deep in very hard soil. The Deep Dig-It is controlled at Van Oord's offshore installation vessel MPI Adventure, which is also equipped with a crane to launch and take out the Deep Dig-It.

The Hollandse Kust (zuid) offshore wind farm is located 22 kilometers off the coast of the Dutch province of Zuid-Holland. The sea cables connect the two offshore platforms with the

Maasvlakte high-voltage substation and the Randstad 380 kV South ring.

The 1,400 MW grid connection will be completed in 2022 and will eventually provide electricity for 1.6 million households. The offshore wind farm contributes significantly to the Dutch government's objective of having a total of 3.5 GW installed offshore wind energy capacity by 2023. With the commissioning of Borssele Alpha and Beta this year, the first 1.4 GW has been realized. For more information, visit www.vanoord.com.

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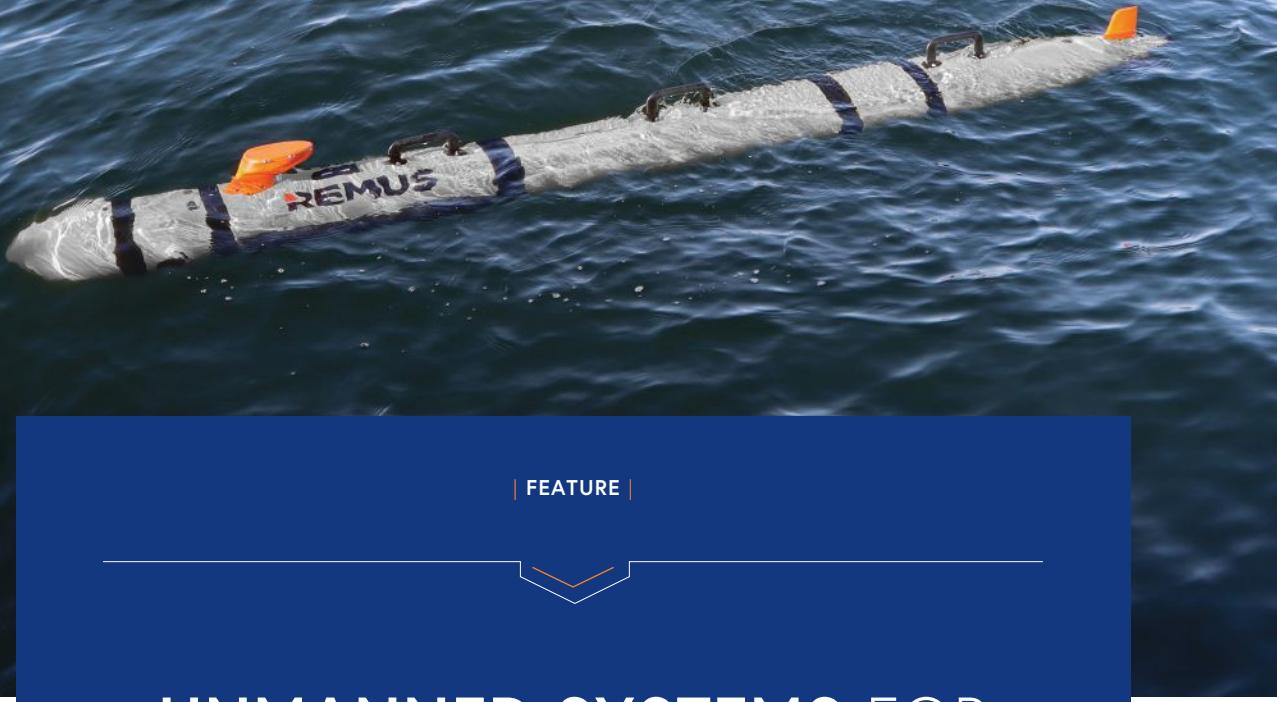


Vehicle



SubTech
Subsea Technologies

» REMUS 300 Unmanned Underwater Vehicle.
(Photo credit: Huntington Ingalls Industries)



| FEATURE |

UNMANNED SYSTEMS FOR THE FUTURE OF NAVAL DEFENSE



By Tom Reynolds

*Senior Director, Business Development,
Huntington Ingalls Industries*

Huntington Ingalls Industries (HII) is widely known as America's largest military shipbuilding company, but that's not all we do. In addition to Newport News Shipbuilding and Ingalls Shipbuilding, there is a third division, Technical Solutions, within HII. This division has three business groups: Unmanned Systems, which the former Hydroid is now a part of; Nuclear & Environmental Services; and Defense & Federal Solutions. While Newport News and Ingalls are well established, Technical Solutions is focused on taking the company into new markets with unique capabilities.

HII saw an opportunity to expand its presence in the rapidly growing unmanned systems market with the acquisition of Hydroid. HII had previously acquired the Engineering Solutions Division of the Columbia Group, a leading designer of unmanned underwater vehicles. They had also worked on many unmanned systems integration projects. HII's experience building ships and submarines can be leveraged in unmanned maritime systems and auxiliary equipment design, enabling

streamlined integration onto these larger platforms.

UNMANNED SYSTEMS |

Unmanned Systems, a business group within HII's Technical Solutions division, creates advanced unmanned maritime solutions for defense, marine research and commercial applications. Serving customers in more than 30 countries, HII provides design, autonomy, manufacturing, testing, operations and sustainment of unmanned systems, including unmanned underwater vehicles (UUVs) and unmanned surface vessels (USVs).

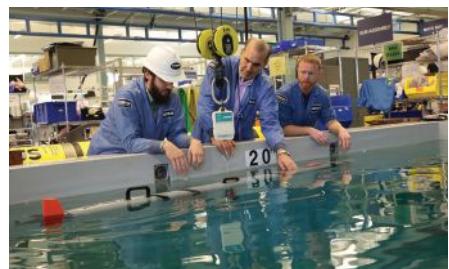
HII now offers the full range of UUVs, from small class to extra-large class. We are also expanding into USVs, investing in Sea Machines so we can partner on key government pursuits. The U.S. Navy is making a commitment to use unmanned systems across their fleet, and we are here to partner with them and support them with their missions.

WHAT WE HEAR FROM THE DEFENSE CUSTOMER |

We're listening to signals from defense customers, and we understand there to be three main focus areas for unmanned systems that the customer wants to enhance: capability, interoperability and applicability.

CAPABILITY |

Anything that can increase the endurance, speed, accuracy or data-collecting ability of an unmanned system will greatly increase



» A REMUS 300 UUV being ballasted.
(Photo credit: Huntington Ingalls Industries)



» The REMUS Sea Launcher, an autonomous launch and recovery system for REMUS 600 UUVs.
(Photo credit: Huntington Ingalls Industries)



» A REMUS 600 UUV outfitted with signals intelligence (SIGINT) payload and a canister that can launch an Unmanned Aerial Vehicle (UAV).
(Photo credit: Huntington Ingalls Industries)

mission efficiency. While the main vessels perform other missions, the unmanned systems can go ahead and bring back valuable data that helps navies plan their next moves. They also take divers away from dangerous or tedious tasks, like mine-hunting and ocean floor mapping. These systems are meant to augment the fleet's capabilities: the more data the fleet has, the better, more informed decisions they can make.

For most UUVs, this means a lot of capability needs to be packed into a small volume. Customers need these systems to be reliable and durable. They need to have advanced autonomy to avoid obstacles and to make decisions when out of communications range.

Having designed and built UUVs for more than 20 years, we have a unique amount of collective wisdom. REMUS UUV technology has its roots in the Woods Hole Oceanographic Institution, who we continue to partner with on research and development projects. We've built all of our new generation UUVs around the REMUS Technology Platform, which provides consistent, reliable performance across the REMUS family of systems. This scalable platform brings together open architecture, advanced autonomy, and reconfigurable modular payload and energy sections to allow the user to tailor the UUV to their specific mission needs. It is built off of the core, field-proven REMUS autonomy, allowing for overlay of autonomy behaviors such as advanced mission planning and collaborative autonomy.

