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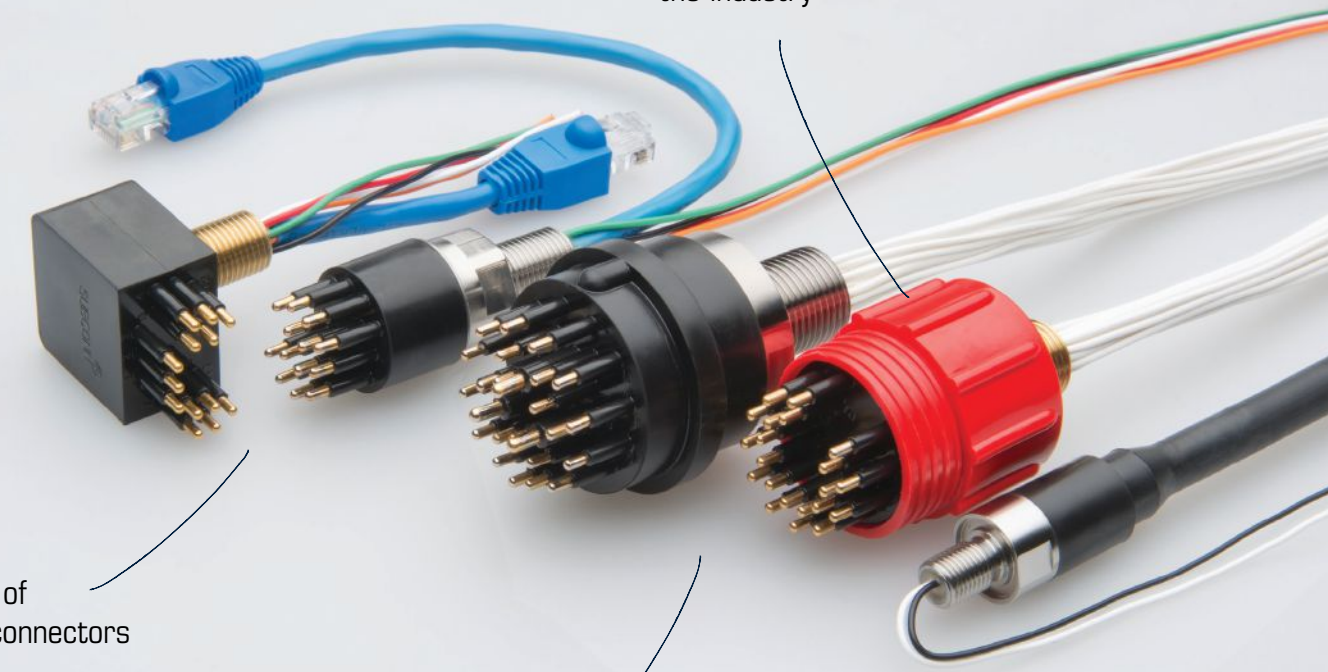

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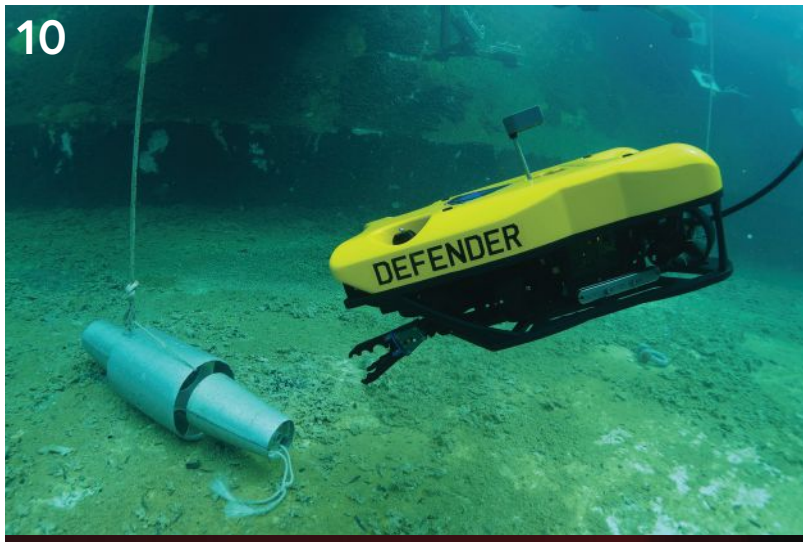

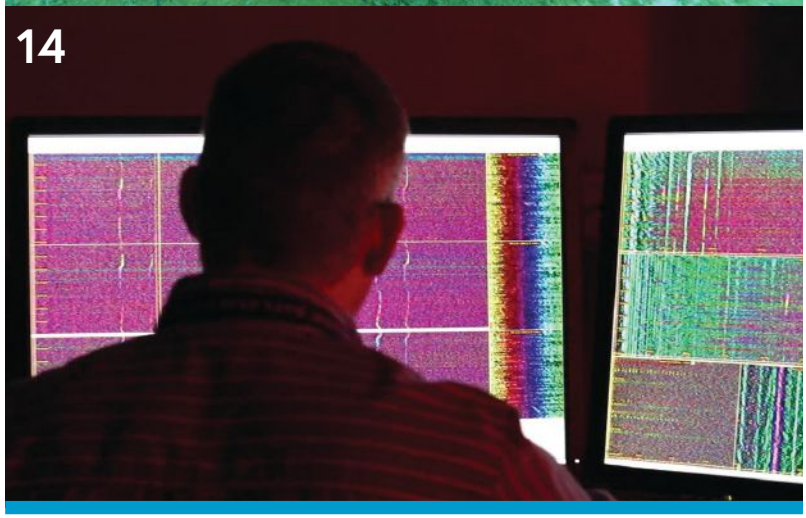

FEATURES & SPOTLIGHTS

DEPARTMENTS

IN EVERY ISSUE

ON THE COVER:
VideoRay's Defender ROV is fast becoming the standard for the US Navy and being deployed worldwide to replace older technology and expand the scope of defense missions. (Photo credit: Rich Arrieta-NIWC)

[WITH THANKS - Ed.]

Welcome to February's ON&T, our Naval Defense & Security edition. This month we spotlight some of the latest technologies engineered to help Navies around the world defend and secure the maritime domain.

Our thanks go to BAE Systems, VideoRay, GeoSpectrum Technologies, Advanced Ocean Systems, GeoAcoustics, as well as to all our advertising partners.

Next month we explore the rapidly evolving world of 21st Century Marine Survey.

editor@oceannews.com

Ed Kremer

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Technology Systems Corporation
PATRICK C. LAGRANGE, CEO

ADVERTISING SALES
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Ocean News & Technology ISSN# 1082-6106 is published 11 times a year in print and digital by Technology Systems Corporation, 8502 SW Kansas Ave, Stuart, FL 34997, telephone 772-221-7720.

THE FUTURE OF UNMANNED NAVAL MISSIONS IS NOW

By Scott Minium,
C4ISR Solutions, BAE Systems

BAE SYSTEMS

Only a few years ago, unmanned programs in the U.S. Navy were fairly limited, with some notable exceptions. Unmanned undersea vehicles (UUVs) were in service with explosive ordnance disposal teams in a minehunting capacity, and work on an unmanned refueling tanker aircraft was proceeding. Today is a different reality. In the air domain, the MQ-4C Triton is deployed and the MQ-25 Stingray nearly so. Prototypes of large and medium unmanned surface vehicles (USVs) are now part of the Surface Navy's Development Squadron, and they have begun to demonstrate the necessary level of reliability by conducting transoceanic passages without support. In the undersea domain, the extra-large UUV (XLUUV) is under contract, and the large (LUUV), medium (MUUV), and small (SUUV) programs have all entered the procurement process in earnest—poised to extend the reach and capability of the U.S. Navy in ways barely imaginable a decade ago.

The BAE Systems offering, for MUUV in particular, will deliver a warfighting capability available to all U.S. submarines rather than just a few specially equipped ones. To do this, the vehicle design supports MUUV launch, recovery, and relaunch via standard torpedo tubes. No current production system does this.

DEVELOPING TRUE AUTONOMY

Similar to the development of unmanned air vehicles, the development of unmanned underwater vehicles like the MUUV will require time, investment, and technology innovation. The nature of the undersea domain also presents significantly complicated challenges. Perhaps the most difficult challenge is the lack of communication with the vehicles (specifically, XLUUV and MUUV) for long periods of time. Radio communication will be infrequent, and underwater communication is mostly limited to short-range and low bandwidth. To be impactful, the vehicles must therefore adjust operational plans *on their own*, using on-board autonomy algorithms, and those plans must conform to pre-defined human priorities and intentions. Developing trust with this technology will take time.

INSPIRATION FROM ABOVE

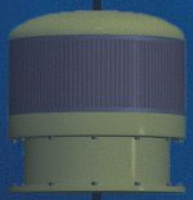
Fortunately, we are not starting from scratch. This level of vehicle autonomy already exists in the air domain in systems developed and built by BAE Systems, and it can be brought to the undersea market.

Currently, the plan for MUUV employment is minehunting and underwater intelligence for the battlespace. While these are two well-understood and necessary missions, it is critical for the U.S. Navy to support other missions when the MUUV arrives.

As the UUV programs are still developing, we have the opportunity to improve upon past unmanned air efforts and develop payloads and mission capabilities in parallel with the vehicle. These could include electromagnetic warfare, communication links, and all manner of surveillance. Collaboration between industry and the Navy can help to ensure all of the mission options and capabilities are delivered to the fleet.

Custom Solutions

for Challenging Defense Applications



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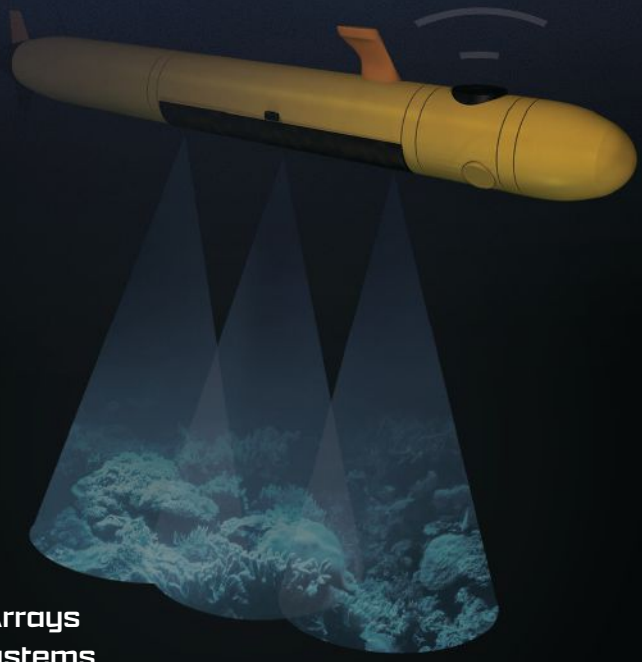

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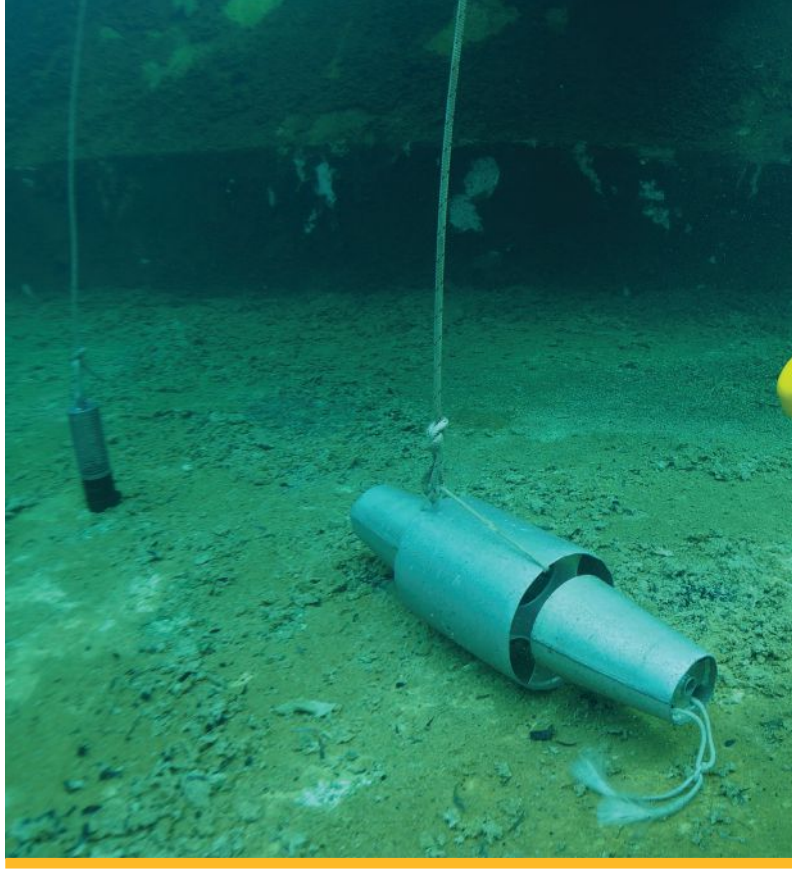


VideoRay LLC, of Pottstown PA, reported a sharp increase in sales of its ROV systems over the last year. While sales were strong across products and product lines, sales of the Defender model were dominant. The US Navy has been ramping up deliveries, which will grow significantly in 2022. The Defender separates Explosive Ordnance Disposal (EOD) operators from underwater explosive threat hazards and mitigating damage to vessels in the area around the threat.

The VideoRay Defender has become an essential tool for underwater EOD missions for the US and other allied Navies around the work. *Lt. Cmdr. Michael Bailey reported in the Defense Visual Information Distribution Service, "The VideoRay Defender is destined to be part of a family of US Navy EOD response vehicles."*

Last year the VideoRay Defender was awarded a program of record under the US Navy's Maritime Expeditionary Standoff and Response program.

PAYLOAD COLLABORATION

VideoRay has brought together best-in-class technology leaders for the US Navy's Defender configuration payload, including Blueprint Subsea, Eddyfi, Nortek, and Greensea:

• Blueprint Subsea provides the Oculus 750d Forward look multibeam sonar and the Seatrac USBL positioning system. Blueprint Subsea specializes in imaging sonars, acoustic positioning beacons, and diver navigation systems.

• Eddify Technologies delivers a dual-axis rotating manipulator with five interchangeable end effectors. Eddify's mission is to create technology enabling people to perform tasks that they could not otherwise do in places they could not otherwise go.

• Nortek contributes a Doppler Velocity log (DVL), an essential component of the Defender's navigation and autonomy system. Nortek designs develops and produces scientific instruments that measure water in motion. Nortek provides truly innovative, robust, and accurate instruments and support to ensure customers maximize value from their measurements.

PIONEERING CONTROL SOFTWARE

Greensea provides EOD Workspace, the Defender's control software which provides the operator an interface to operate the system. EOD Workspace displays information from more than 18 different modules, sensors, and tools in an intuitive interface, making it easy for the operator to complete their mission faster and safer.

The Defender is one of two models using VideoRay's modular Mission Specialist technology, including the smaller Pro 5, and a larger model due for release in the next few months. VideoRay controllers can be used with any Mission Specialist submersibles, making it more affordable to own different systems. Operators can share modules, sensors, and tooling between systems.

» *A team from Naval Information Warfare Center Pacific (NIWC Pacific) put two PRO 5's to the test. (Photo credit: VideoRay)*

» *Defender approaching a mine target. (Photo credit: Rich Arrieta, NIWC)*

All mission specialist models use standard thrusters, communications and power models, cameras, manipulators, lights, and other navigation and sensor packages. These are produced in quantity, which improves reliability, and are easily replaced in the field to minimize downtime. These standard modules include VideoRay thrusters, which are the highest power density available and allow the Defender to produce 26.7 kilograms (59 lbs.) of thrust while weighing only 17.2 kilograms (38 lbs.) in air. The Defender, while man-portable, can go deeper, pull more tether, and fight stronger currents, significantly expanding the mission's operational window when compared with other systems.

New battery technology is now being delivered to the Navy, allowing the system to operate quieter without compromising the Defender's industry-leading thrust. Battery power delivery is available from the topside or on the submersible, and there are advantages to both power delivery methods. VideoRay delivers topside battery power through a Portable Power Supply. The Portable Power Supply is splashproof and can deliver power to the Defender system for 4-6 hours. The batteries in the Portable Power Supply can be 'hot swapped,' further extending operational time. A submersible battery supply allows the operator to use a small diameter tether, significantly reducing drag when operating in stronger currents. The smaller diameter tether is available with copper or fiber communications. The small diameter copper tether is field repairable and can be used for missions of up to lengths of 600 meters. All these features can be implemented on all existing Defender systems, including those delivered years ago.