The REMUS Technology Platform was designed with reliability as a central requirement. More than 500 UUVs have been sold to military, commercial and academic organizations worldwide and have helped to refine both the hardware and software into a solid, dependable platform. Selection of quality components and adherence to rigorous manufacturing and testing standards produce REMUS vehicles ready to endure the harsh operating environments where users need them.

INTEROPERABILITY

Unmanned Maritime Autonomy Architecture (UMAA) and Modular Open Systems Architecture (MOSA) are a big focus for the U.S. Navy. These standards are guiding the industry in how we design the software architecture of our

unmanned systems to be interoperable with customer systems. Specifically, customers want the ability to network all their assets, including manned and unmanned air, surface and undersea systems, through a common control system (CCS). This will allow them to plan missions and collate data across platforms, giving them a better understanding of the operational environment so they can make more informed decisions.

Cybersecurity is also a critical element, as unmanned systems are used for national security missions like mine countermeasure operations and intelligence preparation of the operational environment (IPOE). Unmanned systems need the ability to integrate securely into customer networks. Additionally, large naval platforms weren't designed with unmanned systems in mind, so incorporating them can be a challenge.

The REMUS Technology Platform is built on DDS middleware, with the vehicle and mission control system designed to be UMAA compliant while maximizing MOSA principles. This open architecture framework allows simple integration into a CCS. We're also ensuring that all REMUS UUVs are secure and cyber-compliant.

To integrate into the platforms that unmanned systems are launched from—large ships and submarines—unmanned systems need to be flexible in design. The advanced modularity of REMUS UUVs allows us to easily modify modules to enable different launch and recovery methods, from manual to autonomous launch and recovery. The flexible, open nature of the REMUS Technology Platform allows our UUVs to be easily integrated into established customer platforms.

APPLICATIONS

Customers want the ability to use their unmanned systems across a variety of missions. Some of the applications customers are interested in using UUVs for include mine countermeasures, IPOE, antisubmarine warfare and oceanography. To enable this, modularity and flexibility is needed in these systems. Customers also want the ability to easily integrate new sensors and algorithms into their UUVs. The U.S. Navy is setting up their Rapid Autonomy Integration Lab (RAIL) to help facilitate the integration of capabilities across their unmanned sys-

tems portfolio.

The REMUS Technology Platform provides advanced modularity, allowing the user to choose the payloads and energy sections that best suit their mission requirements. Reconfigurable hull sections with standard interfaces allow for third party or government payload integration. The platform also allows swappable energy modules, a removable hard drive for rapid exfiltration of mission data, and toolless band clamps. Over the years, we've integrated dozens of different sensors and payloads into our UUVs, including sonars and cameras as well as advanced payloads such as SIGINT and unmanned aerial vehicles. In maximizing MOSA principles, the REMUS Technology Platform also makes use of a modular software architecture, enabling more rapid integration of autonomy algorithms.

While customers want enhanced capability, interoperability and applicability, they also want to decrease risk and cost.

| RISK |

When customers talk about risk, they mainly focus on two areas: risk to the mission and risk to the people and platforms. Deploying expensive technology into the ocean is always a risk, with hazardous conditions and limited communication capabilities underwater. To decrease risk to the mission, customers need reliable, robust systems that have been thoroughly tested and fielded. Unmanned systems can navigate into hazardous areas which can take some of the risk to people out

of the equation, but they also need to have safety features in place.

REMUS UUVs are some of the most field-proven unmanned systems on the market. In development since the 1990s, this mature technology has been deployed for thousands of hours on national security missions around the world. These UUVs are thoroughly tested before delivery to the customer and have multiple backup systems and safety features to ensure reliability. Lithium ion batteries are the most common source of energy for our UUVs, and they are rigorously conditioned and tested prior to use. With their long, successful history, REMUS UUVs minimize risk to missions, people and platforms.

| COST |

As budgets become more constrained, customers are keeping a close eye on costs to ensure they are getting the most for their money. The initial price of the system isn't the only cost—throughout the life of unmanned systems, customers have to manage the costs of maintaining, repairing and upgrading their systems.

HII is constantly looking at ways to decrease the procurement and life-cycle costs for customers. Advanced modeling and simulation, state-of-the-art manufacturing facilities and lean processes help to decrease cost while ensuring product reliability. The modularity and open architecture of the REMUS Technology Platform allows for lower development and lifecycle costs with faster and simpler

maintenance and upgrades. Obsolescence isn't a problem due to the ability to rapidly integrate new sensors and payloads. Hardware and software development kits accelerate third-party sensor and algorithm integration, which further decrease development costs and timelines.

| REMUS UUVs |

REMUS has evolved significantly over the past few years, and the REMUS Technology Platform takes it to a whole new level. With a focus on modularity and openness, this platform was developed to be extremely flexible and to keep up with the pace of new technology. The platform itself is constantly evolving—we are integrating new features and capabilities as we iterate and learn.

All new generation REMUS UUVs are built around the REMUS Technology Platform, regardless of diameter or depth rating. The platform is scalable and was initially developed for the REMUS 100 in 2016. The REMUS Technology Platform is also the base of the New Generation REMUS 6000, a 6000-meter (3.73 mile) rated UUV.

More recently, we have increased modularity and expanded the open architecture to be UMAA compliant. The first REMUS 300 was delivered to the U.S. Navy earlier this year and is being evaluated for the small-class UUV contract. This vehicle brings together compact and efficient core electronics, advanced modularity, and field-exchangeable battery modules that allow up to 29 hours of

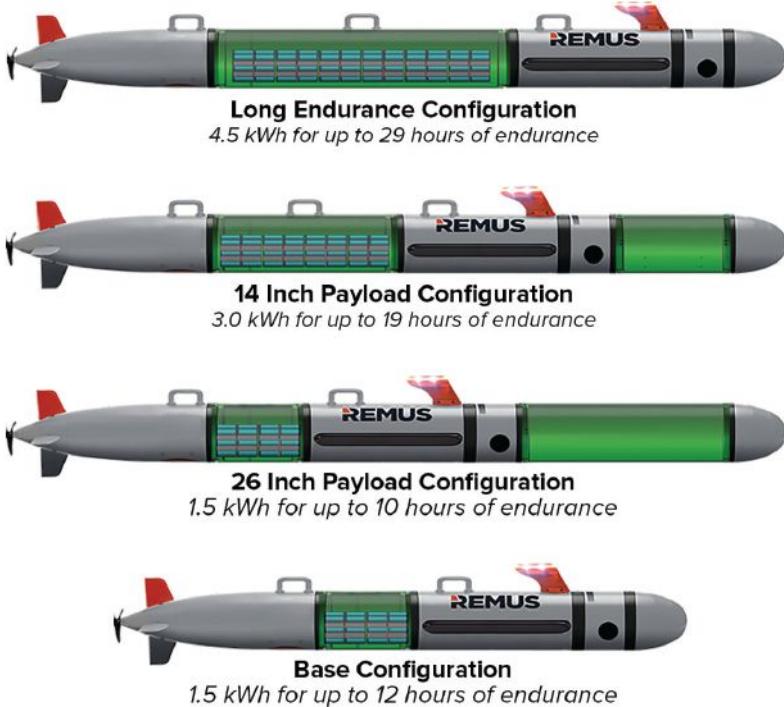


» The production floor in Pocasset, MA where REMUS UUVs are manufactured.
(Photo credit: Huntington Ingalls Industries)



» A REMUS 300 UUV being sea tested.
(Photo credit: Huntington Ingalls Industries)

Flexible, Reconfigurable Platform



» REMUS 300 UUV configurations. (Image credit: Huntington Ingalls Industries)

endurance. It's the same diameter as the REMUS 100, enabling reuse of common modules, but increases the depth rating to 300 meters and remains two-man portable.