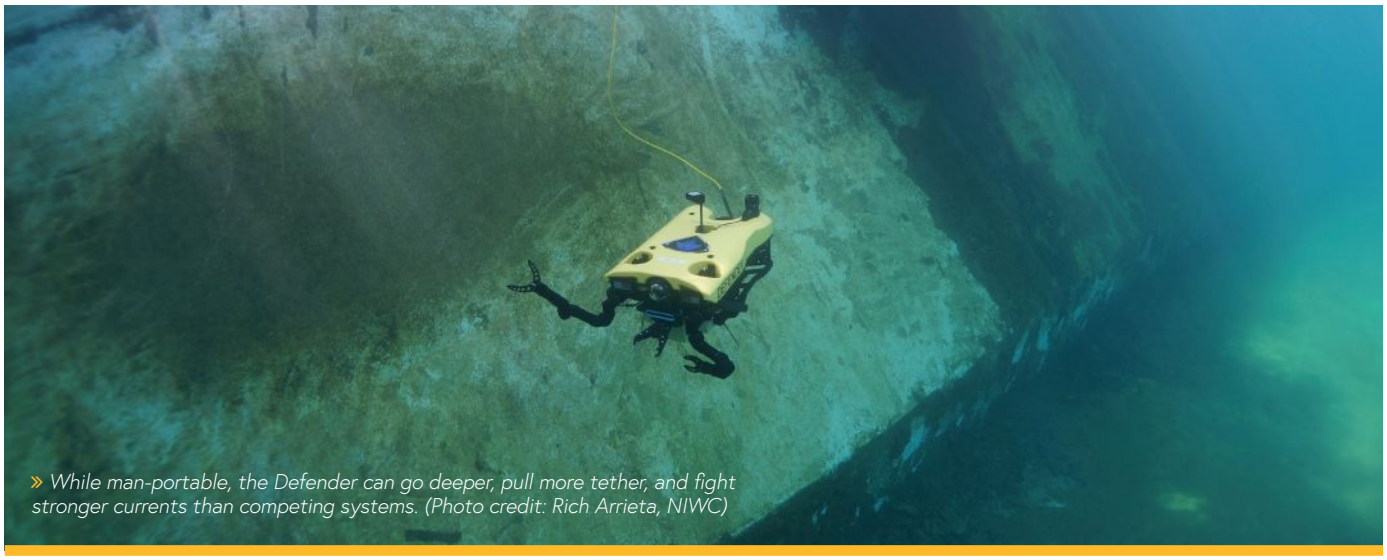
ENABLING AUTOMOMY & VERSATILITY

VideoRay is delivering systems with a prototype subsea processor to act as an autonomy engine onboard the vehicle. The subsea processor will enable a higher level of autonomy and provides a platform for perception technologies and artificial intelligence applications. The subsea processor will allow autonomous control without relying on surface processing. The Autonomy Engine Module will 'plug and play' with existing VideoRay Mission Specialist systems significantly expanding their capabilities.

VideoRay's success in expanding its market share is due to several unique aspects of both VideoRay, and its products. Operators use VideoRay's Mission Specialist Pro 5 and Defender systems for demanding applications in several other fields, such as offshore energy and renewables, first responders, hydroelectric, scientific research, infrastructure inspection, and aquaculture.

VideoRay's modular approach to system design goes beyond VideoRay innovations. Mission Specialist modularity provides a platform making it easy to integrate and work with navigation solutions, sensors, and tooling. VideoRay's Mission Specialist modularity provides operators with specialized capabilities uniquely addressing their mission without compromising the system's integrity and reliability. Modular design provides two distinct advantages. It allows for the hardware equivalent of "Telsa software updates"—improvements to delivered systems with benefits that were not even conceived when the systems were first designed. it also allows VideoRay to leverage and push defense R&D into commercial applications quicker and more cost-effectively.

To learn more about VideoRay ROV systems, visit *www.videoray.com*.



» *While man-portable, the Defender can go deeper, pull more tether, and fight stronger currents than competing systems. (Photo credit: Rich Arrieta, NIWC)*

DRIVING THE REMOTE AND AUTONOMOUS REVOLUTION

By Alastair McKie, Director of Remote Operations EUAF

For decades offshore operators have been realizing the benefits that innovative technology has brought to site characterization and asset integrity projects. Remote solutions are elevating these benefits to the next level and are fast becoming as established as the everyday solutions we witness.

Pioneering technology

The concept of operating offshore navigation systems remotely, controlled by people on land, is not new. But it has taken around 15 years of technological development—and changing mindsets—to turn it into reality. Today remote solutions are delivering safe, continuous operations, increasing efficiency and enabling faster and better-informed decision making in offshore projects. At the same time CO2 emissions are drastically reduced and HSSE risk exposure minimized.

The offshore industry is undergoing a remote and autonomous revolution. Building on its past successes in the development of remote technology such as aerial drones and autonomous underwater vehicles (AUVs), Fugro has built a global network of remote operations centers (ROCs) to deliver a range of remote solutions.

Dynamic people plan

As vital as a focus on continuous development, having the right personnel determines the ability to deliver remote solutions. Having a diverse talent pool where cognitive skills, mental resilience and an openness to new ways of working are blended with traditional competences such as electronics, mechanics and hydraulics are fundamental. For example, Fugro has invested in a dynamic people plan to match the speed of technological evolution to ensure that our ROCs always function as 'mission critical' facilities.

Wide range of remote capabilities

The significant role of ROCs, and the breadth of remote solutions they offer, is validated by successfully completed projects, some recent examples:

• Heading to the North Sea from the Dutch port of Rotterdam, Fugro's *Blue Essence*—the first offshore certified uncrewed surface vessel (USV) with the ability to launch and recover an electric remotely operated vehicle (eROV)—performed a pipeline inspection project. Throughout the project, the USV and its underwater robot were operated from a control room onshore, via a satellite connection.

• In northwest Australia, a pipeline inspection for a major operator utilized a remotely operated USV, equipped with an eROV. The USV was navigated by Fugro's remote operations team located 1,500 kilometers away and covered 1,300 nautical miles. During the landmark underwater inspection, the fuel consumption of the USV compared to a traditional vessel, CO2 emissions were 97% lower.

• Assuring the schedule of a drillship off West Africa, Fugro removed the need for an onboard mobilization crew—together with the associated costs and logistics—when it carried out positioning from one of its ROCs during vessel mobilization.

• Adding flexibility to the operational schedule of a crewed inspection, repair and maintenance vessel, launching of the ROV was controlled from a ROC, as well as ROV piloting and recovery.

Business continuity

In an industry where the daily cost of a drillship can exceed $200,000 per day, operational downtime must clearly be avoided. Equipment failure, logistical problems, safety incidents and hazardous weather conditions have the potential to interrupt offshore projects; but in 2020 the industry had to manage new and unexpected challenges.

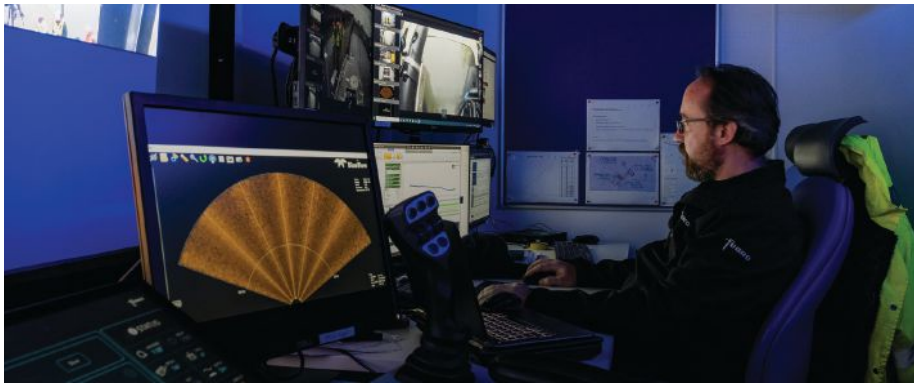
As the coronavirus pandemic brought about measures that included travel restrictions and heightened risk mitigation processes, one result was a drastic increase in remote working. Not only did office staff adapt to working from their homes but for offshore projects the adaptation was to remote operations. The pandemic served as a catalyst for advancing remote operations and in its wake technologies and behaviors continue to evolve.

Business continuity has never been so crucial and remote services that are both flexible and scalable are an attractive proposition. When it's possible to deliver enhanced Geo-data insights via ROCs that provide fast, safe and efficient services around-the-clock, offshore operations can continue.

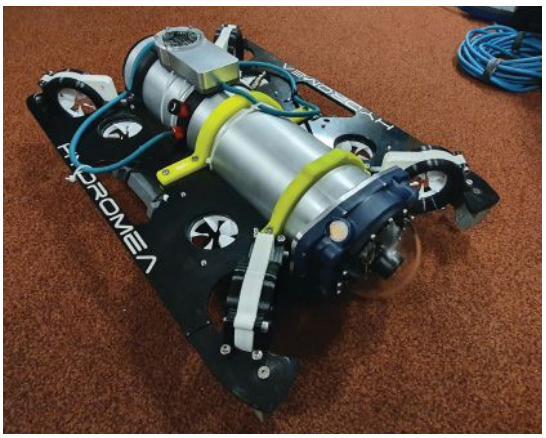
An exciting future

A remarkable milestone is on the horizon for remote operations. For Fugro, clocking up over 350,000 remote project hours in 2021 has been possible thanks to a unique combination of talented personnel and a pioneering culture; increased utilization of ROCs, more USVs and a changing client mindset indicates that the 500,000-hour milestone is easily attainable.

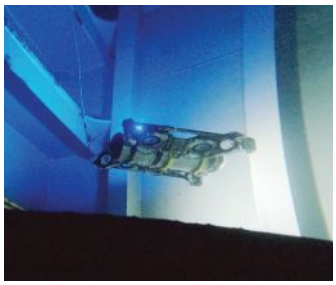
» *Fugro experts managing offshore operations from Fugro's Remote Operation Center in Aberdeen. (Photo credit: Fugro)*



» *A global network of ROCs provides a centralized hub for onshore experts to manage offshore operations, equipment and vessels. (Photo credit: Fugro)*



» *The EXRAY prototype ready for the dive at the TotalEnergies site. (Photo credit: Hydromea)*



» *The wireless EXRAY prototype in a full ballast water tank (the attached cable is for safety during the trial). (Photo credit: Hydromea)*

HYDROMEA SUCCESSFULLY TRIALS ITS WIRELESS ROV SYSTEM AT TOTALENERGIES OFFSHORE SITE IN THE NORTH SEA

Hydromea has successfully trialed EXRAY, its wireless underwater ROV system, within a full ballast water tank on one of TotalEnergies' North Sea floating production, storage and offloading (FPSO) vessels during November 2021. EXRAY was deployed to collect visual inspection data, validating system performance including wireless navigation and wireless communication.

The pilot was able to command and control the vehicle and receive real-time 1080p video feedback, using proprietary wireless optical communication technology that replaces a cabled connection. Without a tether attached, the risk of entanglement in complex confined spaces is greatly reduced.

This project is funded by the Net Zero Technology Centre based in Aberdeen, Scotland and is part of a larger development roadmap focused on enabling portable and affordable multi-robot inspections of the increasing number of submerged assets in the North Sea.

Stephen Ashley, Head of Offshore Energy 4.0 at the Net Zero Technology Centre said: "The development of remotely controlled operations empowered by robotics and autonomous systems is key to drive the net zero goals of the energy industry. Hydromea, a graduate of our TechX programme, has developed a game-changing technology that will play a pivotal role in accelerating our transition to an affordable net zero energy industry. This successful pilot trail has proven the EXRAY technology in a real environment and we look forward to supporting Hydromea through the final validation pilot later this year."

Alexander Bahr, co-founder and COO of Hydromea, added: "Thanks to Net Zero Technology Centre and TotalEnergies, we were able to test our system in the real environment of an offshore site. This is a valuable experience for our development team and it gave us plenty of data points to work with and prepare to our summer validation pilot of the beta system. We are currently looking for the industry partners to work with us in our next funded phase of the roadmap that shall kick-off at the end of 2022."

Founded in 2014, Hydromea is a Swiss-based underwater robotics company helping its customers to have an unparalleled underwater data connectivity and efficient remote inspection access to submerged assets. The portable autonomous underwater drone platform with its array of unique technologies developed in-house, brings a paradigm shift in how submerged assets are inspected and monitored, enabling the sustainable growth of the ocean economy.

ANOTHER TIGER-N ROBOT GOES NUCLEAR

Built to survive in nuclear storage ponds, a sixth Saab Seaeye Tiger-N robot has been ordered for the Sellafield nuclear site.

The sixth Seaeye Tiger-N joins a fleet of nuclear-environment enabled Seaeye Tiger-Ns, deployed to gather and sort, meter-long, 15 kg radioactive fuel bars, for removal to long-term storage, among other roles.

Specially adapted by Seaeye and Sellafield engineers for work in one of the most highly corrosive environments on the planet, the proven Saab Seaeye Tiger design was chosen for its reliability in demanding conditions.

Such reliability is vital as it limits intervention by operators for maintenance purposes, thereby considerably reducing their exposure to the hazardous environment.

The new Tiger-N replaces the Tiger-N used for training and as an operational spare, which will be redeployed to the Pile Fuel Storage Pond for cobalt cutting operations, a key operational priority for the Tiger-N robots.

The robust Seaeye Tiger design has a 20-year record of working in challenging conditions around the world and has the thruster power and ability to manoeuvre in tight spaces with agility and precision.

» *Saab Seaeye's nuclear-environment enabled Tiger-N with one of the seven skid tooling options. (Photo credit: Saab Seaeye)*

KEEPING A FINGER ON THE ACOUSTIC PULSE OF SONAR PROCESSING

By Megan Andrus,
Marketing and Communications Manager, GeoSpectrum Technologies Inc.

From basement beginnings to becoming a leading provider of end-to-end sonar systems, Nova Scotian company, GeoSpectrum Technologies Inc. has found the solution to a challenge that many people in the Anti-Submarine Warfare (ASW) community are trying to solve—*How can I have a sonar system that's always modern?*

Keeping up to speed with evolving technologies and new product developments is a common challenge for many working in the ocean industry. To answer the question, you not only need an intimate understanding of the technical aspects of what you're designing—in this case sonar systems—but also how to operate them in real-world scenarios. That's where the team at GeoSpectrum comes in.

With Subject Matter Experts (SMEs) in sonar operations and numerous former members of the Canadian Military in their employee roster, VP of Sonar Processing, Joe Hood, Capt. (retired) and his software team have provided the missing piece to the ASW puzzle.

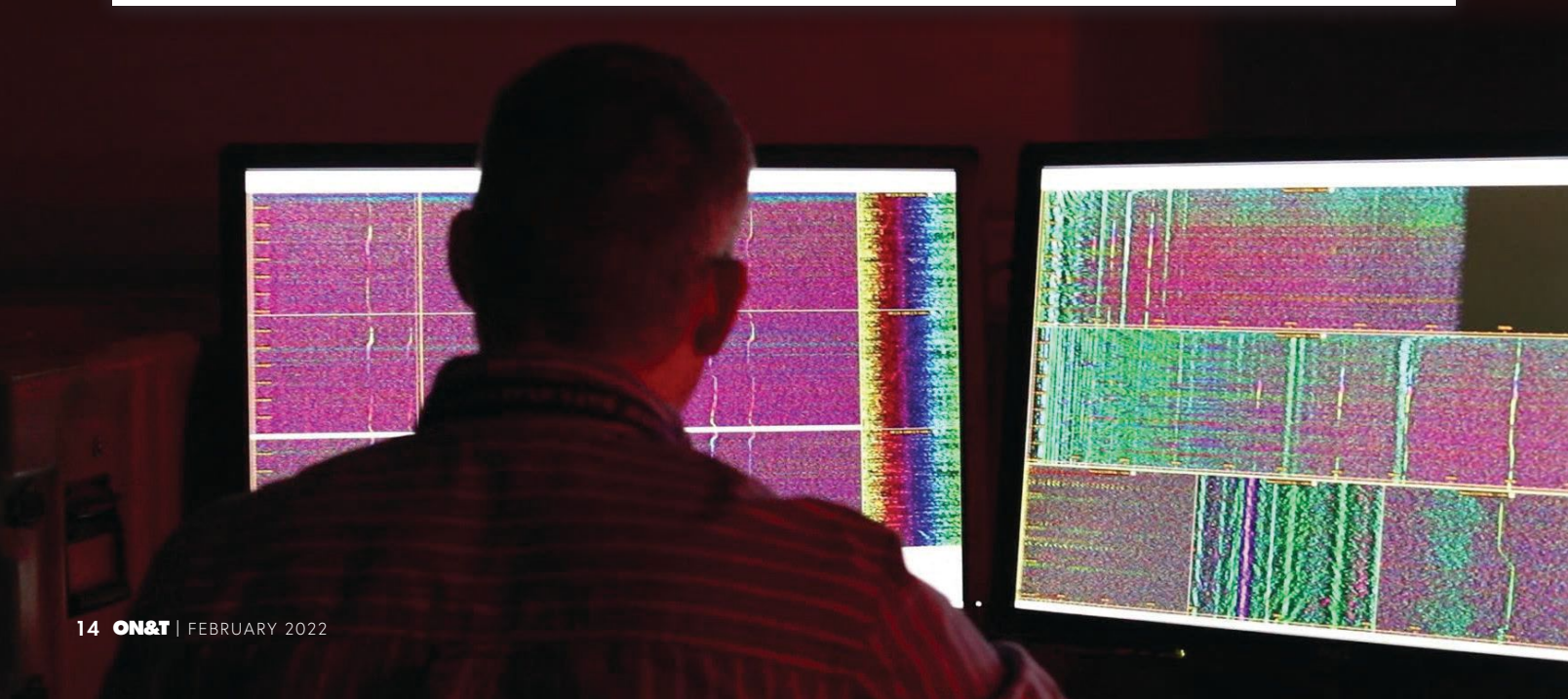
Hood's former research and defense company, Akoostix Inc., started to make waves in the industry with a primary focus on providing service work to Canada's Acoustic Data Analysis Centre (ADAC) and Defense Research and Development Canada (DRDC). Akoostix's key innovation was (and still is) TruView—a rapid post-analysis processing system designed to process data from virtually any type of sonar.

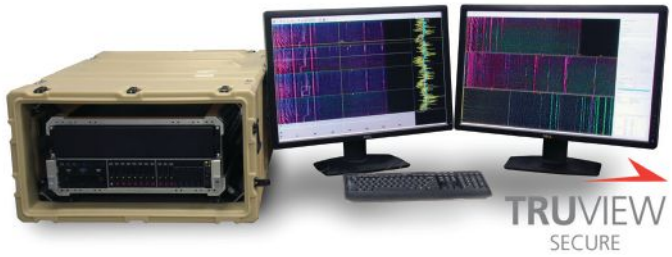
The company found themselves operating in a niche market, which ultimately led to the acquisition by GeoSpectrum over seven years ago. Since then, GeoSpectrum has positioned itself as a full-service provider of military-grade sonar systems.

DESIGNING SYSTEMS THAT SCALE

With a desire to keep their technology flexible, the sonar systems designed by

GeoSpectrum's hands-on approach is geared towards producing scalable and enduring end-to-end sonar systems. (Photo credit: GeoSpectrum)





» *TruView, GeoSpectrum's flagship software product, can process data from virtually any type of sonar. (Photo credit: GeoSpectrum)*

GeoSpectrum aren't just for tracking submarines. The research and defense work from the early Akoostix days remains one of the main driving forces behind software development. Afterall, the company's core sonar processing comes from legacy work with DRDC and the continuation of that relationship helps GeoSpectrum stay on top of leading innovations and developing trends in the defense research community.

With experience in all three corners—military, science, and industry—Hood identified a strong business opportunity for a more adaptable system, one that could scale and process many different types of sonars using the same core software, without a need to completely overhaul the system.

"The systems that I was using in the military were horribly out of date, and there was no real hope of upgrading them…. I didn't feel it was being done as well as it could be done," Hood reflects.

That's the beauty of designing systems that scale in both directions. GeoSpectrum has leveraged their technology to provide small battery-operated processors, cost-effective desktop solutions for commercial and scientific applications, and multi-million-dollar sonar systems for ASW—and the sonar processing is being done using essentially the same software. Hood jokingly compares this to "not throwing the baby out with the bath water."

With the framework already in place from TruView, GeoSpectrum introduced RecView to its product line: a real-time, integrated sonar processing system with tactical picture management.

RecView presents data in an intuitive format and provides special features and tools so that operators can work with and fuse data from all sonar systems to quickly generate an accurate, common tactical picture. RecView runs on commercial-off-the-shelf (COTS) hardware and is designed for regular upgrades to avoid obsolescence issues.

With RecView being most commonly used to support real-time combat, it means that critical decisions are being made on short timelines. *Operators need to trust that the information being presented to them will allow them to make sound decisions.* GeoSpectrum has spent a considerable amount of time behind the screens, making sure their system makes sense to an operator. As Hood puts it: "When a sonar operator sits down at one of our systems, our goal is for it to be easier and more intuitive to use."

What seems like routine work—learning how to operate your own system—can sometimes get overlooked, which is why GeoSpectrum's hands-on approach is such a critical part of their design and testing process.

HUMAN FACTORS PROVIDE THE EDGE

With a dedicated in-house team of sonar SME's, scientific data analysts, developers, quality assurance professionals, and project managers leading software development, GeoSpectrum takes pride in conducting sonar trials on its own proprietary systems.

When an extra set of hands are needed, they employ the expertise of professional Human Factors Engineers from Human Systems Inc.® who have been working with the GeoSpectrum software team since the inception of Akoostix. Their added knowledge and experience bring further insight in how to design and improve the operator experience, and it's certainly paid off, with high praise from Hood: "The best

» *RecView runs on commercial-off-the-shelf (COTS) hardware and is designed to quickly generate an accurate, common tactical picture. (Photo credit: GeoSpectrum)*

compliment that I've received about our systems is that it looks like it was designed by a sonar operator."

THE OCEAN'S THE LIMIT

While GeoSpectrum continues to ensure that the systems they have in service today stay up to date, they are always looking ahead for future options to enhance their sonar systems. With a commitment to supporting research and defense applications, the company plans on taking full advantage of advancements in a variety of developing areas, such as machine learning and sonar processing, to feed future growth and innovation.

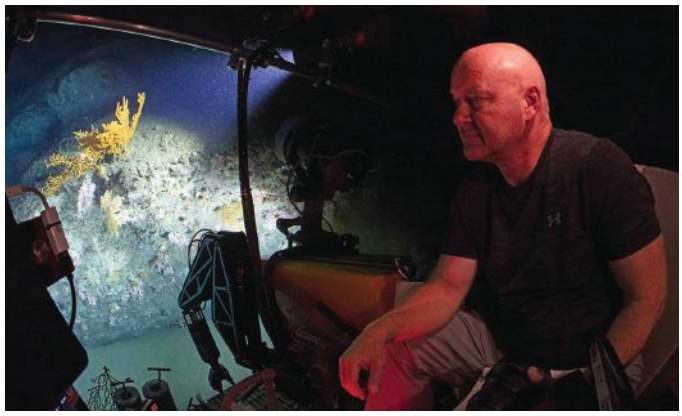
From a service-based research and defense prototype to full-service military-grade sonar systems, GeoSpectrum has put a substantial pin in the ocean technology map, by providing end-to-end sonar solutions to the global market. With over 20 systems in service and under contract, from North America, South Asia, Southeast Asia, Europe, and the Baltic Region, it is full steam ahead for the team at GeoSpectrum.

GeoSpectrum Technologies Inc
Customizing Detection

WHOI TO CO-LEAD DEEP-OCEAN GENOME PROJECT WITH UNIVERSITY OF CONNECTICUT

A global effort to map the genomes of all plants, animals, fungi and other eukaryotic life (organisms with a cellular nucleus) on Earth is entering a new phase as it moves from pilot projects to full-scale production sequencing. This new phase of the Earth BioGenome Project (EBP) is marked with a collection of papers published January 17 in Proceedings of the National Academies of Science describing the project's goals, achievements to date, and next steps. Included among these are an ambitious effort co-led by the Woods Hole Oceanographic Institution (WHOI) and the University of Connecticut (UConn) to obtain fundamental new knowledge of the organization, evolution, functions, and interactions of life in one of Earth's least-understood regions: the deep ocean.

"The special feature on the EBP captures the essence and excitement of the largest-scale coordinated effort in the history of biology," said Harris Lewin, chair of the EBP Working Group and Distinguished Professor of Evolution and Ecology at the University of California, Davis, which will serve as the project's administrative center. "From fundamental science to breakthrough applications across a wide range of pressing global problems, such as preventing biodiversity loss and adapting food crops to climate change, the EBP's progress in sequencing eukaryotic life is humbling and inspiring. Achieving the ultimate goal of sequencing all eukaryotic life now seems within our reach."



» *WHOI deep-sea biologist Tim Shank will help lead the Deep-Ocean Genomes Project as part of the Earth BioGenome Project. (Photo credit: Luis Lamar)*

Earth is forecast to lose 50% of its biodiversity by the end of this century without action to curb climate change and protect the health of global ecosystems. Creating a digital library of DNA sequences for all known eukaryotic life can help generate effective tools for preventing biodiversity loss and pathogen spread, monitoring and protecting ecosystems, and enhancing the natural services that healthy ecosystems provide the planet.

Of these, the ocean is the largest and most biodiverse ecosystem on Earth, hosting 33 known phyla from the tree of life comprising roughly 410,000 named species, with estimates of the total number of species exceeding 100 million. In addition, the deep sea hosts a wide range of unique habitats that present remarkably diverse and seemingly extreme living conditions, including immense pressures, near-freezing to beyond-boiling temperatures, absence of sunlight, and chemicals toxic to almost all other life forms on Earth.

"Deep-sea life has overcome some incredible challenges, but it has been able to thrive and diversify," said WHOI deep-sea biologist Tim Shank, who will co-lead the Deep-Ocean Genomes Project with Rachel O'Neill, Director of UConn's Center for Genome Innovation. "Learning more about the deep ocean could revolutionize our understanding of biology and evolution on Earth in ways that stand to benefit both society and the environment."

Network of networks

EBP functions as an international network of networks, coordinating numerous group-specific, regional, and national-scale efforts. These include programs such as the California Conservation Genome Project, Darwin Tree of Life Project, the Vertebrate Genome Project, and the Deep-Ocean Genomes Project.

Although far removed from human activity on land, deep-sea life is considered to be more vulnerable than ever to the spread of ocean acidification, ocean warming, oxygen minimum zones, extractive industries, and pollution from chemical waste and plastics. The Deep-Ocean Genomes Project will use comparative sequencing methods to identify genes that are essential to life in the deep sea and to trace the evolution of life in the ocean. This is expected to provide fundamental insights into life on Earth, help inform conservation and management efforts, and even spur novel technologies and applications in human and environmental health.

"Even though it seems remote and even alien, this overlooked part of our planet plays a vital role in making our planet habitable," said Shank. "We need to learn as much as we can before humanity changes the deep ocean forever."

SABERTOOTH HUNTS SHACKLETON'S ENDURANCE

Two Saab Sabertooth robots are set to go under the Antarctic ice in the hunt for the wreck of the Endurance, sunk during Shackleton's ill-fated expedition in 1915.

Lowered by helicopter, the Sabertooths will be sent through a prepared hole cut in the ice to embark on a 160 km search mission to find, survey, and film the wreck, believed to be 3,000 meters underwater, its precise location unknown.

The multi-role, 3,000-m rated, Saab Sabertooth is the world's only roaming and hovering robot that can operate in both fully autonomous and tethered modes, enabling fully flexible dual operations from a single platform fitted with cameras, sonars, and tooling.

IXBLUE DEMONSTRATES COLLABORATIVE USV CAPABILITIES TO TOTALENERGIES

Continuing to enable the use of emerging breakthrough technology, TotalEnergies has partnered with iXblue to demonstrate collaborative uncrewed capabilities for subsea inspection and asset survey operations.

Successful trials were recently conducted off the coast of La Ciotat (South of France), deploying two uncrewed platforms: iXblue DriX Uncrewed Surface Vehicle (USV) and Teledyne Gavia Autonomous Underwater Vehicle (AUV). Both uncrewed platforms were remotely controlled and supervised from iXblue Onshore Control Center, with iXblue DriX USV acting as a communication gateway between the onshore control center and the Gavia AUV. The two drones were able to successfully communicate together, thanks to the Gaps USBL positioning system installed within the DriX gondola, and that tracked the Gavia AUV.

"With these sea trials, we were able to successfully demonstrate the combination of two light drones working in a collaborative mode, remotely controlled and supervised from the shore. Thanks to the DriX USV, we were able to track the Gavia AUV and send it new mission plans to allow the AUV to closely inspect some defined subsea features, all from the safety of the onshore control center," explained Mathieu Lardeux, R&D Project Manager at TotalEnergies. "This opens up great possibilities for future multi-energy offshore developments. Replacing the use of conventional large, crewed inspection and survey vessels with uncrewed solutions such as the DriX USV will allow us to reduce offshore risk for personnel, decrease operational costs and lower the carbon footprint of our offshore operations."

"We are delighted to have been able to demonstrate our capability to conduct collaborative surface/subsea autonomous vehicles operations to TotalEnergies. This broadens the range of applications of our DriX USV, and especially for deeper waters operations, where the use of AUV is necessary. We now look forward to the next steps in our collaboration and to conduct an operational survey on one of TotalEnergies Offshore field in the near future," added Olivier Cervantes, VP Energy Markets at iXblue.

» *DriX and Gavia AUV during sea trials. (Photo credit: iXblue)*

ATLAS NORTH AMERICA ADDS RANGER TO ITS IMAGING SONAR SYSTEMS

Marine Sonic Technology (MST), a brand of Atlas North America, a leader in the ultra-high resolution imaging sonar systems is pleased to announce a Synthetic Aperture Sonar (SAS) designed for man portable autonomous undersea vehicles (AUV) and larger. As with all Marine Sonics Sonars, the Ranger SAS consumes the least power of any SAS sonar on the market while still providing a search rate that meets the most stringent of demands.

The Ranger SAS utilizes MST's proven sonar electronics module in combination with uniquely designed SAS arrays which provide a 300-meter search range (150 meters per side) at a 3 cm resolution. This standard sonar has a 300-meter depth rating but is also available with a 1,000-meter depth rating. In addition, the standard system includes our proprietary Sea Scan Survey Software, Lifetime Technical Support and a three (3) year warranty.

"The Ranger is our most ambitious, and technically-advanced development project to date. It has all of the hallmarks of our compact, lightweight, and energy-conscious design philosophy," beamed Josh Nicholson, Director of Engineering at Marine Sonic Technology.

"The small, compact, affordable SAS allows users of small-size AUVs to employ this technology from all but the smallest classes of AUVs." The Ranger SAS will deliver greatly enhanced underwater imaging capabilities which will fit most any customer budget," said Sergio Diehl, President of Atlas North America-Marine Sonic Technology.

The Ranger is a long-awaited addition to the Marine Sonic Technology product line of sonars, which are known for superb quality, ease of use, and are specifically designed for today's challenging environment.

» *Fine details (3 cm resolution) of a sunken sailboat at 100-m range (altitude 8 m). (Image credit: MST)*

» *With a compact footprint, RANGER SAS can fit on most vehicles. (Photo credit: MST)*

» *The 6205s2 is ideally suited to compact USV projects. (Photo credit: EdgeTech)*

EDGETECH LAUNCHES THE 6205s2 SWATH BATHYMETRY & SIDE SCAN SONAR SYSTEM

EdgeTech, a leader in high resolution sonar imaging systems and underwater technology, recently introduced the 6205s2 Combined Swath Bathymetry & Side Scan Sonar System. Building on the success of the popular 6205 and 6205s systems, EdgeTech has redesigned the 6205s2 and achieved a more compact and lighter package with additional features and benefits including the options for an integrated INS, the higher resolution frequency pair of 850/1600 kHz, and EdgeTech's gap-fill side scan output.

The EdgeTech 6205s2 produces real time, high-resolution, three-dimensional maps of the seafloor while providing an enhanced and fully integrated swath bathymetry and dual frequency side scan sonar system.

The new 6205s2 offers co-registered dual frequency side scan and bathymetry with swath coverages up to 200° with a selection of equidistant and equiangle output options. Additionally, the 6205s2 is the only bathymetry system to now offer EdgeTech's motion tolerant side scan sonar feature for operation in more adverse weather conditions. The new 6205s2 is ideally suited to compact USV projects, especially those looking to achieve bathymetry, side scan and sub bottom profiler datasets with a single data-pass.

The 6205s2 incorporates EdgeTech's Full Spectrum® technology to exceed IHO SP-44, NOAA and USACE specifications for feature detection and bathymetric point data uncertainty. The data outputs of the 6205s2 are accepted by most third-party acquisition and post processing software packages.

INTEGRATED AUTONOMOUS & REMOTE SYSTEMS FOR THE OCEAN INDUSTRY

Advancements in oceanographic technologies are transforming the way that we work at sea, and these advancements are taking place at an unprecedented rate. Domestic and foreign governments will utilize fully integrated unmanned and autonomous technologies to secure global oceans and local borders, the commercial industry has adopted many advanced ocean technologies to reduce its carbon footprint while searching for natural resources, and scientific and research institutions are adopting new technologies that are revolutionizing the way that our global oceans are studied.