A New Generation REMUS 600 is also in development. Scaling up capabilities from the REMUS 300, the New Generation REMUS 600 also advances modularity over the legacy REMUS 600. The larger diameter allows for larger, more advanced payload to be integrated and this UUV is being developed to be deployed from many different types of platforms including large ships, RHIBs and submarines.

| WHAT ABOUT THE FUTURE? |

Over the next five to 10 years, we expect to see continued focus on open architecture and modularity as well as larger, longer endurance systems to enable more over-the-horizon operations. Flexibility will be key, as unmanned systems will be used for a variety of different missions and deployed from many different platforms. As artificial intelligence evolves, it will be interesting to see the increase in autonomy on these unmanned systems, enabling them to process more data and make more decisions without human intervention.

The REMUS that came out in 2001 is vastly different than our current UUVs. We're working hard to make sure our vehicles provide the modularity and flexibility needed to continue to integrate new capabilities into the future.

For more information, visit
TSD.HUNTINGONGALLS.COM



» REMUS 600 UUV with Kongsberg High-resolution Interferometric Synthetic Aperture Sonar (HISAS). (Photo credit: Huntington Ingalls Industries)

U.K. LEADS U.S. AND NORWEGIAN SHIPS TO TRAIN IN THE BARENTS SEA



» British Royal Fleet Auxiliary RFA Tidespring (A136)

Ships from Norway, the U.S. and the U.K. entered the Barents Sea on September 7, 2020, working together to conduct maritime security operations in the challenging environment above the Arctic Circle.

Royal Navy frigate HMS Sutherland (F81), leading the surface action group as the commanding ship, is joined by Arleigh Burke-class guided-missile destroyer USS Ross (DDG 71), British Royal Fleet Auxiliary RFA Tidespring (A136), and Royal Norwegian frigate HNoMS Thor Heyerdahl (F314), demonstrating seamless integration among allies.

"Our maritime advantage continues to be our strong, cohesive partnerships," said Vice Adm. Gene Black, commander, U.S. Sixth Fleet. "Our forces are able to conduct sustained operations in the vital waterways in the Arctic because of the support and cooperation of our international partners, allowing us to be present together where and when it matters."

U.S. Sixth Fleet routinely conducts operations in the High North with allies and partners to ensure the region remains stable and free of conflict. Allied and partner navies must remain proficient in all operating environments to ensure

continued, collective security and access to the seas. This is especially critical in the Arctic, where the austere weather environment demands constant vigilance and practice.

"This opportunity to train with Norway and the U.K. is invaluable to the crew," said Ross' commanding officer, Cmdr. John D. John. "Our Sailors have been working with their counterparts on other ships to gain proficiency in maneuvers at-sea, air operations, tactics, and communications and we look forward to carrying this over to our other operations throughout the region."

Ships from the U.K. and U.S. operated together in the Barents Sea in May of this year. Three Arleigh Burke-class guided-missile destroyers USS Donald Cook (DDG 75), USS Porter (DDG 78), USS Roosevelt (DDG 80), supported by the fast combat support ship USNS Supply (T-AOE 6), were joined by the Royal Navy's HMS Kent (F 78) operating above the Arctic Circle.

Other recent U.S. Navy operations in the High North include USS Roosevelt's (DDG 80) 50-day patrol to the region, which concluded August 27. While on patrol, the ship executed multiple passing exercises with Royal Norwegian Navy counterparts and joined five other countries to participate in NATO Allied Maritime Command-led anti-submarine warfare (ASW) exercise Dynamic Mongoose 2020.

"The realistic and relevant training we are conducting here in the Barents cannot be replicated anywhere else," John added. "This proves we can operate anywhere in the region with our allies."

U.S. Sixth Fleet, headquartered in Naples, Italy, conducts the full spectrum of joint and naval operations, often in concert with allied and interagency partners, in order to advance U.S. national interests and security and stability in Europe and Africa.

KRAKEN SIGNS MAJOR CONTRACT WITH DANISH NAVY FOR MINE HUNTING EQUIPMENT

Kraken Robotics Inc. recently signed a contract with Danish Ministry of Defense, Acquisition and Logistics Organization (DALO) to supply mine-hunting sonar equipment to the Royal Danish Navy. This was a competitive bid process and under the program, Kraken will deliver its KATFISH™ towed Synthetic Aperture Sonar, Tentacle® Winch and Autonomous Launch and Recovery System (ALARS). Kraken's mine hunting system will be integrated onboard the Royal Danish Navy's optionally unmanned surface vessels. The total contract value is approximately US\$36 million, with the majority of that received over a 2-year equipment acquisition phase.

Commenting on the announcement, Kraken President and CEO Karl Kenny said: "We are very pleased to sign this contract to supply our KATFISH™ and ALARS systems to the Royal Danish Navy. This was a very competitive process and we are proud to have been selected. We are looking forward to a long-term relationship with the Danish Navy. As part of its commitment to Denmark, Kraken will be expanding its European presence with the establishment of a new Danish Centre of Excellence in Mine Counter Measures. This new operation will not only conduct research and development to further

improve the capabilities of Kraken's world-class MCM solutions but will also be able to offer local technical support for Danish customers. Kraken's new Danish operation will also engage with local Danish companies, universities and technical institutes, ensuring a long-term benefit to Danish technical development."

The Head of the Maritime Division within DALO, Captain (RDN) Kim Bo Meier noted:

"The ability to recognize conditions below sea level on Danish maritime territory is as ever considered a vital task of the Royal Danish Navy and its MCM forces. After a lengthy and rigorous procurement process the Royal Danish Navy has selected Kraken's KATFISH™ 180 system as its future main mine hunting sensor. A modern sensor, which within the months to come is to be fully integrated in to the Danish MCM modular concept of unmanned and remotely controlled MCM drones. With this new sensor the Royal Danish Navy can maintain its MCM capacity and necessary operational preparedness in relation to being able to locate and clear mines in both national and international waters and straits. We look forward cooperating with Kraken ensuring a smooth integration of the new main sensor."



» KATFISH™ and ALARS – Storage Position



» KATFISH™ and ALARS – Deployed Position



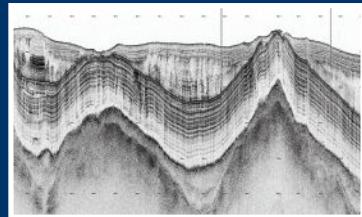
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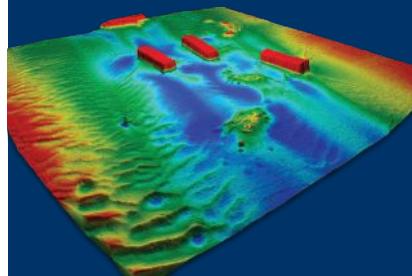
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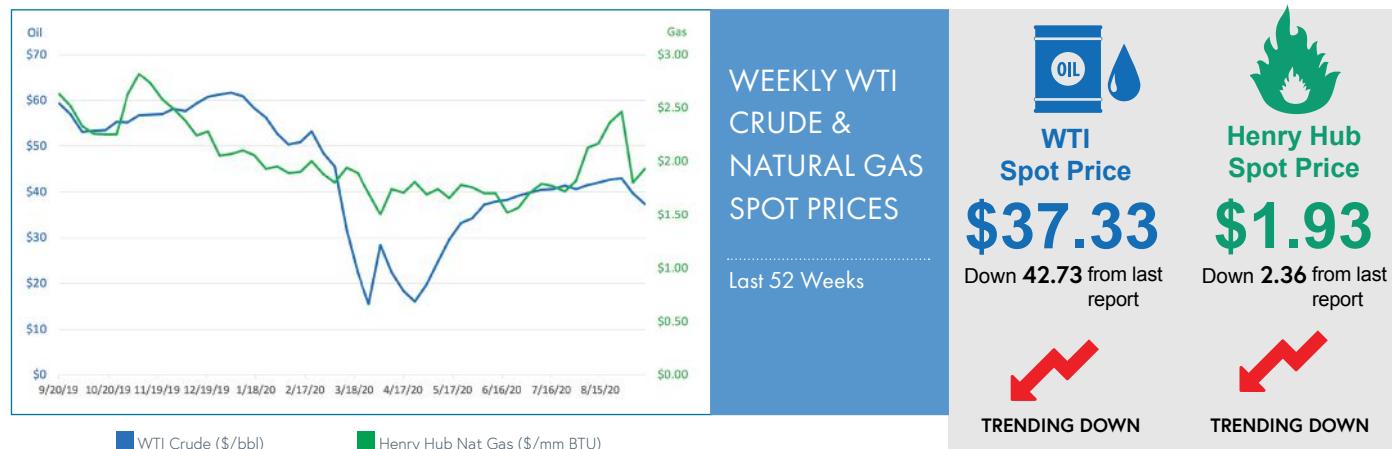
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CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF SEPTEMBER 14, 2020