FORGING ALLIANCES

Advanced Ocean Systems, Inc. (AOS) was formed to respond to the demand for full-system solutions by leveraging the combined technology, products, services, and infrastructure of its group companies—Okeanus Science & Technology (OST) and SeaRobotics Corporation (SRC). OST and SRC are industry leaders in the design, development, and deployment of unmanned vehicles, oceanographic handling systems, deck systems, and autonomy and software services. Together, these companies provide the ocean industry with a unique capability to develop and deliver autonomous and remote systems, including advanced deck systems for the growing fleet of ASVs and USVs around the world.

OST was formed in 2013 with the oceanographic professional in mind. Initially providing hard to find oceanographic gear and making it available to the global markets for rental. With the acquisitions of Sound Ocean Systems, Inc. (SOSI) in 2016 and DT Marine Products, Inc. (DT) in 2017, Okeanus has become a leading provider of standard and advanced marine winches, A-Frames, and launch and recovery systems (LARS). The Okeanus team is currently working on numerous manned and autonomous deck systems for government and defense, commercial, and scientific & research clients across the globe. Rugged, Reliable and Proven deck systems, now benefiting from advanced autonomous technologies from SRC.

UNMANNED TECHNOLOGY

SRC has been developing and delivering unmanned marine technology for over two decades and brings an extensive catalog of standard and custom-built products serving a wide variety of customers—from oceanographic / scientific surveys to the Department of Defense. SRC's in-house design and manufacturing teams have delivered numerous solutions to its clients and are currently working on a variety of unmanned developments for government, defense, energy, and scientific research clients worldwide. SRC was recently awarded a contract to supply a custom long-endurance ASV to Canada's Marine Institute and has recently delivered several ASVs to the United States Research Laboratory.

The AOS Group of companies offer systems engineering and development, integration and testing, an extensive line of standard products, and a comprehensive fleet of rental systems to the ocean industry. Specializing in autonomous, automated, and remote technologies for the government, defense, energy, academic and scientific markets, the group offers an extensive line of oceanographic winches, advanced deck systems, launch and recovery systems, ASV's, USV's and advanced survey systems for purchase or rental. For more information, visit: *www.advancedoceansystems.com*

» *With manned or unmanned capacity, the SR-Endurance 7.0 is designed for offshore survey and surveillance. (Photo credit: AOS)*

» *AOS offers a comprehensive range of autonomous LARS, A-Frames, and multipurpose winches. (Photo credit: AOS)*

COMMODITY MARKETS CONTINUE TO POWER AHEAD TO LOFTIER LEVELS

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

CRUDE OIL:

As the calendar flipped to February, the forces that sent WTI oil prices up 55 percent last year continued to drive them higher. As we complete the first week in February, WTI has advanced another 22.4 percent! Oil prices are above $90 per barrel, the highest price since September 2014 when oil prices were collapsing. This means consumers will face much higher gasoline pump prices—as high as $5 per gallon in California, and $4 in many other states—this spring. For residents in the Northeast, where heating oil is in strong demand, winter bills will be much higher than in previous winters.

Is there any relief in sight? The short answer is No. The reason oil prices are this high, besides investors and speculators pushing futures prices up, is that the oil industry has experienced more than half a decade of underinvestment. Less money going into finding new oil reserves and boosting output means the power of natural oilfield production decline rates is limiting supply growth, thereby tightening the oil market and lifting prices. This is true not only in the United States, but in all oil producing countries around the world.

Last July, OPEC members, plus their Russian partner, pledged to gradually restore excess production mothballed following the pandemic related collapse in global oil demand in 2020. OPEC+ pledged to add 400,000 barrels per day of supply back to the market each month until the full surplus output is returned, which we be done later in 2022. The problem is that several OPEC members—Angola and Nigeria—have struggled to restore their offline production due to technical issues and aging deepwater fields. Even Russia has not fully met its increased production quota. Therefore, the market is growing skeptical of how much additional oil might be able to be pumped. That supply concern is contributing to higher global oil prices.

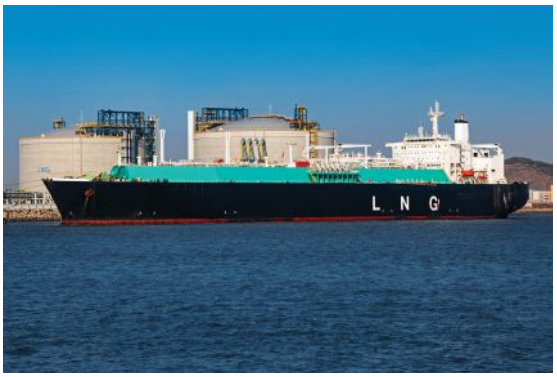
Oil prices seem to be locked into going only one way—up. The test of pricing's strength will come in a couple of months when winter demand ends and before summer's heat arrives. Sentiment is emerging that crude oil prices have risen too far and too fast and that the market is due for a correction. When it happens, the magnitude of the pullback may startle people. Could we see a price that starts with a six? That is not out of the question, depending on where prices sit when the correction begins.

Would such a correction signify that the oil bull-market is ending? No. Bull markets, and commodity super cycles, are marked more by the duration of the above-trendline prices and not that they must continue rising. In other words, it is the amount of area under the price curve, and not the height of the curve that tells us about the likely longevity of this oil cycle. We think it has several years still to run.

NATURAL GAS:

Winter is when natural gas prices often experience their greatest volatility due to shifting weather patterns. Storms and periods of bitter cold temperatures impact gas trader thoughts about their impact on gas demand, and in turn on how much supply will be withdrawn from storage. The more gas pulled from storage tanks and caverns means that much more demand will be experienced in the spring and summer when storage needs to be rebuilt to meet next year's winter demand.

At the end of January, gas storage volumes fell by six percentage points below the 5-year average storage level, and more than twice that percentage shortfall from last year's storage. Traders are



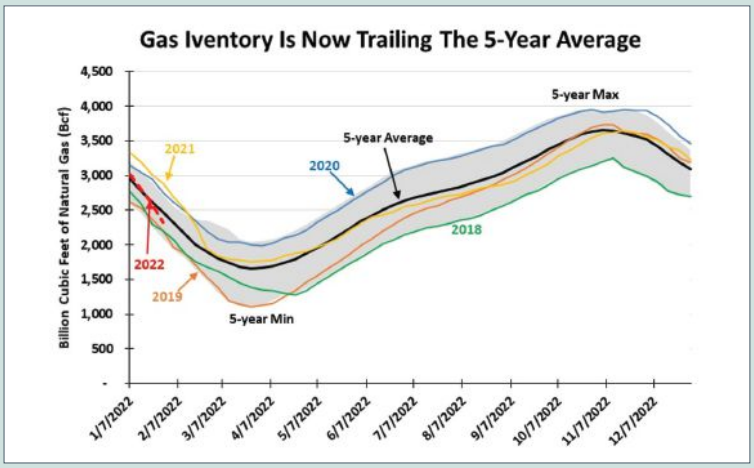
viewing these shortfalls as signs the domestic gas market is adequately, but not overly supplied, meaning any increase in cold weather could generate greater supply concerns.

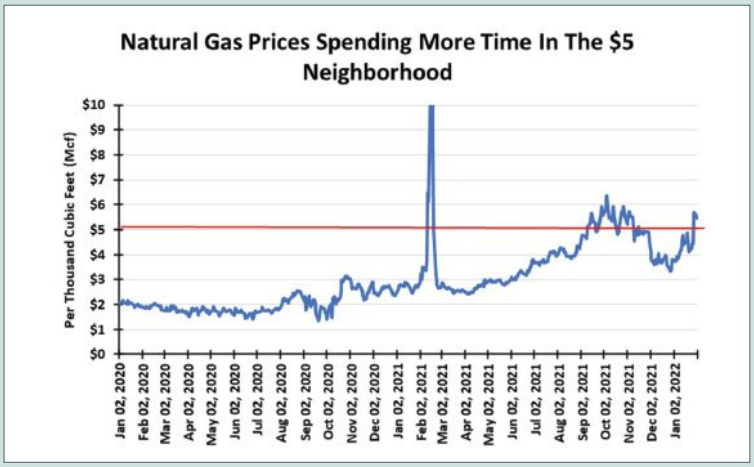
The latest estimates of daily gas production from IHS Markit show the volume to be about one billion cubic feet per day above the year-ago level. Marketed gas volumes have increased about 1.5 Bcf/d above last year, with liquefied natural gas shipments helping to lift those volumes.

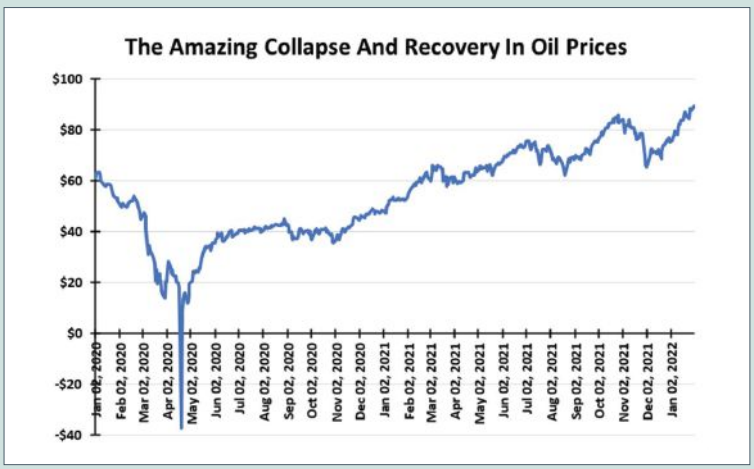
So far this winter, due to a warmer-than-usual fall and early winter, domestic demand has been anemic with LNG deliveries taking up much of the slack. The United States federal government has been working to increase LNG shipments to Europe, given the continent's worsening energy crisis, sky-high electricity and natural gas prices, and growing geopolitical pressures. Those shipments have knocked down spot natural gas and electric power prices in Europe by 30 percent, although they remain extremely elevated.

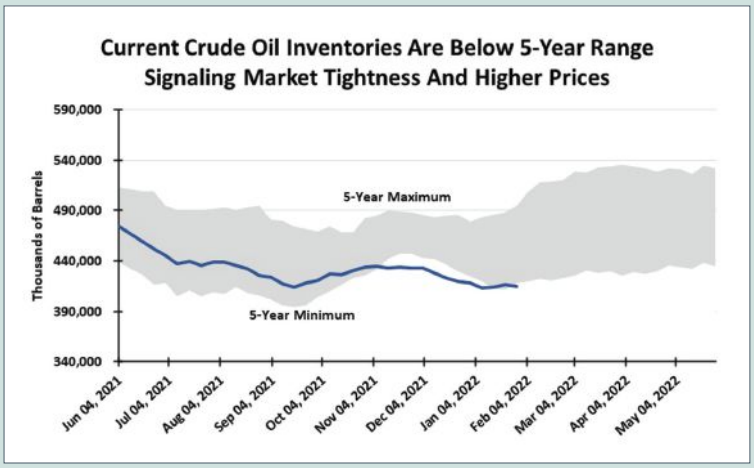
A bitter cold spell in the Northeast drove Boston spot natural gas prices to $30 per thousand cubic feet, nearly ten percent above comparable European gas prices. Those prices are nearly six-times higher than the Henry Hub spot gas price, ensuring attractive profit opportunities for natural gas producers, who are seen to be slowly increasing their drilling activity. In recent times, Henry Hub prices have been near or slightly above the $5/Mcf level, something not seen for many years.

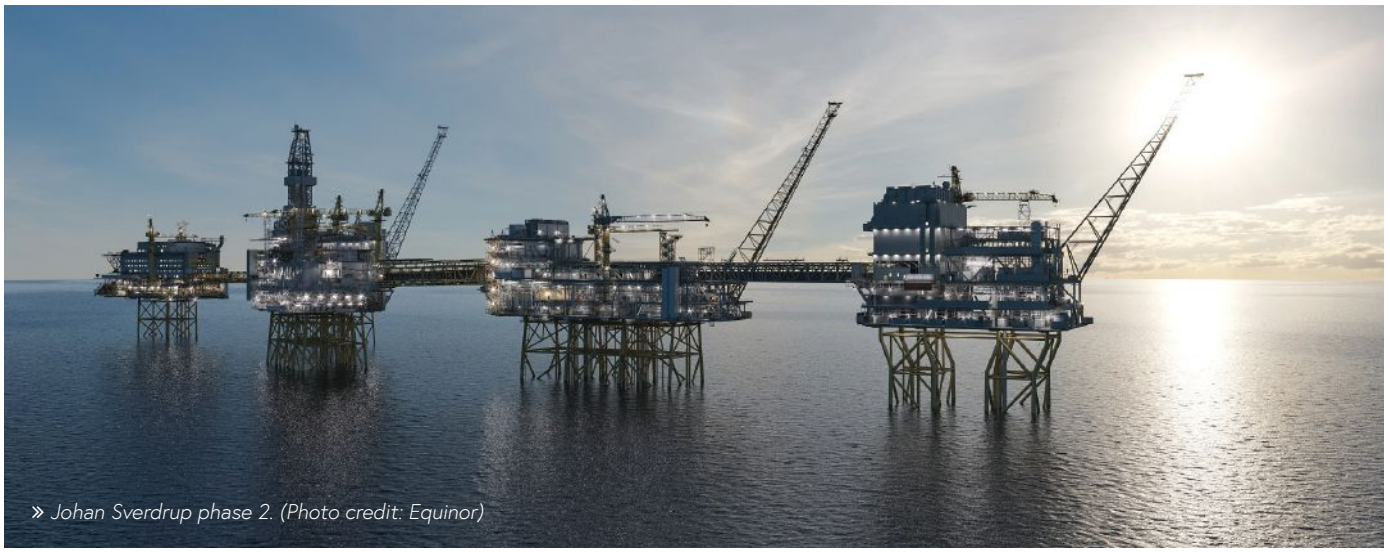
Currently, natural gas traders believe Henry Hub spot prices are elevated due to the European situation. With winter's end in sight, gas prices will be impacted by developments and sentiment regarding a possible military confrontation between Russia and Ukraine that could involve NATO and U.S. troops. Russia's heavy hand in Europe's natural gas business—supplying roughly 40 percent of the continent's gas supply—ensures that these geopolitical tensions will continue to influence gas price thinking. The use of natural gas as a weapon in this confrontation could send European gas prices soaring, pulling along U.S. prices. Predicting the endgame for Ukraine's political/military confrontation is impossible, thereby ensuring gas price volatility.











» *Johan Sverdrup phase 2. (Photo credit: Equinor)*

RECORD-HIGH REVENUES FROM THE NORWEGIAN SHELF

The combination of high production of oil and gas from a total of 94 fields, significant demand and high commodity prices led to a historically high level on the State's revenues from petroleum. Much of this is due to record-high gas prices. The Norwegian Petroleum Directorate expects stable, high production to continue over the next few years.

High Production

Production in 2021 came to 102 million standard cubic meters of oil (642 million barrels) and 113 billion standard cubic meters of gas. This corresponds to about four million barrels of oil equivalent per day, a minor increase from the previous year.

Five fields started production last year; Duva, Yme (older field which was restarted), Solveig, Martin Linge in the North Sea and Ærfugl in the northern Norwegian Sea.

Phase 1 of the Johan Sverdrup field in the North Sea is in full operation, and Phase 2 is scheduled to start up this year. Once full production is achieved, Johan Sverdrup will account for 35 percent of oil production on the Norwegian shelf.

Additional fields are in the pipeline. Eight development plans (PDOs) were submitted in 2021, and the companies are expected to submit dozens of PDOs this year.

The temporary change in the petroleum tax has most likely led to an increase in project activity. The projects would most likely have been carried out even without the tax package, but some of them would have been postponed.

Major Investments

A total of about NOK 150 billion was invested in fields and the development of discoveries on the Norwegian shelf in 2021, which is somewhat lower than the previous year. The Norwegian Petroleum Directorate's (NPD's) forecasts show an additional reduction in investments in 2022, before they are expected to increase again leading up to 2025.

The investments contribute to continued high and profitable production towards 2030, at which point the current plans show that production will decline. The extent and speed of this decline will depend, among other things, on how much additional oil and gas the companies will discover in the years to come.

While production remains high, CO2 emissions are dropping. The most important reason for this is the use of power from shore. The objective is to cut emissions in half by 2030 compared with the level in 2005.

Many New Discoveries

Last year's wildcat wells yielded 18 oil and gas discoveries. 40 exploration wells were completed (31 wildcat wells and 9 appraisal wells).

Two additional discoveries were made in production wells with exploration targets.

Resource growth in 2021 amounted to 81 million standard cubic meters of oil equivalent (510 million barrels of oil equivalents). There has been a steady resource growth over the past years, and 2021 had the highest growth since 2014.

2021 saw the award of new exploration acreage in the annual Awards in Pre-defined Areas (APA) as well as in the 25th licensing round. 30 companies were offered a total of 61 production licenses in the APA round, and seven companies offered ownership interests in the 25th round. There was also significant interest and a large number of applications in the APA round in 2021, and this award will take place in a few weeks.

New Industries

New players and industries are emerging on the Norwegian shelf. The technology pilot Hywind Tampen is the world's first project to supply power to petroleum installations from offshore wind. The plan calls for the turbines to be installed in the North Sea this year.

Seabed mineral extraction could also become a new industry. In autumn 2021, the NPD carried out its own expedition and participated in several other expeditions with Norwegian universities over the course of the year. Preliminary results from four years of data acquisition show that there are interesting occurrences of manganese crusts and sulphides on the Norwegian shelf.

The NPD has previously mapped opportunities for CO2 storage on the Norwegian shelf. Estimates show that there is room to store 80 billion tonnes of CO2—the equivalent of 1,500 years of Norwegian emissions at the current level.

NPD is seeing increasing interest from both established and new players looking for CO2 injection acreage. The authorities received applications from five companies following the announcement of two areas in 2021.

NREL INTEGRATES INTERTRUST CLIMATE AND WEATHER API TO ENHANCE WIND ENERGY ANALYTICS SOFTWARE

Intertrust has announced the integration of its Planet OS weather data API into the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) OpenOA (Operational Assessment) software to enhance performance of operational assessments of wind energy plants. OpenOA helps wind energy development planners more accurately estimate energy production from wind plants and other operational assets. The joint solution allows wind energy experts to understand weather variability, which is critical to planning renewable energy systems.

NREL is the leading U.S. federal government R&D center focused on renewable energy, energy systems, energy efficiency, energy systems integration and sustainable transportation. The NREL OpenOA framework is developed to provide references of common wind energy operational analytics methods to address the lack of standardization of these methods in the wind industry.

The core feature of OpenOA is a state-of-the-art method for estimating the long-term annual energy production (AEP) of a wind plant based on a few years of operational data. This long-term AEP analysis method can be used to determine the accuracy of preconstruction energy yield estimates, help detect underperformance, and assist with financial transactions involving the wind plant.

OpenOA requires access to data from the Copernicus Climate Change Service's ERA5 and NASA's MERRA2 global climate retrospective analysis models. Previously, analysts were required to provide these data themselves when using OpenOA. In the new version of OpenOA, users can go to Planet OS Datahub, sign up for an API key, and integrate ERA5 and MERRA2 data into their workflow through using the Planet OS API. Through this integration, Planet OS provides this data in a seamless, fast, and reliable manner, which is essential to the OpenOA workflow. Planet OS Datahub is a companion data application to Intertrust Platform, an interoperability layer giving organizations the capability to securely and efficiently manage diverse datasets and devices.

"By accurately estimating energy production from wind plants and other operational assets, the combination of OpenOA with Intertrust PlanetOS' weather data API will be a huge asset for wind farm owners and planners to better understand their operations and projected output," said Eneli Toodu, Climate Data Technologist at Intertrust.

EQUINOR AND BP ACHIEVE KEY STEP IN ADVANCING OFFSHORE WIND FOR NEW YORK

On January 14, 2022, at an event with U.S. Secretary of Energy Jennifer Granholm, New York Governor Kathy Hochul and U.S. Representative Paul Tonko, Equinor and bp announced the finalization of the Purchase and Sale Agreements (PSAs) with the New York State Energy Research and Development Authority (NYSERDA), for Empire Wind 2 and Beacon Wind 1. The PSAs set the terms under which these projects will supply homegrown, renewable power to New York and inject significant economic investments into the state's economy.

The finalization of the PSAs concludes the contracts awarded in January 2021, when Equinor and bp were selected to provide New York State with offshore wind power in one of the largest renewable energy procurements in the U.S. to date.

Once completed, Equinor and bp's portfolio of active offshore wind projects (Empire Wind 1, Empire Wind 2 and Beacon Wind 1) will produce enough electricity to power about 2 million New York homes, and will help generate more than $1 billion in economic output to New York State. This includes investments in ports and infrastructure that will reinforce New York's position as the regional offshore wind industry hub—and a leading example of economic activity driven by the energy transition.

The offshore wind projects on the US east coast are key building blocks to accelerate profitable growth in renewables and the ambition to install 12-16 GW of renewables capacity by 2030. Equinor expects to deliver these projects within the return guidance communicated at the last Capital Markets Update in June 2021.

The completion of the PSA represents a major milestone and enables the start of project execution for the Equinor-bp partnership.

"Today's announcement sets Equinor and bp on the path to provide over 3.3 gigawatts (GW) of offshore wind power for New York. It also offers a large-scale, tangible demonstration of the incredible economic activity and carbon reduction potential being driven by New York's green energy transition," said Siri Espedal Kindem, President of Equinor Wind US. "We are proud to help lead the growth of this exciting industry in New York."

Doreen M. Harris, President and CEO, NYSERDA, said: "Offshore wind is bringing unprecedented investment to New York State, and we are proud to further cement ourselves as the offshore wind hub of the nation. Meeting our nation-leading offshore wind goal of 9,000 megawatts by 2035 will be an essential economic driver for the state, and these projects will help transform our energy system while providing thousands of family-sustaining jobs to bolster our growing green economy."

Felipe Arbelaez, bp's senior vice president for zero carbon energy, added: "These are world class assets and we are moving quickly and safely to get them producing the energy people need in the way that they want it – all the while creating positive ripple effects for the surrounding communities and industry. Today's milestone is a critical step forward and we will continue to work hard to deliver the Empire Wind and Beacon Wind projects, providing clean energy and stable returns for decades to come."

The PSAs agreed to with New York State finalizes the terms under which Equinor and bp will provide generation capacity of 1,260 MW of renewable offshore wind power from Empire Wind 2, and another 1,230 MW of power from Beacon Wind 1, while making substantial investments in New York's infrastructure.

The projects include port upgrades to transform South Brooklyn Marine Terminal into a major staging and assembly facility for the industry, as well as an operations and maintenance base for the projects. Equinor recently announced the opening of a New York project office located in Sunset Park, Brooklyn, opposite the South Brooklyn Marine Terminal. The partnership will also invest in the Port of Albany, making it America's first offshore wind tower and transition piece manufacturing facility.

» *Artisitic rendering of concept for site development of the South Brooklyn Marine Terminal (not final). (Image credit: Equinor/bp)*

» *Oscilla Power's Triton wave energy converter will deliver cost competitive, utility-scale energy. (Photo credit: Oscilla Power)*

OSCILLA POWER AWARDED $1.8 MILLION GRANT FROM DOE TO SCALE-UP WAVE ENERGY SYSTEM

Wave energy system developer Oscilla Power has been selected for a $1.8 million grant from the U.S. Department of Energy (DOE) that will accelerate the development of a utility-scale version of the company's core Triton technology. The $1.8 million will be augmented with an additional $200,000 in cost-sharing from Oscilla Power and its partners.

The project funding will enable performance improvements and result in a detailed design for a system that is pre-permitted for the DOE's PacWave, a first-of-its-kind, grid-connected, full-scale test facility for wave energy conversion technologies off the coast of Oregon. The system will be suitable for over two years of continuous operation at the PacWave site and will be designed to ensure a clear pathway to IEC type certification for the first commercial units.

"The power of this funding is that it not only enables the continued development of our flagship utility-scale Triton system, but it provides a clear pathway and process for commercial testing and deployment at full-scale in a real-world operating environment as the logical next step beyond this program," said Balky Nair, Oscilla Power CEO. "We look forward to working with our partners to complete the Triton design for PacWave through this project and subsequently building and getting our Triton system in the water."

Oscilla Power has developed a highly efficient system known as a "multi-mode point absorber." It consists of a geometrically optimized surface float connected to a ring-shaped, vertically asymmetric heave plate by three taut, flexible tendons. Unlike most conventional wave energy devices, Triton's surface float can extract energy from ocean waves in all six degrees of freedom (heave, pitch, surge, sway, roll and yaw) allowing for increased energy capture across a wider range of ocean conditions. This provides a greater average annual energy production and a substantially lower levelized cost of electricity.

The DOE awards are designed to strengthen wave energy technologies to accelerate their commercial viability and deploy them at scale to help decarbonize the grid and reach President Biden's goal of net-zero carbon emissions by 2050.

In a press release announcing the grants, U.S. Secretary of Energy Jennifer Granholm said: "Harnessing the unrelenting power of the ocean is a clean, innovative, and sustainable way to curtail carbon pollution—benefitting American businesses and families, especially coastal communities hit hardest by the impacts of climate change. Diversifying and expanding our clean energy sources will usher in a new era of energy independence that makes the grid more resilient, curbs the climate crisis, and saves Americans money on their energy bills."

Oscilla's partners on this project include: Glosten Associates, Spencer Fluid Power, Applied Motion Systems, Applied Control Engineering and DNV.

JAN DE NUL ORDERS INNOVATIVE USV FOR MARINE & OFFSHORE CONSTRUCTION

Jan De Nul Group has ordered Maritime Robotic's well-proven and hybrid Mariner Unmanned Surface Vehicle (USV) as the first step towards unmanned and autonomous offshore survey operations. Named Beluga 01, this vessel will sail under the Luxembourg flag and be deployed for worldwide hydrographical and environmental surveys on marine and offshore construction projects. Jan De Nul is herewith the first dredging contractor to deploy an unmanned survey vehicle in marine and offshore conditions.

The Beluga 01 is based on the innovative Maritime Robotics' Mariner class USV, which for years has proven its mobility and seaworthiness for data acquisition under rough conditions. Maritime Robotics' system convinced Jan De Nul of its well-engineered high-quality design, based on 10 years of experience. It is a user-friendly, cost-effective and low-risk platform for data acquisition at sea as an alternative or adjunct to larger manned vessels.

By choosing unmanned surveys and by opting for the Mariner class USV, Jan De Nul fully commits to improved safety and operational control during its survey activities, reduced carbon emissions, and more efficient data acquisition.

Mike Lycke, Survey Manager Offshore Projects at Jan De Nul Group said: "For several years, we have been studying different autonomous systems. Our primary focus has always been to build up our expertise on autonomy for maritime survey operations. The global circumstances in 2020 and a maturing USV market enabled us to take it to the next step and order a turnkey vessel for our marine and offshore projects. We found the perfect partner in Maritime Robotics, a leading provider of innovative unmanned solutions for maritime operations and data acquisition."

Eirik Hovstein, COO of Maritime Robotics added: "We are very proud to have been selected as supplier for Jan De Nul Group. We stand for in-house developed systems, with sustainability and autonomy in mind, in close collaboration with civilian, governmental and military partners. We look forward to collaborating with Jan De Nul on the further development of the Beluga 01. Together, we will explore the future of unmanned solutions to ensure safer, greener and more cost-effective data acquisitions at sea."

» *Artisitic rendering of concept for site development of the South Brooklyn Marine Terminal (not final). (Image credit: Equinor/bp)*

Reduced carbon footprint

The Beluga 01 is equipped with a fully redundant hybrid propulsion system. The prime source of propulsion is a diesel engine that is mechanically coupled to the water jet. Alternatively, the vessel can be operated in full electrical mode. The additional electrical Torqeedo propulsion, installed parallel to the main propulsion, can maneuver the vessel in sensitive marine areas.

There is also a range extender module to top up the batteries which will operate longer than 12 hours. This system has lower emissions than the main engine, which could also be used as an alternator for the batteries.

Furthermore, the electrical propulsion acts as redundancy for the main engine in case of a failure, or vice versa.

Jan De Nul is committed to cutting carbon emissions. Zero-emission propulsion on future vessels is part of the Group's strategy. When designing vessels for instance, Jan De Nul takes into account the environmental impact and tackles environmental challenges by focusing on reducing the footprint of its activities, particularly on water and air quality and on the climate.

Proven record in harsh offshore conditions

The Beluga 01 is capable of operating in up to sea state five, although this usually precludes gathering any useful survey data. The vessel can survive in up to sea state seven. The Beluga 01 only needs 80 cm of water to operate in.

Named after the Beluga whale

The Unmanned Surface Vehicle is named after the Beluga whale. The name is the result of an internal survey amongst Jan De Nul crew and staff, which has also brought forward the company's smaller USV names, Curiosity and Calypso.

The name links the vessel to the whale's hydrographical and marine environmental survey skills. The Beluga whale uses echolocation for navigation, foraging, and hunting in various environments. The animal emits calls of sound waves and listens to the echoes generated by the surroundings. The echoes are used to identify the landscape and locate objects in the whale's surroundings (Source: Wikipedia).

Main features of the Beluga 01 (Mariner-class USV)

- Fully redundant hybrid propulsion system
- Autonomy up to 50 hours
- Redundant communication setup with a range up to 30 km
- All navigation aids available (VHF, AIS, Radar)
- Fitted with a special designed Launch and Recovery System
- Fits in a container for easy transport

NOAA AND BOEM ANNOUNCE INTER-AGENCY COLLAB-ORATION TO AD-VANCE OFFSHORE WIND ENERGY

NOAA and the Bureau of Ocean Energy Management (BOEM) signed an interagency memorandum in support of the Biden-Harris Administration's ambitious offshore wind energy goals to advance wind energy responsibly while protecting biodiversity and promoting cooperative ocean use. Offshore wind energy development plays an important role in how the U.S. is leading the charge to combat the climate crisis, and build a clean energy economy and climate-ready nation.

The Administration set a goal of significantly increasing the nation's offshore wind energy capacity. This new agreement underscores NOAA's and BOEM's commitment to responsibly deploy 30 GW of wind energy production capacity in Federal waters by 2030. The memorandum will help leverage the responsibilities, expertise, and relationships of both NOAA and BOEM in support of the goal by outlining areas of cooperation, and creating a framework to develop future, more detailed agreements related to specific program areas.

"This agreement is powerful and timely as we face climate change head on. It will help ensure coordination, collaboration, and alignment by NOAA and BOEM at key decision points in support of the Administration's offshore wind energy goal," said NOAA Administrator Rick Spinrad, Ph.D. "It will also provide specific pathways for NOAA data and services while protecting our ecosystems and marine resources."

"We are already seeing the impacts of climate change on communities across the country and the ocean resources that we manage. Now is the time to act. Working together, we will further advance offshore wind, which can play a critical role in meeting our country's energy needs while combating climate change and creating new family supporting jobs," said BOEM Director

» *Offshore wind turbines in Block Island Sound off Southern New England. (Ionna22)*

Amanda Lefton. "This agreement and the collaboration between NOAA and BOEM shows that fighting climate change and responsible resource management go hand-in-hand."

The research, planning, and regulatory mechanisms in the offshore wind and clean energy industry will provide for new, good paying jobs while also advancing the scientific understanding of the potential impacts of offshore wind development. Surveying, spatial modeling, mapping, oceanographic assessments, and characterization of ocean regions and jurisdictional boundaries are all critical elements to the successful development of this growing industry.

Oi oceanology international 2022
15-17 MARCH 2022
LONDON, EXCEL

OCEANOLOGY INTERNATIONAL IS BACK

By Ed Freeman, Managing Editor, ON&T

This time two years ago, many of us were half packed; with airline tickets issued, online registrations confirmed, and booth displays in full production, it was time to congregate and discuss a new decade of ocean technology. We all know what happened next.

The ocean tech industry was quick to adapt to COVID-19 restrictions and, overall, has fared remarkably well. The collective response in the face of the storm has been calm, clear and undeterred: adjust course with caution, but press on. For the conference industry, however, the last 24 months have been particularly rough.

VIRTUAL REALITY

Event organizers had little choice but to pull the plug on in-person events and dive into the virtual realm. After the initial pandemic paralysis and obligatory crash course in Zoom etiquette, we were soon reminded of just how important the open and collaborative exchange of information, ideas, and insights is to our professional ecosystem. Something was missing, though.

Fast forward to March 2022, and many of us are poised to rediscover that missing ingredient at Oceanology International (Oi) from March 15 –17 in London, UK. Oi was one of the first major international conferences to be sidelined in early 2020 but is now firmly back on the calendar of in-person events.

Connecting The Global Ocean Technology Community is the rally cry for representatives from the international commercial, scientific, and government markets, and while Reed Exhibitions will also stage a virtual edition of the conference—Oi Connect—organizers are expecting a resurgent in-person turnout at the 100-acre ExCeL London venue.

Speaking exclusively to ON&T, Oi Exhibition Director David Ince said: "While business has continued throughout the pandemic for many of the core ocean industries we represent, there's now the expectation of getting back to the high-impact face-to-face interactions, networking and knowledge sharing that Oi is known for. It's the physical products and solutions on show, that makes Oi what it is, and is what the industry has been waiting for. We look forward to welcoming ON&T readers and Oceanology International community in March."