Oil prices slumped back to below \$40 per barrel in September after spending most of August above the \$40 mark. West Texas Intermediate (WTI) spot prices closed at \$37.33 per barrel on September 11, down more than \$5.00 per barrel since mid-August. Low levels of demand and high inventories are combining to push prices down. CNN Business reported that the end of the driving season in the U.S. and low demand for jet fuel as COVID-19 limits air travel are concerning the markets. Meanwhile, Bloomberg News reported that Saudi Arabia cut its official selling price to Asia and the United States due to waning demand.

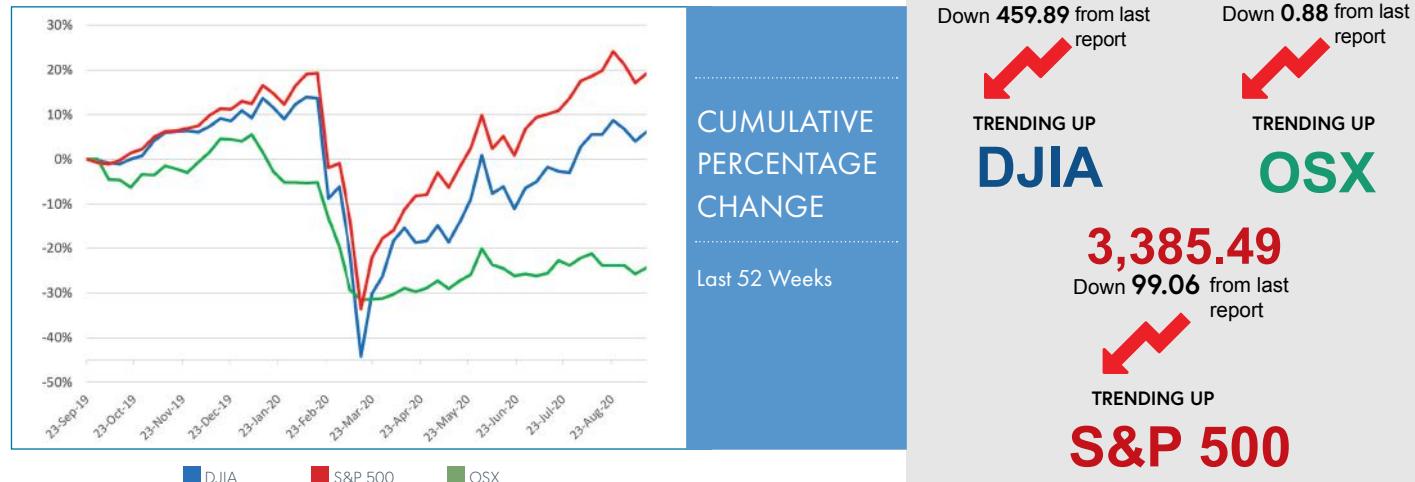
Natural gas prices slid downward in the past month, dropping back below the \$2.00 per million British thermal units (MMBtu) mark after spending virtually all of August above that mark. *Wall Street Journal* reported that cooler weather, reducing the need for air conditioning and, therefore, demand for natural gas, brought about the drop in price. Low demand continues to be an issue for natural gas prices. A September report by the U.S. Energy Information Administration reported that U.S. natural gas consumption was down 2.7% on a year-on-year basis.



KEY EQUITY Indexes

In the past month, the Dow Jones Industrial Average (DJIA) reached record territory briefly, before sliding back and ultimately finishing about 450 points below where it began. On September 2, the Dow broke the 29,000-point barrier for the first time, but slid back during the days that followed to below the 28,000-point mark. ABC News reported that poor performance in the tech sector fueled the drop. The S&P 500 saw a similar trend, crossing the 3,500-point mark on several occasions but falling back each time and closing on September 14 below 3,400 points.

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WEATHER AND UNCERTAINTY CONTROL THE COMMODITY MARKETS

BY G. ALLEN BROOKS | Author, *Musings From the Oil Patch* | www.energymusings.com

CRUDE OIL:

The Red Queen and Alice discussed the problems of running and making progress in *Alice in Wonderland*. "Well, in our country," said Alice, still panting a little, 'you'd generally get to somewhere else—if you run very fast for a long time, as we've been doing."

"A slow sort of country!" said the Queen. 'Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

That may describe crude oil prices since they rebounded following the devastating demand collapse in March and April. After falling in late April to a negative \$39 per barrel, oil prices rebounded to \$40 by early June. Since then, like the Red Queen, the oil market has been running hard only to remain in the same place.

In the past several weeks, as new COVID-19 outbreaks emerged in Europe and various U.S. states, oil demand's anticipated recovery has been called into question. With OPEC and its partners discussing adding more supply to the global oil market, and U.S. producers restarting wells suspended last spring, prospects of a second half 2020 oil glut have grown, poisoning the oil market sentiment. The souring outlook for an improvement in the supply/demand balance knocked oil prices down from \$45 a barrel to \$38.

Recent commentary from the heads of three of the world's largest oil trading firms reflects sharply differing outlooks, helping explain why oil prices are stuck around \$40. Two trading houses see demand weakening and supply growing. They see global oil inventories rising to the point we will see oil tanker storage becoming popular again. The largest trading firm sees China oil demand recovering to previous levels, more airplanes flying and mobility picking up. Therefore, they see global oil inventories shrinking, supporting higher

oil prices. A recent Dallas Federal Reserve Bank survey of oil executives concludes that they will end 2020 between \$40 and \$45 a barrel—more running in place.

The market's optimism/pessimism struggle will not be resolved soon. Only additional data will establish the direction. As government leaders are learning, their constituents will not tolerate lockdowns for much longer. We know the most vulnerable people in society at risk of the virus and how to protect them. By practicing healthy protocols, there is little reason why economies cannot become more open. Fear of the disease will keep the recovery in activity restrained, but it likely won't halt it. Total confidence will only come with a vaccine, but a more normal life can be lived in the meantime. Better oil demand lies ahead.

NATURAL GAS:

We suggested in our last column that weather and LNG shipments would control natural gas pricing. Both dynamics have impacted gas prices and are continuing to impact them, increasing price volatility. The latest disrupter is the fallout from hurricanes hitting the Gulf Coast and cutting natural gas demand. While the storms played their usually havoc with offshore gas production, it has been the devastation of the Lake Charles region of Louisiana by Hurricane Laura that has had the greatest demand impact. The storm created weeks-long power outages, shutting down several LNG export terminals.