So, what can visitors to Oi 2022 expect? A lot.

AN OCEAN OF OPPORTUNITY

The three-day conference is stacked with opportunities to reconnect, network, and sample the latest in applied technology and thought leadership. From the expansive exhibition floor—replete with over 400 companies from more than 30 countries—to the popular dockside demonstrations, there is no better place in our trade to experience innovation in action.

Interoperable systems for marine data acquisition, transfer, storage, and analysis will be the hot topic in the Ocean ICT zone, a space dedicated to serve the growing demand and interest in the cutting-edge ocean IT, communications, satellite, and data solutions. This year's Ocean ICT will feature 30 companies that specialize in this area.

The technical conference will unite an exclusive rollcall of subject matter experts and thought leaders from around the world to consider the ocean sector's most dominant trends and pressing challenges, from sensor technology and data security systems to autonomous vehicles and low carbon initiatives, and everything in-between.

Each day of the program also features the Future Tech Hub, which will hand the stage to 18 start-ups and small businesses and invite them to make daily 'pitches' to promote solutions and services never shown before at Oceanology International.

As if that weren't enough, there's the lineup of live demonstrations on Royal Victoria Dock. Whether from aboard a survey vessel—this year's roster includes the *SV Thame* and the *Ocean Surveyor*—or from a dockside cabin—from where Teledyne Marine, Ocean Alpha, Blueye Robotics, Maritime Robotics, Fugro, and L3Harris will all be presenting—visitors can get up close and personal with the latest in marine robotics and interact with technical experts.

The bags are fully packed, and ON&T looks forward to seeing friends old and new in London.

» *Dockside demos on Royal Victoria Dock allow visitors to experience the latest ocean tech. (Photo credit: Oi)*

» *The Oi exhibition hall will host 400 companies from more than 90 countries. (Photo credit: Oi)*

CHECK THE TECH

UPDATES INCOMING FOR SIDE SCAN AND SUB-BOTTOM SYSTEMS

» *GeoPulse Compact is suitable for geological surveys, marine archaeology, seabed infrastructure detection, and dredging surveys. (Image credit: GeoAcoustics)*

The GeoAcoustics brand is familiar to most subsea professionals for its workhorse shallow water bathymetric, side scan and sub-bottom profiling systems, most of which come without the complexity of similar systems in the market.

The UK-based company was building sub bottom profilers in the late seventies and with its base technologies fully developed, has continued to focus on resilience as a core design goal for decades. Most end-users would agree that reliability is critical in such technology, and the GeoPulse Sub-Bottom Profiler's position as the de facto industry standard for shallow water applications reflects this.

But the company is no stranger to technology innovation; the TPIIM USL Tracking system (1988) and GeoAcoustics DFSS side scan sonar (1994) were industry firsts and are used by navies worldwide today. More recent innovations include the GeoPulse Compact launched in 2019 and available in the market during 2020, and the Pulsar towed side scan sonar which has provided high performance object detection and imaging since its launch in 2015.

AI POWERED AUTOMATION

GeoSwath sonars are among the most well-known GeoAcoustics products. Launched in 2000, GeoSwath can scan twice as much area in the same time as a standard multibeam system. It is based on a methodology called interferometry, which creates a data point for every single sounding returned, so post-processing can be more involved than with a matching multibeam data set.

The existing filtering system can exclude some soundings to speed processing up, but still needs an experienced user to optimize the process. GeoAcoustics is working on a joint Artificial Intelligence program with the University of East Anglia however, which will result in a new filtering solution with significantly more autonomy, powered by machine learning and new, proprietary algorithms.

A NEW STATE OF INDEPENDENCE

GeoAcoustics returned to independence following its divestment from Kongsberg Maritime at the end of 2020. With Oceanology International 2022 fast approaching, the renamed 'GeoAcoustics Ltd' is keen to focus on a newfound freedom to innovate. Its AI technology and other developments will be releasing later this year, but visitors to its stand (N400) in the ExCeL this March can see:

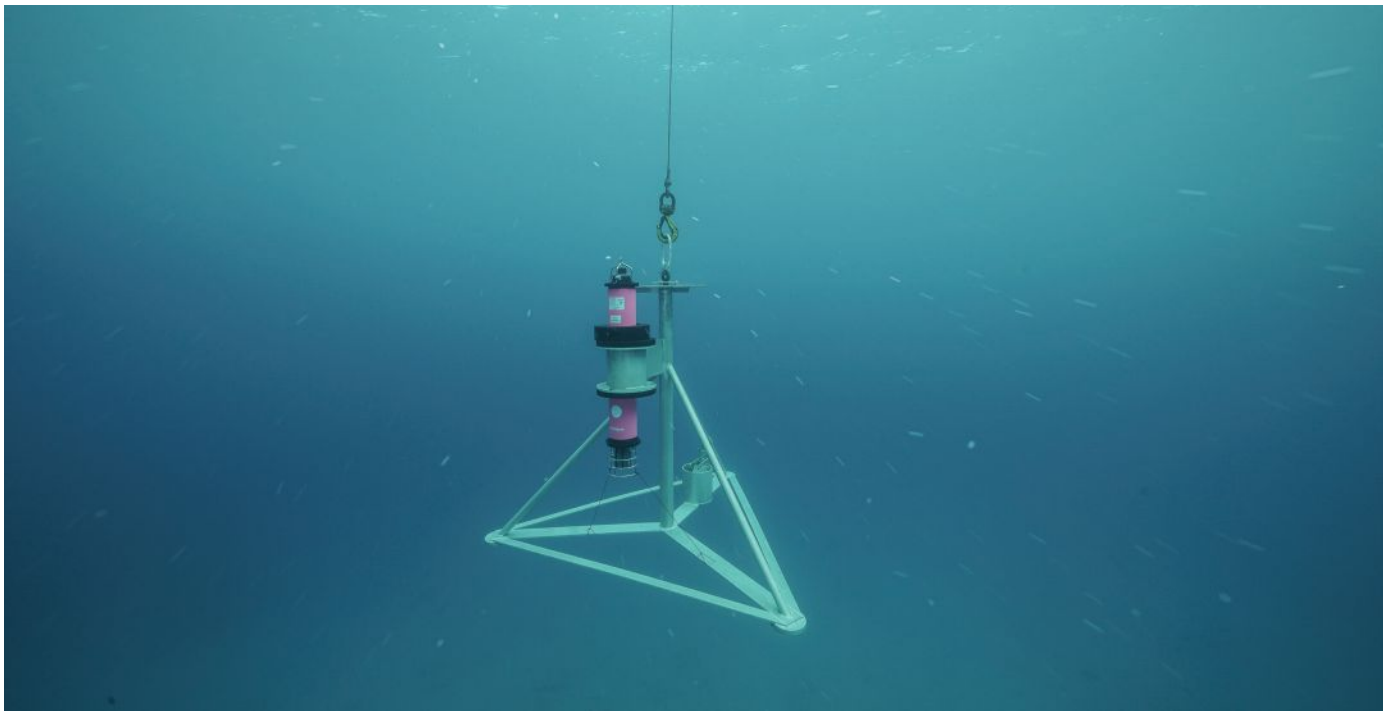
Bathymetric Sonar: The industry-leading interferometric system offers highly accurate, efficient simultaneous swath bathymetry and side scan sonar mapping for shallow water environments. With versatile hull mounting options as well as USV integration, the GeoSwath 4 product line on show at Oi 2022 is suitable for a wide array of survey tasks and applications, including hydrographic surveys, environmental assessments, infrastructure inspection and inland waterway and seabed mapping.

Side Scan Sonar: The Pulsar provides for simple deployment and intuitive operation, capturing high resolution images of the seabed using a rugged tow fish which can be easily operated with a water-protected deck unit and a portable cable hand reel. It operates within a 550KHz to 1MHz frequency with selectable FM and CW pulses, allowing the user to optimize the configuration to the survey task, making it ideal for applications such as search and recovery operations, object detection and identification, inspection of underwater structures, and marine archaeology.

Sub-Bottom Profiling: GeoPulse Sub-Bottom Profilers provide unparalleled reliability and accuracy of data, producing repeatable, high-quality results time after time. Application specific, ruggedized and towed or over the side use make GeoPulse suitable for a wide range of applications including geological surveys, marine archaeology, pipeline, and buried structure detection, and dredging surveys. *www.geoacoustics.com*

» *The GeoSwath USV module for an array of survey tasks. (Image credit: GeoAcoustics)*

» *GeoSwath can scan twice as much area in the same time as a standard multibeam system. (Photo credit: GeoAcoustics)*



» *iXblue Canopus LBS Transponder. (Photo credit: iXblue)*

VAN OORD DEPLOYS IXBLUE LBL SUBSEA POSITIONING SOLUTION FOR OFFSHORE WIND FARM PILES INSTALLATION

Global marine contractor Van Oord recently deployed iXblue new LBL subsea positioning solution to conduct the installation of 190 offshore wind farm piles in the Bay of Saint-Brieuc (France). Already used on major oil and gas and renewables projects, iXblue Canopus transponders, Ramses transceivers and Delph Subsea Positioning Software have been used by Van Oord to conduct metrology operations. Those aimed to ensure the laid-out piles had been positioned as per the requested specifications.

Instant pile positioning verification was made possible by installing the Canopus LBL transponders on top of a centering frame which was placed on top of each of the pile that made up the wind turbine foundations (3 piles per turbine). The Canopus transponders then measured and logged the distance separating them by sending acoustic interrogations to each other. The logged data was then transferred to the Ramses LBL transceiver and sent back to Delph Subsea Positioning global supervision software that generated reports from all received baselines.

» *Offshore installation vessel Aeolus. (Photo credit: Van Oord)*

"Thanks to our global subsea positioning solution, Van Oord was able to retrieve highly accurate measurement data only 20 minutes after the Canopus transponders had been installed on the piles. This enabled the overall baseline measurement to be conducted in less than 3 hours for all four piles installed at the time," explained Hans-Willem Deleeuw, Sales Manager at iXblue.

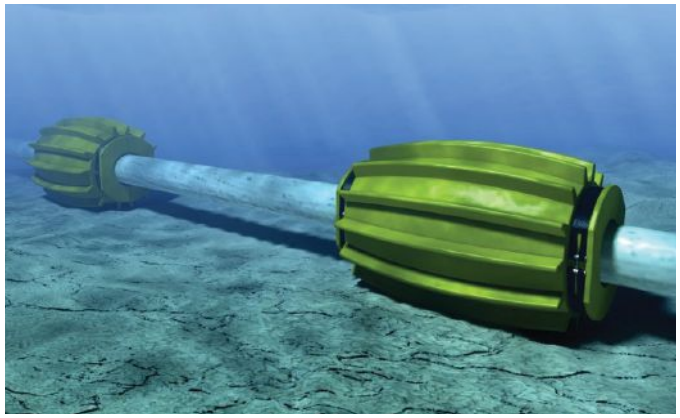
Delivering operational efficiency and flexibility, iXblue LBL subsea positioning solution indeed offers plug-and-play, easy to deploy and to operate systems. Versatile, they can be used on multiple offshore applications such as metrology or ROV/AUV positioning and are easy to integrate to existing pool of equipment thanks to their open protocols. When used in combination with iXblue Inertial Navigation Systems, innovative SLAM and Sparse LBL modes can be used, deploying a reduced number of transponders, and thus enhancing operational efficiency and cost-effectiveness.

"The intrinsic qualities of our LBL solutions, together with the comprehensive remote training of Van Oord personnel, as well as 24/7 support from the iXblue teams made this wind farm metrology operation a real success," Hans-Willem added.

CRP SUBSEA DELIVERS INNOVATIVE BUCKLE MITIGATION BUOYANCY SOLUTION TO PROTECT GOM FLOWLINES

CRP Subsea has successfully delivered contracts providing more than 500 Rotating Buoyancy Modules (RBMs), which adds to previous deliveries that have been installed and successfully operating for the past 3 years. They will also be attached to deepwater high-temperature, high-pressure flowlines to mitigate pipeline buckling on the seabed.

The RBMs will protect the pipeline by allowing it to roll on the seabed reducing lateral friction and berm creation, thus eliminating rogue buckles and reducing axial walking in the pipeline. Using this innovative buckling mitigation buoyancy solution will reduce the risk of pipeline failure and increasing the lifetime of the field.



Steve Bray, Commercial Team Manager at CRP Subsea stated: "Our advanced rotating buoyancy solution is engineered to reduce lateral friction and berm creation, thereby generating repeatable and predictable pipeline behaviour. In addition, the rotating buoyancy design reduces the number of modules needed along the pipeline, significantly lowering overall project costs for operators. We are delighted to have been chosen to supply rotating buoyancy for these innovative projects and look forward to collaborating further in the future."

Manufactured at CRP Subsea's state-of-the-art manufacturing facility in Skelmersdale, England, these RBMs are their latest delivery of what is now a growing track record over recent years.

Rotating Buoyancy Modules (RBMs) are used to mitigate buckling in seabed pipelines. Buckling occurs during start-up and shutdown sequences as the thermal fluctuations cause pipelines to expand and contract, leading to problematic buckling along its length. Traditionally non-rotating cylindrical buoyancy modules have been installed along sections of the pipeline to reduce the weight and friction in that section and promote controlled bending. However, in certain conditions the modules have displaced seabed material to build ridges (berms) that have then restricted the lateral movement that the modules were installed to promote. The RBMs roll on the seabed, thereby reducing lateral friction and berm creation.

ASHTEAD TECHNOLOGY BOLSTERS RENTAL FLEET WITH INVESTMENT IN INNOVA MULTIPLEXERS

International subsea equipment rental and solutions specialist Ashtead Technology has further strengthened its rental fleet with a significant investment in twelve new Matrix MK II+ multiplexers from Innova.

The Matrix is an established and proven stand-alone fiber optic multiplexer and control solution. It provides a simple plug-and-play interface for a large array of sensors and equipment to any remotely operated system offering reliable power management and strong diagnostic capabilities to help simplify and enhance the efficiency of survey operations.

The additional systems are available to rent throughout the company's nine international technology and service hubs in Q1 2022.

Ross MacLeod, Ashtead Technology's Technical Director, said: "With over 17,000 assets in our subsea equipment rental fleet we offer the largest pool of Innova subsea multiplexer systems for rent worldwide. The Matrix MK II+ multiplexers from Innova are extremely popular and we have invested in additional systems to meet growing demand.

"This latest investment also demonstrates our continued commitment to the global subsea rental market by ensuring we can offer the broadest range of best-in-class subsea equipment from leading manufacturers to support our customers' projects worldwide."

Eivind Brimsøe, Sales Director at Innova AS, said: "We have enjoyed a strong relationship with Ashtead Technology for many years and are delighted to support their continued investment in the latest survey technologies. We believe that our systems offer unrivalled performance and flexibility while maintaining the openness and ease of use that are vitally important to Ashtead Technology and its customers."

» *Ashtead Technology's rental fleet will include 12 new Matrix MK II+ multiplexers. (Photo credit: Ashtead Technology)*

FIRST UNCREWED VESSEL SURVEY IN IRISH WATERS UNDERTAKEN BY XOCEAN

In a first for Ireland, an Uncrewed Surface Vessel (USV) was launched by XOCEAN off the Co. Louth coast last week, to undertake an environmental survey of the seabed in collaboration with Dundalk Institute of Technology (DkIT). This is the first time an uncrewed vessel has operated in Irish waters and represents a major step forward in reducing the carbon footprint associated with offshore survey operations. XOCEAN's carbon-neutral approach to delivering marine data has seen demand for its services grow steadily since it commenced operations in 2019, and with clients across the globe, and revenue tripling in 2021, the company is set to continue its impressive growth trajectory in 2022.

» *XOCEAN's 4.5-m USV emits just one thousandth of the carbon typically produced by traditional offshore survey vessels. (Photo credit: XOCEAN)*

XOCEAN is pioneering uncrewed marine technology and to-date has delivered over 100 projects globally for some of the world's largest companies. In the last 12 months, the XOCEAN team has grown from 41 to 120 and plans to recruit 100 additional hires in the next 6 months. Ireland is fast-tracking the development of its offshore wind sector in line with commitments to increase offshore wind capacity to 3.5 GW as part of the government's ambitions to deliver 70% of electricity from renewable sources by 2030, as a result of the 2019 Climate Action Plan. This environmental research survey, utilizing multibeam echo sounder sensors will be used to characterize the seabed in this area of the Irish Sea.