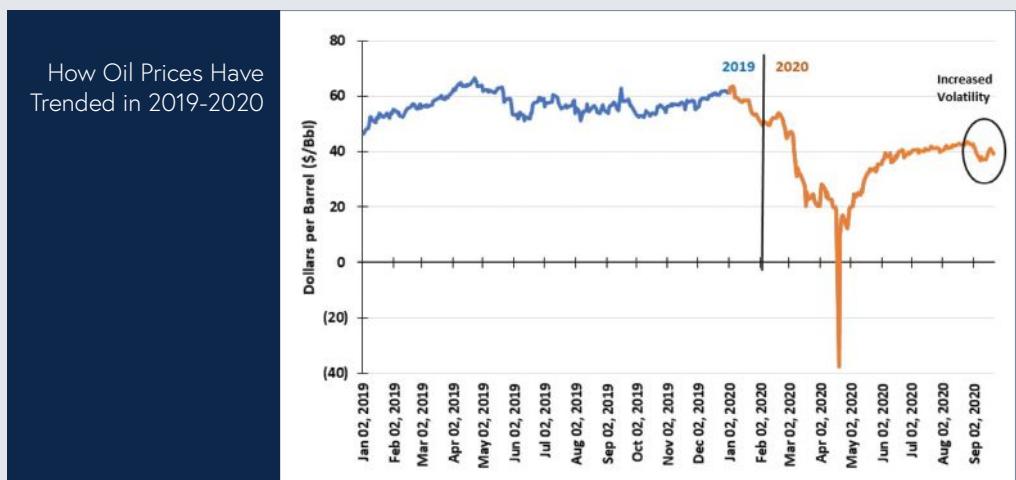
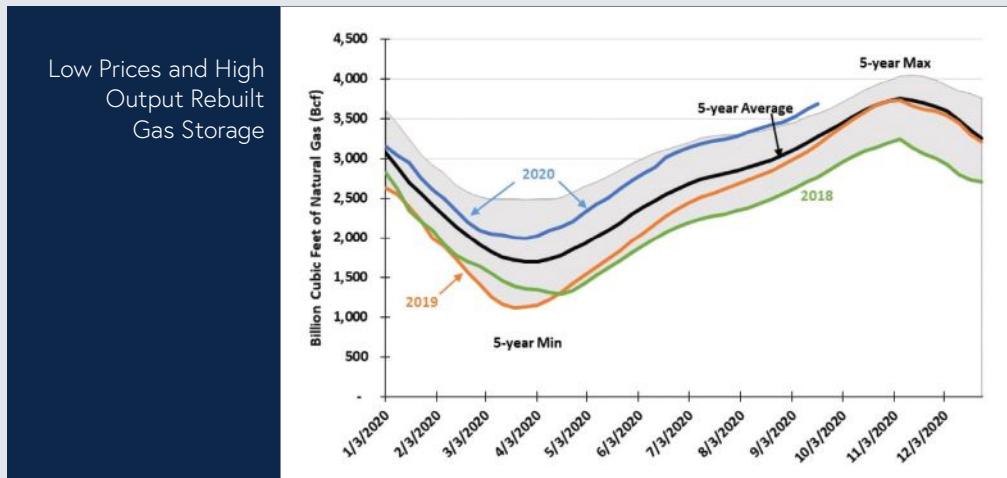
The idled LNG terminals forced them to curtail their gas feed. The curtailments have added to the supply glut, which, not surprisingly, caused a sharp drop in spot gas prices. Spot gas prices fell substantially more than futures prices. That was not surprising, as all prices needed to adjust to a level that would entice buyers into the market. Some analysts interpreted the spot price drop, which bottomed at \$1.33

per thousand cubic feet, as establishing a new trend for the overall gas market, rather than a one-time event driven solely by the speed with which the glut emerged.

Besides the hurricane's impact on LNG shipments, weather-related demand also disrupted the market. Temperatures rapidly went from unseasonably hot to unseasonably cold and then back again. When the air conditioning power load evaporated, support for gas prices eroded. The cold temperatures, while unseasonably cool, were insufficient to generate a meaningful uptick in heating-related gas consumption. This was just one more slam to gas demand, which forced prices to adjust to properly allocate gas supply.

The optimism that natural gas supply would drop as crude oil production fell in response to weak oil prices has not been as strong as the reality that demand has fallen more than gas output. Associated natural gas supply has declined, and will likely continue declining, as long as oil drilling doesn't pick up soon. With oil prices predicted to remain below the level that would restart drilling activity, associated natural gas supply should contract further during 2021.

The key issue for gas prices will be, as it always is at this time of the year, the expected level of storage when winter ends. As the current gas inventory shows, there is more gas in storage than during the past five years. Should we experience another warm winter, such as those of the past two, gas storage next April is likely to be greater than normal. Absent soaring demand for power generation and/or LNG exports, gas prices will face headwinds this winter and next summer.





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San Diego, CA » February 15-17, 2021

www.oceanologyinternationalamericas.com

Floating Wind Solutions

Houston, TX » February 25-26, 2021

<https://floatingwindsolutions.com>

Offshore Wind Executive Summit

Galveston, TX » March 2, 2021

www.offshorewindsummit.com

Offshore Well Intervention LATAM

Rio de Janeiro, Brazil » March 9, 2021

www.offsetnet.com/lata

Int'l Conference on Ocean Energy (ICOE)

Washington, DC » April 28-30, 2021

www.icoe2021.org

EUROPE

Ocean Energy Europe

Brussels, Belgium » December 1-2

www.oceanenergy-europe.eu/annual-event/oee2020

Oceanology Int'l

London, UK » December 1-3

www.oceanologyinternational.com

Deep Sea Mining Summit

London, UK » December 7-8

www.deepsea-mining-summit.com

UDT

Rotterdam Ahoy, The Netherlands
» December 8-10

www.udt-global.com

SMM

Hamburg, Germany

» February 2-5, 2021

www.smm-hamburg.com

Upstream Digital Transformation Europe

Virtual » February 10-11, 2021

www.offsetnet.com/udt-eu

Submarine Networks EMEA

London, UK » February 16-17, 2021

www.terrapinn.com/conference/submarine-networks-world-europe/index.stm

Offshore Wind Power Substations

Bremen, Germany

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www.iqpc.com/events-offshore-windpower-substations

Subsea Expo

Aberdeen, UK

» February 23-25, 2021

www.subseaexpo.com

All-Energy

Glasgow, UK » May 12-13, 2021

www.all-energy.co.uk

OTHER REGIONS

Telecoms World Asia

Virtual » Oct. 27-29

www.terrapinn.com/conference/telecoms-world-asia

Submarine Networks World

Virtual » Nov. 3-4

www.terrapinn.com/conference/submarine-networks-world

ADIPEC

Virtual » Nov. 9-12

www.adippec.com/virtual

MAST Asia

Tokyo, Japan » Nov. 9-11

www.mastconfex.com/asia2020

Offshore Well Intervention Australia

Perth, Australia » Feb. 9-10, 2021

<https://offsetnet.com/owi-aus>

Underwater Technology (UT)

Tokyo, Japan » March 1-4, 2021

www.ut2021.org

Int'l Conference on Coastal and Ocean Engineering

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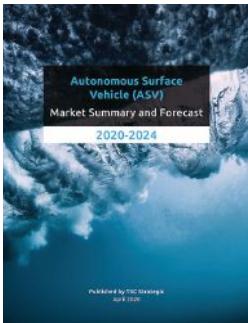
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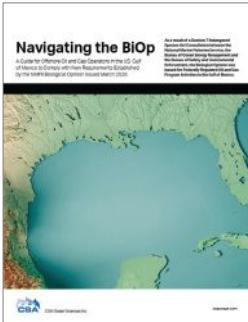
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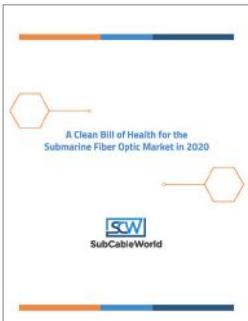
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YARA MARINE LAUNCHES NEW START-UP ACCELERATOR PROGRAM

Yara Marine Technologies has announced its new corporate accelerator program, Yara Marine X, a start-up competition aiming to provide a home for technology and solutions that will contribute to a greener maritime industry.

"Our corporate mission is to nurture the next generation of high value, high performance sustainable ocean technologies," says Yara Marine CEO Thomas Koniordos. "With this new program, we are seeking to position Yara Marine in the global start-up space while developing new opportunities for the company." He relates that the long-term goal for the program is to integrate new ideas into the Yara Marine's business.

The competition is designed to attract mature start-ups looking for partners and investors. "We will be recruiting young companies or professionals with a focus on sustainability and green solutions within vessel operations," says YMT Strategy Business Development Manager Thomas Gabestad. "Candidates will need to be adjacent to what we do in order to enhance our corporate performance as a

whole and help us to build on our strong brand."

The winner will enter a bootcamp orientation of two weeks, followed by six months in a tailored accelerator program. The program includes office space, a US\$ 10,000 up-front stimulus grant, potential later-stage investment from Yara Marine, and access to the company's mentors, network and facilities. Piloting and distribution opportunities with Yara Marine customers, suppliers and network are part of the longer-term plan.

Gabestad notes that target sources include ocean and maritime clusters, incubators, universities, various maritime programs, and the global start-up media. Key markets for the new technologies will be Asia, the Americas, and Europe. "The winning candidate will take up residence at our Headquarters in Oslo," he says.

Those interested can apply from September 1 through October 11 at www.yaramarinex.com. The winner will be announced on November 4.



» Yara Marine CEO Thomas Koniordos



» YMT Strategy Business Development Manager Thomas Gabestad

SeaState

THE ON&T PODCAST

In the next episode of SeaState we talk with Stockton Rush. Stockton is the Chief Executive Officer and Founder (2009) of OceanGate Inc. As CEO, Rush is responsible for OceanGate's financial and engineering leadership, shaping the company's strategic direction with a clear vision focused on developing the next generation of manned submersible solutions for subsea operations in the commercial and defense sectors.

Rush is a co-founder and member of the Board of Trustees of OceanGate Foundation (2012), a nonprofit organization dedicated to leveraging the challenge, excitement, and importance of exploring our oceans to inspire students to pursue careers centered on the oceans and educate community leaders to better advocate for our oceans.

Rush became the youngest jet transport rated pilot in the world when he obtained his DC-8 Type/Captain's rating at the United Airlines Jet Training Institute in 1981 at the age of 19. He proceeded to serve as a DC-8 first officer during college summers, flying out of Jeddah, Saudi Arabia for Overseas National Airways under a subcontract from Saudi Arabian Airlines. Over the course of three summers, Rush flew to locations such as Cairo, Damascus, Bombay, London, Zurich, and Khartoum. In 1984, Rush joined the McDonnell Douglas Corporation as a Flight Test Engineer on the F-15 program. During this time, he spent two years at Edwards Air Force Base on the APG-63 radar test program and then on the Anti-Satellite Missile Program as the sole full-time representative of McDonnell Douglas.

Over the past 20 years, Rush has overseen the development of multiple successful IP ventures. He served on the Board of Directors for Seattle's BlueView Technologies, a manufacturer of small, high-frequency sonar systems. In 2012, Rush was involved in the company's acquisition by Teledyne Inc, a leading provider of cutting-edge subsea technologies. He has served as board member for Entomo, an enterprise software developer focused on

SEASON 1 / EPISODE 5

MANNED SUBMERSIBLES: SCIENCE, EXPLORATION, AND THE TITANIC

post-sale channel management and financial reporting, and as Chairman of Remote Control Technology, Inc. (RCT), a manufacturer of wireless remote control devices for several Fortune 500 industrial clients, including Exxon, Conoco-Philips and Boeing. He also served on the Board of Trustees of the Museum of Flight in Seattle from 2003-2007, chairing the Development Committee from 2006-2007.

In 1989, Rush personally built a Glasair III experimental aircraft, which he still owns and flies today. He also completed a heavily modified Kittredge K-350 two-man submersible, in which he has conducted over 30 dives to date.

He obtained his BSE in Aerospace Engineering from Princeton University in 1984, and his

MBA from the U.C. Berkeley Haas School of Business in 1989.

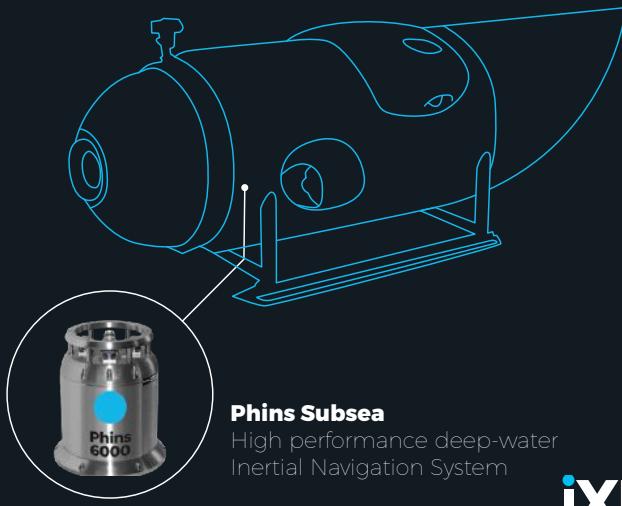
Rush has written numerous engineering articles on manned submersible vehicles in subsea operations for a variety of trade publications and has spoken on private-public investment opportunities in the new ocean economy.

Visit www.oceannews.com/seastate



» Stockton Rush,
CEO-OceanGate

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iXblue

OPITO LAYS GROUNDWORK FOR CROSS-SECTOR SKILLS TRANSFER

OPITO, a global skills organization for the energy industry, together with the Merchant Navy Training Board (MNTB), has launched a new standard to support the transition of marine personnel into the oil and gas industry.

The OPITO BOSIET with CA-EBS – [STCW 95/2010 Conversion]¹ recognizes similarities between the BOSIET training requirements for workers travelling to offshore installations and the maritime industry's STCW95/2010 certification, which offers similar instruction on basic safety and emergency response for marine personnel.

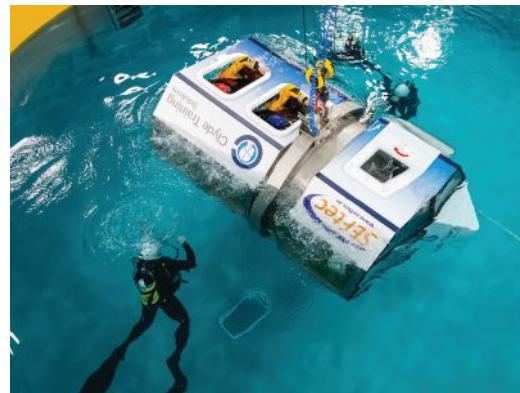
While the maritime sector has always played a key part in offshore operations, the opportunity for employees to transition between the two industries has been impacted by differing training practices and procedures.

The new standard provides an efficient way for marine personnel to broaden their career options, by acquiring the knowledge and skills needed to work offshore.

Delivered via a one-day conversion course², learners will gain an understanding of the potential hazards and risks involved—including helicopter safety and escape, offshore evacuation, and firefighting and self-rescue; knowledge they can then apply in pursuit of opportunities in the oil and gas industry, and wider energy markets.

John McDonald, CEO, OPITO, said: "There are many commonalities that already exist between the maritime, and oil and gas sectors; not least the fact that both are fortunate to benefit from a professional, highly skilled and capable workforce.