XOCEAN's USVs offer significant benefits including safety with operators remaining onshore, efficiency with 24/7 operations and environmental with ultra-low emissions which together leads to significant economic savings for customers. The uncrewed vessel is around the size of an average car (4.5 meters) and half its weight (750 kg) and emits just one thousandth of the carbon typically produced by traditional offshore survey vessels. Throughout the survey, a team of qualified mariners and surveyors monitored the USV 24/7 to ensure the safety of navigation and that the highest quality data was collected.

Having operated in 16 jurisdictions globally in North America, Europe and Asia, XOCEAN is delighted to have completed last week's survey in Irish waters and is grateful to the Minister of State at the Department of Transport, Hildegarde Naughton T.D. and the Marine Survey Office for their engagement and support in enabling this highly innovative project to be delivered.

Commenting on the project, James Ives, CEO of XOCEAN said: "Our USV platform has demonstrated itself to be a safe, reliable and low carbon solution for the collection of ocean data. We are delighted to be working in Irish waters and in collaboration with Dundalk Institute of Technology, on this important environmental project."

Hildegarde Naughton, T.D. and Minister of State at the Department of Transport, and former Chair of the Oireachtas Committee on Climate Action has been keen to highlight the Government's responsibility to address the urgent issue of climate change, stated: "We are constantly looking for innovative ways to promote positive sustainable action on climate change and XOCEAN's low-carbon approach to delivering marine data in the safest way possible is a very positive step forward."

FUGRO'S SUPPORTS SAFE SUBSEA OPERATIONS IN BRAZIL'S MERO 2 PROJECT

Maersk Supply Service has awarded Fugro a subsea survey and positioning contract to support installation of an anchoring system for the floating production storage and offloading (FPSO) vessel Sepetiba in Petrobras' deepwater Mero 2 project, offshore Brazil.

These operations are scheduled to begin in Q1 2022 and last approximately 4 months. Fugro will accomplish the work using their QuickVision® augmented reality camera, a touchless, vision-based approach proven in Petrobras' Mero 1 deepwater project last year.

QuickVision® is part of Fugro's strategy to make offshore operations safer, more efficient, and more sustainable. Integrated with Fugro's Starfix® navigation suite, the camera system eliminates the need for staff to mount sensors on subsea assets, which in turn reduces offshore personnel needs, vessel time and carbon emissions. For the Mero 2 project, Fugro will use the technology to help guide installation of 24 subsea torpedo piles and mooring lines, as well as to support real-time positioning for additional subsea installation and construction activities.

» *Fugro's QuickVision® solution enables remote tracking pattern positioning on subsea installation projects. (Photo credit: Fugro)*

John Chatten, Business Development Manager for Fugro's marine operations in Brazil stated: "We are delighted to be working with Maersk Supply Service on their Mero 2 project for Petrobras following the successful deployment of our QuickVision® technology on the Mero 1 project. It is Fugro's goal to be the partner of choice for subsea services, delivering innovative solutions for complex installation and construction projects that contribute to the responsible development of Brazil's energy assets."

SUBSEA 7 AWARDED SUBSTANTIAL SUBSEA INSTALLATION PROJECT IN GOM

Subsea 7 has been awarded a substantial project for subsea installation services related to Beacon Offshore Energy LLC's Shenandoah Development, located offshore Gulf of Mexico in water depths up to 6,300 feet.

The project covers the tie-back of four subsea wells to the Shenandoah host facility through a subsea manifold with dual flowlines and risers. The work scope includes engineering, procurement, construction, installation ("EPIC") and commissioning of the subsea equipment including structures, umbilicals, and production and gas export flowlines. Subsea 7's scope also includes the wet tow and hook-up of the semi-submersible FPS to the field and mooring system installation.

Project management and engineering will commence immediately at Subsea 7's offices in Houston, Texas. Fabrication of the flowlines and risers will take place at Subsea 7's spoolbase in Ingleside, Texas, with offshore operations scheduled for 2024.

Craig Broussard, Vice President for Subsea 7 US, said: "We are pleased to have been selected as a partner for the delivery of the Shenandoah development. This project allows Subsea 7 to demonstrate the full capacity of our offering, including our extensive involvement in mooring and installation of host facilities, EPIC activities related to the flowline system, and utilizing our industry leading experience and welding capabilities to support the development of high-pressure fields. We look forward to building on the collaborative approach demonstrated by the Shenandoah project to form a long-term cooperative relationship in support of Beacon Offshore Energy's future growth plans."

TECHNIPFMC AWARDED INTEGRATED IEPCI™ CONTRACT BY EQUINOR

TechnipFMC has been awarded an integrated Engineering, Procurement, Construction and Installation (iEPCI™) contract for Equinor's Smørbukk Nord development.

The contract covers a high-pressure, high-temperature subsea production system and associated equipment for a brownfield tieback in the Åsgard field in the Norwegian Continental Shelf, where TechnipFMC has a large installed base. The award follows front end engineering and design work on the project in 2021.

Jonathan Landes, President, Subsea at TechnipFMC, commented: "Our ability to deliver this optimized solution for Equinor is possible due to our close collaboration with the client, portfolio of subsea equipment, and integrated execution model. We're delighted to be once again delivering an iEPCI™ project for Equinor."

The installation campaign will use TechnipFMC's battery hybrid vessel, which will reduce greenhouse gas emissions through reduced fuel consumption.

HGIS WRAPS UP FIRST USV SURVEY FOR SHELL IN BRUNEI

Malaysia geo-solutions provider HGIS has used their first uncrewed surface vehicle (USV), the 5.5-m M40P developed by OceanAlpha, to complete an entirely remote nearshore inspection of a subsea pipeline in TALI Field for their project with Brunei Shell Petroleum (BSP).

As a project highlight, the USV is deployed to acquire seabed data from offshore, nearshore, and onshore fields to provide continuous geo data support to the construction, operation, and maintenance of pipeline routing and subsea infrastructure in field developments.

The USV was remotely controlled and monitored using OceanAlpha's independently developed control system from a station near Shell Crude Oil Terminal, approximately 4-5 km from the Tali Field pipelines. As the USV autonomously executed accurate surveys with minimal human intervention, surveyors could allocate more effort to critical data analysis and hazard pin-pointing.

"Due to mixed factors, including workforce shortage caused by the COVID and the industry's shared goal for sustainable development, we see increasing interest in our USVs. M40P is a platform dedicatedly developed to empower the transition of the offshore industry by digitizing the workflow and cutting down carbon footprint," introduced Ran Zhang, General Manager of OceanAlpha, a Hongkong-based USV manufacturer.

"Conducting surveys remotely from shore is a unique and inspiring experience for us," said Mr. Alexis Wan Ullok, Executive Director of HGIS. "The Introduction of unmanned technology undoubtedly reduces HSSE exposure and survey duration. With less human activity on the sea and cut-downed fuel consumption, it's a down-to-earth fulfillment of our goal to support sustainable economic development."

» *The 5.5-m M40P USV. (Photo credit: OceanAlpha)*

N-SEA SIGN LONG-TERM VESSEL AGREEMENT FOR HYBRID SURVEY/ ROV SUPPORT VESSEL

N-Sea Group has signed a long-term vessel agreement with Geo Plus for the Geo Focus, an advanced DP1 35M Hybrid Survey/ROV Support Vessel. The vessel has a strong track record of continuous survey operations in various regions for many years.

N-Sea has taken significant steps through a plan of growth by creating an environment for future investments, strategic partnerships, and long-term client relationships.

The Geo Focus is one of six vessels that N-Sea will have under full management and control. By having dedicated vessels, it allows N-Sea to provide safer and more efficient operations through working with fully committed and integrated teams. Through this new dedicated vessel initiative N-Sea can offer its clients, a unique set of subsea solution capabilities supported by experts, better serving the needs of our clients.

"I would like to congratulate and thank Geo Plus on this unique opportunity, as it secures N-Sea's position as one of the most diverse companies in the subsea solution industry for clients to accomplish and succeed their growth ambitions, by creating a community of entrepreneurship, knowledge, experience, and innovation," said Arno van Poppel (CEO).

» *Hybrid Survey/ ROV Support Vessel Geo Focus. (Photo credit: N-Sea ©Kloet)*

HPR ROV REPORTS POSITIVE START TO 2022 WITH CONTRACT WINS

HPR ROV, which supplies vehicle inspection and intervention services to the global offshore and wind energy industry using ROVs, recently implemented changes to its operations with a shift of its focus into new markets both in the UK and overseas, including decommissioning and following industry conversations into the global renewable energy market.

Known predominantly for its high-performing micro ROV systems, over the last year HPR ROV has worked on an array of projects with tier-one operators and service companies in the North Sea, Central Asia and West Africa. The company has also supported a number of late life asset management work scopes within the UK decommissioning sector including gas sampling, pipe cutting and debris recovery.

The company, which is headquartered near Inverurie, Aberdeenshire, recently invested more than £100,000 to supplement its fleet of systems in order to capitalize on the changing opportunities and plans to further invest in further ROVs in the coming months to support incoming work.

MERMAID CHARTERS DSCV VAN GOGH

Mermaid Subsea Services (International) Ltd. (MSSI) has entered into a two-year charter-in contract for the DP2 Diving Support Construction Vessel (DSCV) Van Gogh to support Mermaid Subsea Services (International) Ltd., which comes on the back of secured work and anticipated continual demand in worldwide operations for essential subsea services.

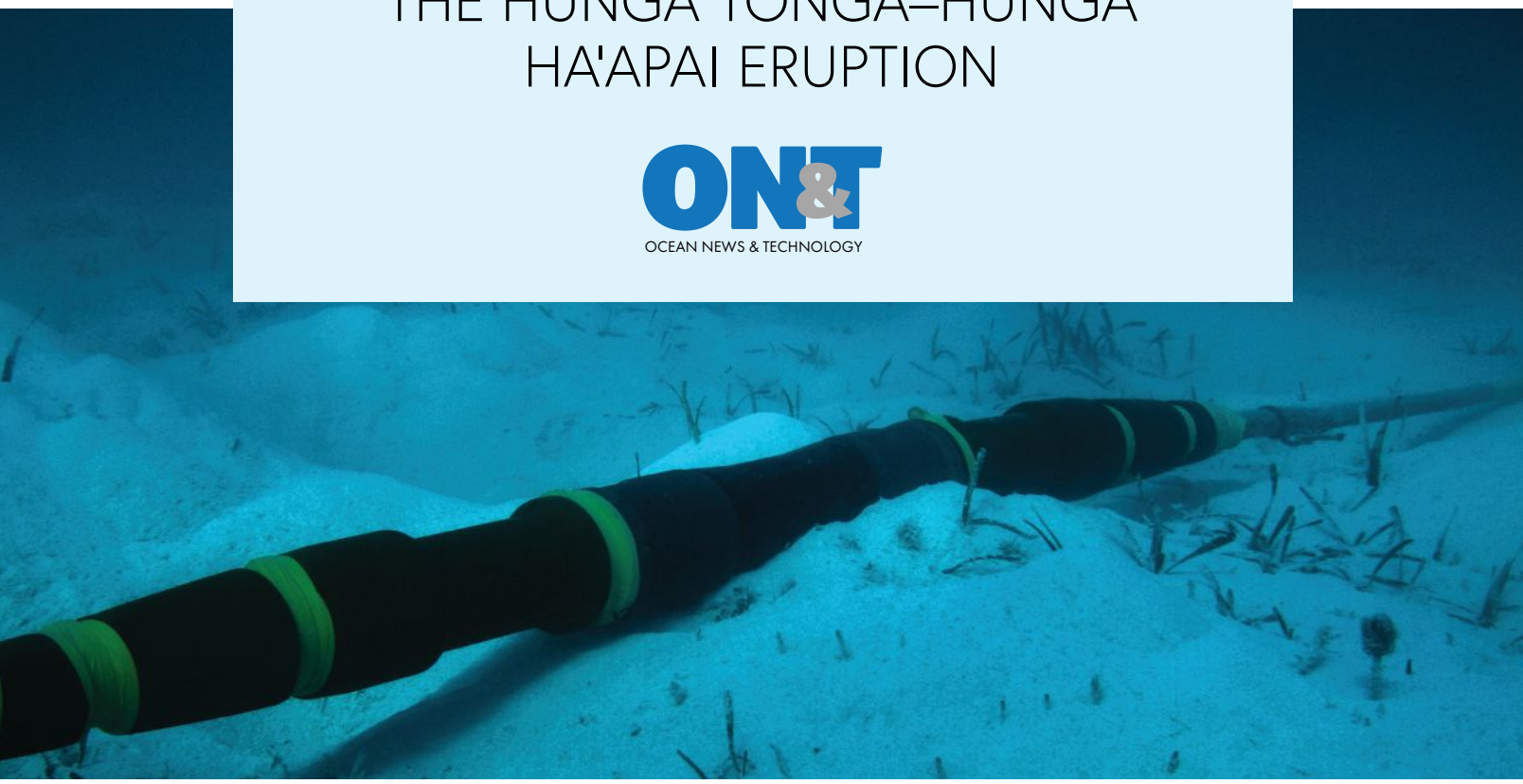
The DSCV Van Gogh comes with built-in saturation diving and air diving system, 120 beds, and a 150-ton crane. The vessel will undertake inspection, repairs, and maintenance contracts as well as perform saturation diving in support of construction interventions, and ongoing field maintenance and call out repair. MSSI has chartered-in this DSCV and will deploy her to support its various subsea projects commencing in February 2022.

Mermaid's subsidiary, Mermaid Subsea Services (Thailand) Ltd., has already secured subsea contracts worth circa US$12 million, that will utilize this DSCV for a scheduled duration of approximately 120 days, expected to end in June 2022. In addition, Mermaid is also targeting utilizing the DSCV Van Gogh for several prospective long-term projects in West Africa.

» *DSCV Van Gogh. (Photo credit: Ultra Deep Subsea)*

CABLE OUTAGES: THE CASE OF THE HUNGA TONGA–HUNGA HA'APAI ERUPTION

ON&T
OCEAN NEWS & TECHNOLOGY



Internet connectivity in Tonga is now scheduled to be restored in late February, after cable repair ship Reliance found more than one break along the Fiji end of the Tonga Cable. The Tonga Domestic Cable Extension (TDCE), which links Tongatapu with Pangai and Neifau, was also severed further offshore. The damage caused by the Hunga Tonga–Hunga Ha'apai eruption left Tonga, a kingdom of some 170 South Pacific islands, largely cut off from the rest of the world, with any satellite service thwarted by the billowing ash cloud.

While residents of small island nations in the Ring of Fire are all too familiar with the threat of earthquakes and tsunamis, in today's ever-interconnected world the prospect of losing reliable network communications is a mounting concern. ON&T recently sat down with two subsea infrastructure experts, **Ocean Specialists' Perry Wright (VP & General Manager)** and **Tony Mosley (Director of Business Development)**, to find out more about how prepared the submarine cable industry is for such outages and how ocean technology might play an increasingly instrumental role in responding to such disruptions.

ON&T: *How does the submarine cable industry plan for outages such as the one impacting Tonga?*

PW: Crisis management, as with most industries, is an import part of business planning. Given the very nature of subsea cables and the environmental forces they are exposed to, maintenance planning is a big part of preparedness. Disaster drills and designating personnel and equipment to respond is key. In this case, though, the cumulative effects of ash and flooding pose almost impossible challenges for a swift and effective attempt to reestablish a reliable connection. In general, for cables of this type, there are typically three approaches to planning for a subsea cable outage:

1. Membership in a Cable Maintenance Zone agreement, which provides a consortium of cable owners with access to cost-effective deep water repair capability. Vessel availability is governed by the consortium agreement, with ongoing/planned repairs typically taking precedence. As the cost of vessel is spread across the consortium as a standing charge, the actual cost of a repair is significantly reduced.

2. Alternately, a cable operator may implement a "call out" agreement where the cable system operator maintains all spares and when a repair is needed, a vessel is sourced from the spot market.

3. Or, lastly, a dedicated repair vessel, where the cable owner also operates its own repair vessel.

ON&T: *What are the steps required to respond to a major submarine cable outage such as this one?*

TM: The Operations and Maintenance (O&M) Manual is the playbook for response following a system outage. Normal steps include a system test to pinpoint the location and extent of the fault, using either Time Domain Reflectometry (TDR)—where an electrical signal is imposed on a conductor and the echo of that signal is detected as a reflection from the fault—or Optical Time Domain Reflectometry (OTDR) for damaged Optical Fibers providing a more accurate result.

Once located, the operator will apply for any necessary permits to perform the repair. At which point, the operator either notifies the consortium of the repair requirement or approaches the market for a vessel. In parallel with this, they will verify spares condition and prepare spares for loading to the installation vessel.

On permit approval, the vessel is mobilized to pick up cable spares and transit to the site of the repair. Unfortunately, repairs can take weeks if not months, typically with permitting, particularly for some pacific islands and vessel availability adding time to the project.