"As we transition towards a lower carbon future, and as highlighted in our most recent skills landscape report, our success



» The one-day conversion course will offer instruction on basic safety and emergency response for marine personnel.

will depend on our ability to collaborate across industries to ensure the availability of a flexible and multi-skilled workforce. That is what our strategic partnership with the MNTB and the introduction of this new standard sets out to achieve, marking an important first step in that direction."

Kathryn Neilson, Director, MNTB, said: "Through our ongoing collaboration with

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For info and to register, visit www.bluetechweek.org

OPITO, we identified the opportunity to create a training program that will enable marine personnel to more readily bring their skills and experiences to the table in the oil and gas industry. The focus for both our organizations has always been on the provision of quality training and the creation of a safer working environment for those employed across our industries, and this is just the start of what promises to be a very effective partnership."

The conversion course was successfully piloted in early 2020 at Clyde Training Solutions, with the center recently achieving OPITO-accreditation for delivering the course to interested learners.

Kris McDonald, Training Centre Manager at Clyde Training Solutions, said: "The new OPITO BOSIET with CA-EBS—[STCW 95/2010 Conversion] demonstrates innovative cross-industry collaboration that will benefit marine personnel moving across to the oil and gas sector."

"As a fully certified international offshore, marine and renewables training center,

we are uniquely placed to deliver a comprehensive, multi-industry training offering, and are proud to have been successfully certified by OPITO as the first training provider in the world to offer this new Training Standard."

OPITO is a global organization, operating in more than 50 countries. Through the application of a stringent quality assurance process, OPITO ensures that training is delivered to a consistently high standard across the world, to OPITO standards, via a network of more than 200 accredited and independent training providers. More information for training providers who want to apply to become OPITO-approved can be found here: <https://www.opito.com/approvals/industry-standards-approval>



» John McDonald, CEO, OPITO

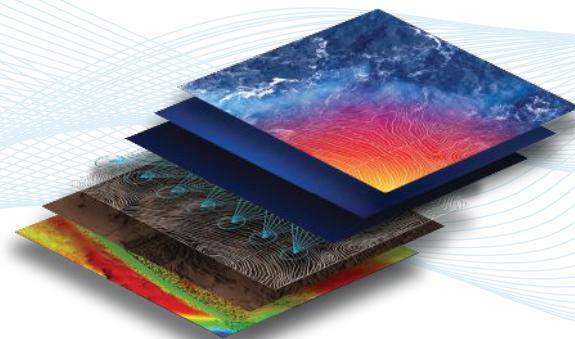
1. OPITO Basic Offshore Safety Induction and Emergency Training (BOSIET) with Compressed Air Breathing System (CA-EBS) Standard.

2. Learners must hold a valid Maritime Coastguard Agency (MCA) STCW95/2010 Basic Safety Training Certificate and OPITO Minimum Industry Safety Training (MIST) certificate / OPITO International MIST certificate.

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Contact: Shannon Searing



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Teledyne Marine is a group of leading-edge subsea technology companies that are part of Teledyne Technologies Incorporated. Through acquisitions and collaboration over the past ten years, Teledyne Marine has evolved into an industry powerhouse, bringing Imaging, Instruments, Interconnect, Seismic, and Vehicle technology together to provide total solutions to our customers.

ADCP/DVL

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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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MetOcean Telematics designs and manufactures drifting buoys, environmental platforms, and the world renowned NOVATECH locator beacon product line. In addition to providing complete end-to-end telematics services, is one of the few drifter manufacturers in the world to achieve ISO 9001 certification. MetOcean Telematics's drifting buoy family consists of environmental and weather monitoring, oil spill response, and search and rescue drifters: NOVA profiling float, Iridium SVP (iSVP), iSPHERE, Argosphere, SLDBM, and iSLDBM.

BUOYANCY PRODUCTS

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Contact: 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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Since 1977 Subsalve USA has been America's #1 manufacturer of standard and custom flotation devices and we are the innovators in buoyancy and engineered inflatables. Our products include: Professional, Commercial, Standard, Shallow Water, Enclosed Flotation Bags, Cable & Pipeline Floats, Water Load Test Bags, Rapid Recovery & Mark V/ORCA EOD Systems.

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Arctic Rays LLC is a specialist in the design and manufacture of deep sea lighting and imaging products specifically for use on AUVs, but also prove ideal for manned vehicles and all other underwater, surface vehicles or platforms. Our designs feature the smallest possible size and lowest power consumption available.

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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).

DEEPSSEA POWER & LIGHT

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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.

Design criteria for products include ease of service, reliability, high performance, and cost effectiveness. Products are rigorously tested in both the initial design process and manufacturing stage to perform in the harsh marine environment—from wet/dry surface applications to full ocean depth deployments. DeepSea Power & Light offers a versatile product line while developing new designs to continue exceeding market expectations.

SIDUS SOLUTIONS, LLC

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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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Contact: Gary Brown, Sales Manager



Since 1957, South Bay Cable Corp has designed and manufactured specialized electrical, electro-mechanical and electro-optical-mechanical cables for use in demanding marine environments. Cables are designed to meet customer requirements and include tether and umbilical cables for ROVs, tow cables, video inspection, faired cables and a host of other customer specific applications.

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BIRNS has served the subsea industry since 1954, and is an ISO 9001:2015 certified global leader in the design and manufacturing of high performance connectors, cable assemblies and lighting systems. With a NAVSEA PRO-020 certified molding facility, it offers sophisticated connector lines, including 6km-rated electrical, electromechanical, coaxial, electro-coax, optical, electro-optical and electro-opto-mechanical hybrids. BIRNS provides the industry's highest volume of cost-effective hydrostatic and helium pressure testing, and has a wide range of ABS Product Design Assessment (PDA) certified fiber optic and electrical penetrators. BIRNS' LED and tungsten-halogen marine, chamber, security and commercial diving lights are trusted in the world's most extreme environments.

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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 uv 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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SOURIAU-SUNBANK Connection Technologies is a global leader in interconnect solutions engineered to withstand the harshest of environments as aeronautics, space, defense, transport, energy, industrial equipment, healthcare devices, and lighting. It invests in R&D and manufacturing facilities to produce solutions that comply with environmental requirements and international trade rules. SOURIAU-SUNBANK's wide range of products are designed using cutting-edge electrical and optical connection technologies. All are suitable for use in non-hazardous environments as well as those involving extreme temperatures, strong vibrations and corrosive liquids, and meet specific international market standards.

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KEARFOTT CORPORATION

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RJE International offers product design, development, evaluation and marketing for military divers, offshore and marine scientific communities, search and rescue teams, and more. RJE has become the industry leader in diver navigation and acoustic relocation. Our team has an extensive background in developing, manufacturing, and supplying underwater acoustic marking and relocation systems, diver navigation platforms, and other subsea equipment.

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- Manufacturer's Representative:** Teledyne RD Instruments, Deep Water Buoyancy, WERA Northern Radar.

RBR

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ROMOR OCEAN SOLUTIONS

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A manufacturer of miniature data loggers with sensors as temperature, depth/pressure, salinity, tilt/acceleration, compass direction/magnetometer, light levels, acoustic receiving/transmitting. The loggers are used for various researches, including oceanography, fishing gear studies, equipment behavioral monitoring and fish tagging.



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Cortland designs, manufactures, and supplies technologically advanced synthetic fiber ropes, slings and synthetic fiber strength members. For example, we offer deep water synthetic fiber rope solutions, oceanographic mooring systems, synthetic reinforcing over braids, hair fairing to reduce drag / strumming, and inline attachments or lifting points (cable grips).

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General Dynamics Mission Systems' Bluefin Robotics products provide undersea capabilities for defense, scientific and maritime customers worldwide. Bluefin Robotics products offer a range of systems and configurations that can operate in the open ocean and in constrained waterways. Our core autonomous product line includes Bluefin SandShark, Bluefin-9, Bluefin-12, and Bluefin-21, Hovering Autonomous Underwater Vehicle (HAUV), and Subsea Power technologies.

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L3Harris OceanServer develops autonomous, lightweight Unmanned Undersea Vehicles. L3Harris OceanServer 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.

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Mariscope offers from small towed systems or compact Observation Class ROVs up to complete multifunction units. The company also provides other solutions such as antifouling devices, side-scan sonars, oceanographic instruments for ports and offshore platforms (current/wave meters), or even manned submarines.

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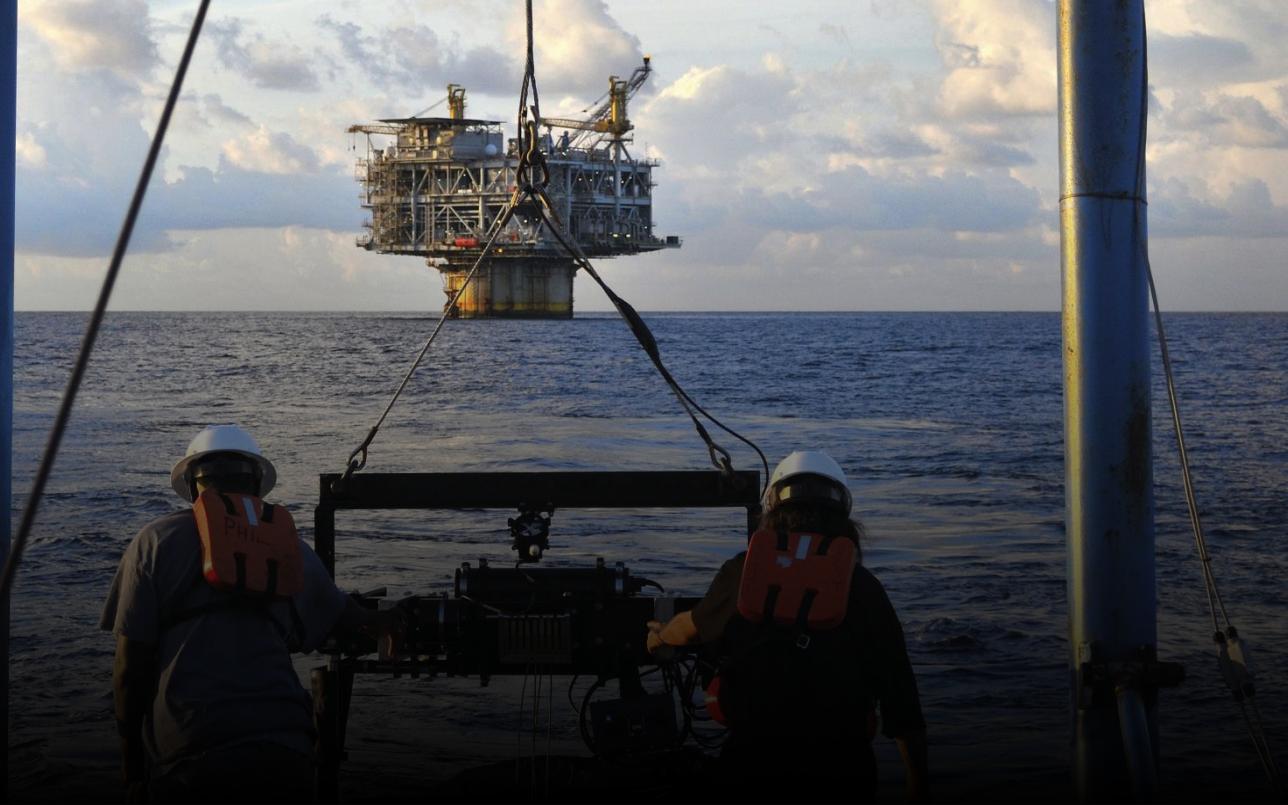
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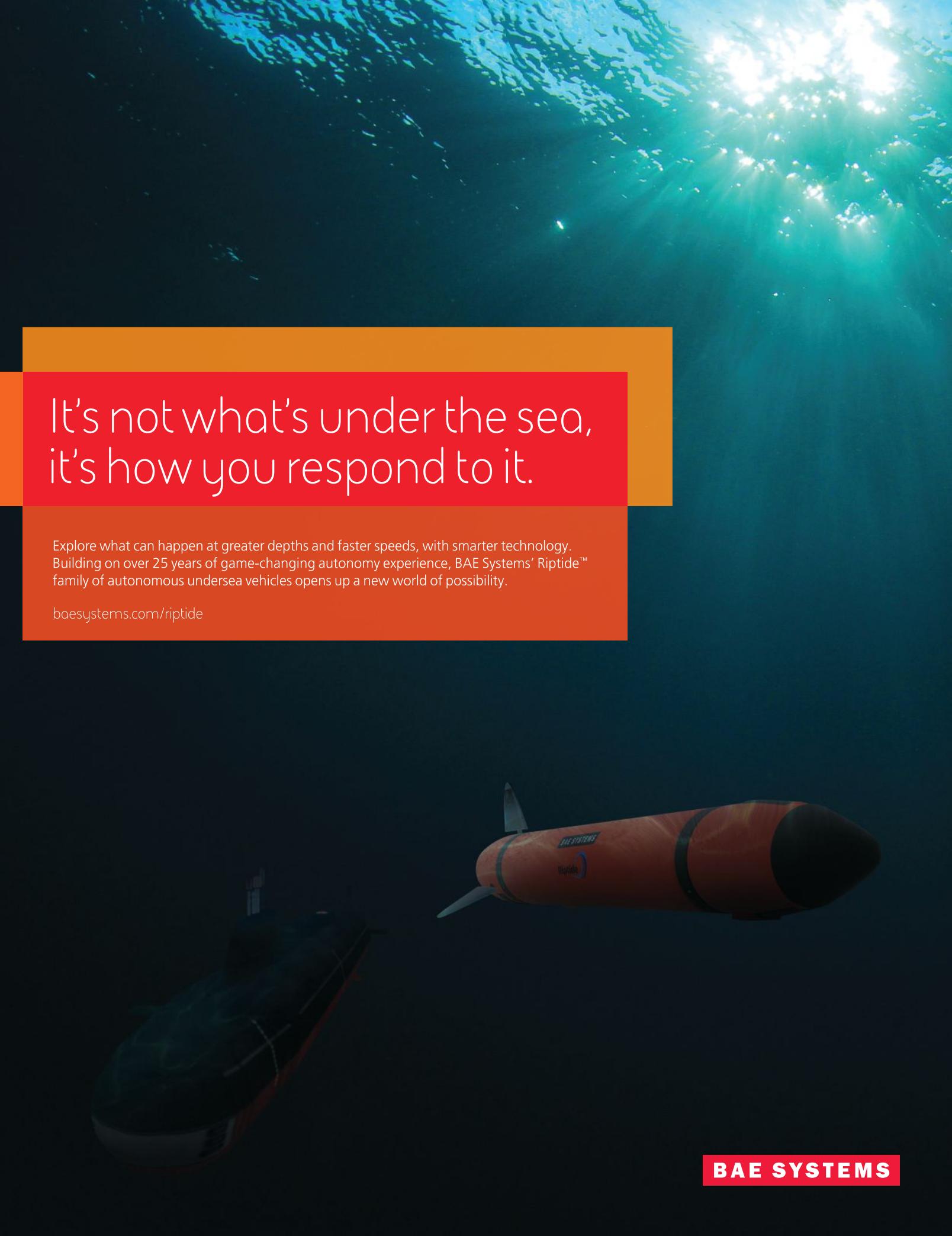
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