ON&T: *How would the ship find the exact location of the fault, considering that the cable might be buried by underwater landslide or may have shifted from its original position?*

PW: Usually by deploying an ROV outfitted with cable detection equipment. An electrical tone may be applied to the cable to aid in the cable detection. Indeed, the cable may be buried or displaced over a large area requiring the cable route be surveyed prior to the repair. Or the vessel will need to search for the cable at intervals along the route until the cable is detected. It's vital to have copies of the cable as laid information for the maintenance vessel.

ON&T: *Could a case be made for the use of submarine cables for scientific data collection, so that cables could bring further understanding of geologic forces at play and inform future disaster planning?*

PW: To date, early earthquakes and tsunamis detection has been achieved by discrete Ocean Observatories and buoys deployed in key locations, such as the Neptune system located off the West Coast of Canada. While more countries with at-risk coastlines have existing systems or are considering similar deployments, there has been a developing interest in using subsea cable systems to create a series of distributed sensor arrays.

Long haul submarine cables use "repeaters" to amplify the optical signals to achieve transmission distances from 500 km to many thousands of kilometers, typically with repeater spacings of approximately 100 km along the length of the cable. The repeater is a pressure housing with electrical power feed and optical fiber communication and offers an ideal environment for the integration of a suite of sensors that can be used to monitor for critical environmental factors, including pressure that would allow the repeater to function as a tsunami detector.

This technology, referred to as "SMART" (Science, Monitoring and Reliable Telecommunications) cables, has been under discussion in a Joint Task Force since 2012. OSI is engaged in this development as a partner, along with Samara Data Systems in a newly formed entity, Subsea Data Systems (SDS) that is actively working on developing this technology, with the aim of providing transformative advancements in tsunami and earthquake monitoring and network integrity.

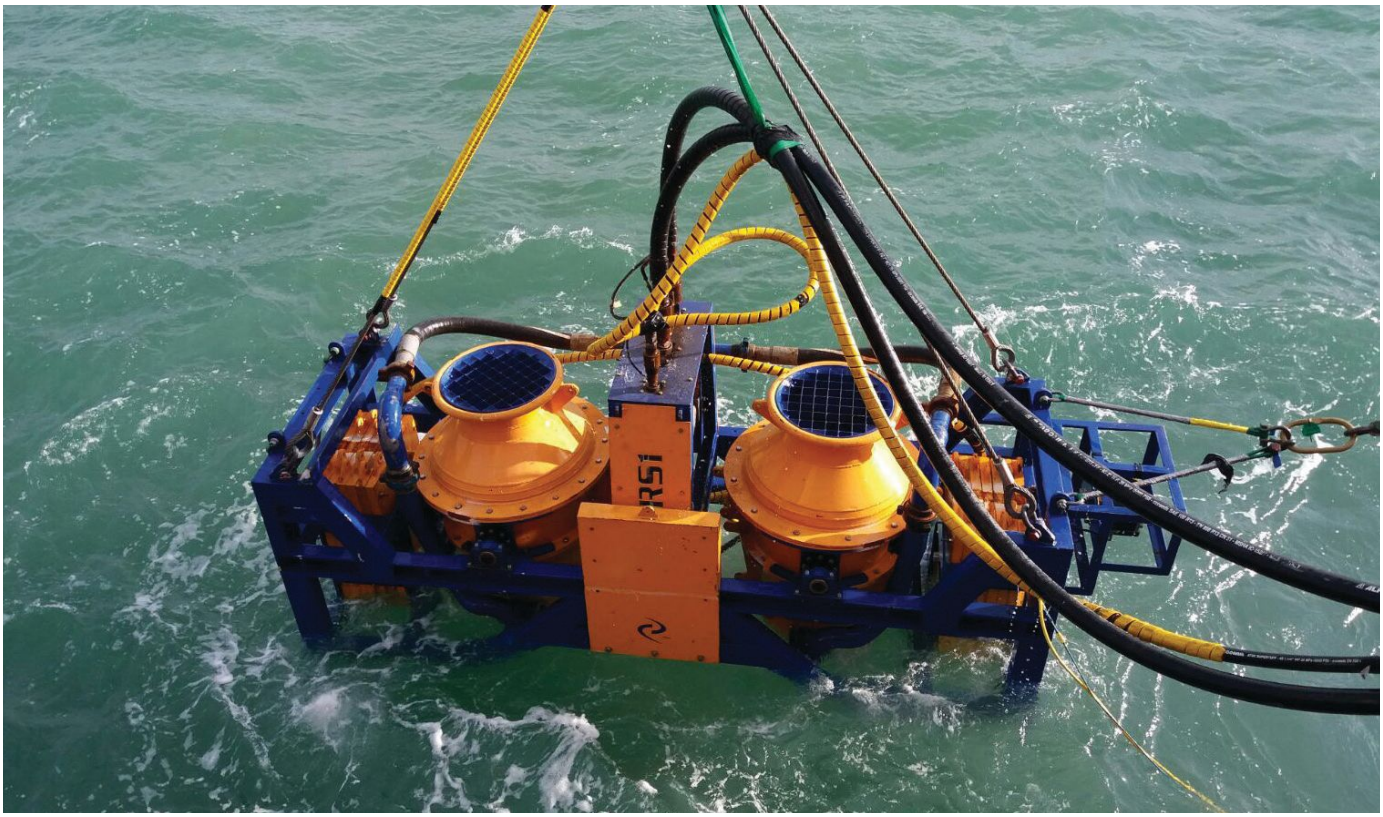
ON&T: *This recent event demonstrates the risks of relying on a single cable for international Internet traffic. What can we learn from this tragedy?*

TM: While many nations and telecom operators have multiple cables connecting to a variety of landings across the globe, smaller island nations often do not have the population and GDP sufficient to justify funding the construction of a single cable, let alone multiple cables needed to provide a level of communications redundancy that the rest of us take for granted. Numerous islands have received grants from Development Banks (such as the World Bank and Asian Development Bank) to support subsea cables in addition to having a long communications relationship with the satellite community. Although satellites are not a perfect redundant substitution for undersea fiber, used in combination can support many of these islands until an additional subsea fiber solution can be found.

But the redundancy should not stop at the duplication of cables. It requires separation of the cable path including the landing stations and terrestrial routes at each end of the cable, to avoid a single point of failure. Strengthening of redundant communications paths be it subsea fiber or satellite is always a part of disaster planning and a key operational consideration in other offshore industries where subsea fiber communication is used.

» *The availability of a cable vessel is key to the speed of response following a major outage. (Photo credit: SubCom)*

» *Inspection ROVs can assist the response team in immediately assessing damage to the cable. (Photo credit: SeaBotix)*



» *TRS1 tool plays instrumental role in power cable project. (Photo credit: Rotech Subsea)*

ROTECH SUBSEA DELIVERS CRITICAL UK SUBSEA CABLE SCOOP

Active again in subsea power cable IRM, leading excavation and trenching operator, Rotech Subsea, has delivered a critical de-burial, cut and recovery and re-burial project in UK waters. In late Q3 Rotech Subsea's TRS1 tool was mobilized from Aberdeen to the site of a vital subsea power cable infrastructure project.

Contracted by a major subsea engineering contractor, Rotech's TRS1 CFE (controlled flow excavation) tool from its industry-leading RS range of trenching and excavation equipment was selected to de-bury, and carry out post-lay trenching for approximately 500 m of subsea cable. The subsea pioneer's RSG-C tool was used for the grab, cut and recovery of the section of cable.

Deployed by vessel crane, the TRS1 operated in water depths ranging from 80 – 85 m in flat/calm conditions successfully de-burying the cable from 0.6 – 0.8 m below seabed. Soil conditions were soft sand and currents ranged from 1.5 – 2.5kts.

For the grab, cut and recovery phase, the RSG-C was lowered to depth using the vessel crane, tied off to the crane wire every 15 m. An ROV positioned the tool over the cable, which was grabbed and raised 2 m, allowing the ROV to sling either side of the grab for cable recovery. Lowered 1 m, the cutting operations took 8 minutes.

The post-lay trenching phase saw the cable buried to client specification of a minimum of 0.6 m below seabed. Positioned perpendicularly over the cable with its nozzles angled marginally inwards, the TRS1 operated at a range of 3 m from the seabed and progressed at 3 m/min.

Speaking about the scope of works, Rotech Subsea Director of Subsea, Stephen Cochrane, commented:

"Rotech Subsea was delighted to play its part in a critical phase of the cable replacement works. The project showed off the versatility of our RS range of tools and was completed on schedule and on budget. It was yet another extremely successful deployment for the TRS1 which can deliver deeper, narrower, precision trenches with speeds more than double that of Mass Flow Excavation tools and other methods such as contact trenching systems and ploughs."

With enhanced capabilities, Rotech Subsea's CFE suite of tools is firmly established as the method of choice for cable trenching in Europe and beyond. The Aberdeen-based contractor's in-house research, development and engineering team has created a suite of 14 non-contact Controlled Flow Excavation (CFE), Suspended Jet Trenching tools. Further game changing enhancements to CFE and related subsea services are due to be unveiled.

NEXANS TO SUPPLY SUBSEA CABLES TO SOUTH FORK OFFSHORE WINDFARM

Nexans has received the first order under the frame agreement to manufacture approximately 110 km of high voltage subsea cables to South Fork Wind, a joint venture between Ørsted and Eversource. The 3-phase 138 kV high voltage alternative current (HVAC) subsea export cables will be integrated with two fiber-optic cables and transmit 132 MW of electricity to Long Island, New York.

Located 35 miles offshore from Montauk Point, New York, the 132 MW South Fork Wind Farm will address East Hampton's energy needs, producing enough clean energy to power 70,000 homes annually. The historic project will be the New York state's first offshore wind farm and will play a key role in reaching the state's clean energy goals. Construction will start in 2022.

The Export Cable Framework Agreement, providing the opportunity to supply up to 1,000 km of high voltage subsea cables in the U.S. by 2027, was signed in December 2019 between Ørsted Wind Power North America LLC and Nexans to accelerate the energy transition in North America by bringing Nexans' industry-leading subsea cable technology to the U.S. This contract is the first project to be delivered under this agreement.

The HVAC cables will be manufactured at Nexans' newly transformed subsea high voltage plant in Charleston, South Carolina, the only plant in the U.S. capable of manufacturing high voltage subsea cables. It is a critical part of building out the strategic supply chain for offshore wind industry in the US.

"The South Fork Wind Farm will deliver crucial renewable energy to thousands of households in New York State. It's the perfect project to officially kick off the delivery of our partnership agreement with Ørsted and Eversource. The project represents a great opportunity for Nexans to support the US's burgeoning offshore wind sector, which is providing better energy security, driving economic development, improving energy price stability, and contributing to the fight against climate change," said Ragnhild Katteland, Nexans EVP Subsea & Land Systems.

"As the world leader for cabling solutions for offshore wind-power production, Nexans will play an instrumental role in providing the expertise and infrastructure to deliver the project. Offshore wind is one of the most stable and secure sources of renewable energy, and the partnership is the latest part of our strategic commitment to electrify the future and fast-track the energy sector's journey to net zero," added Katteland.

SBSS WELCOMES NEW CABLE SHIP TO ITS FLEET

On 3 February 2022, S.B. Submarine Systems Company Limited (SBSS) welcomed their latest fleet addition, the cable ship *Fu Tai*, to Shanghai. The vessel has berthed at SBSS's Wujing cable depot on the Huangpu River and she will shortly assume international telecom cable maintenance duties in Asia.

CS *Fu Tai*, ex-Bourbon Oceanteam 101, was originally built in Spain in 2007 as an offshore construction vessel (OCV). She was purchased by SBSS in July 2021 and has since been converted and mobilized as a bespoke cable ship. Her cable spread design and her newly installed equipment and machinery will primarily be utilized in the Asian submarine cable maintenance market.

With over twenty-six years' experience in the submarine cable market, SBSS understands that having, and implementing, an asset strategy and a sensible tonnage replacement plan is critical to the company's future.

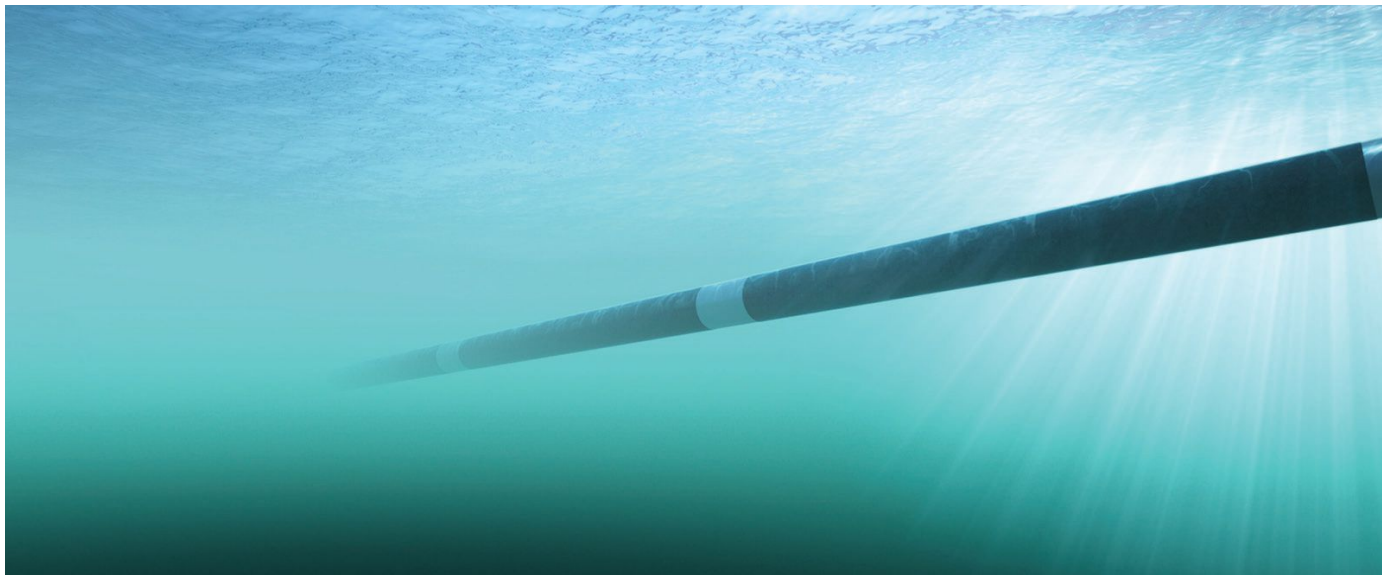
» *CS Fu Tai is powered by four 2,700kW high quality Wartsila units. (Photo credit: SBSS)*

Integral to our asset strategy, in early 2020 SBSS retired a stalwart cable ship, *CS Fu An*. In the same year, SBSS invested in the 5,500t capacity power cable installation and maintenance barge *Fu Yong 6*. These investments, as well as various other actions taken in support of our company strategy, have proven to be timely. The company's overall service capability in both its core telecom business, as well as its entry to the booming Chinese offshore wind market, is seeing SBSS thrive and grow.

CS *Fu Tai* now joins the fleet and, whilst numerically replacing CS *Fu An*, the new tonnage is of far superior build and capability. The current demand for tonnage in the submarine telecom sector, means that there will be no shortage of work for her in the foreseeable future. In July 2021, SBSS successfully took delivery of the vessel in Vigo, Spain, and has reflagged the vessel from Malta to Panama.

Post conversion, this DP2 vessel now has a cable carrying capacity of 3,000 tonnes in two main static cable tanks, and is equipped with capable cable handling machinery, 18kV Power Feed equipment, Power Grounding Unit (PGU), Universal Jointing spreads and a full suite of modern telecom cable test equipment.

Initially built as an OCV to support the oil and gas industry, CS *Fu Tai* is fuel efficient being powered by four 2,700kW high quality Wartsila units. She has excellent station-keeping capability, a comfort class DNV notation, a 70t active heave-compensated (AHC) crane and hence the ability to perform a variety of offshore construction works.



PRYSMIAN GROUP SECURES LANDMARK HVDC SUBMARINE CABLE PROJECT IN THE MIDDLE EAST

Prysmian Group, a world leader in the energy and telecom cable systems industry, has entered into a Limited Notice to Proceed (LNTP) for the supply of power cables in the context of a landmark HVDC submarine cable project in the Middle East, worth around €220 million. The LNTP was awarded to Prysmian by Samsung C&T as part of its EPC consortium with Jan De Nul Group. The new link, part of the strategic HVDC transmission system for the Abu Dhabi National Oil Company (ADNOC) Abu Dhabi National Energy Company PJSC (TAQA) Lightning Project, will allow bulk-power energy transmission between the converter station in Al Mirfa, in Abu Dhabi mainland, and that on the Al Ghallan offshore island.

The project involves the design, supply, accessories assembly and site acceptance testing of four HVDC 320 kV single-core cables with XLPE insulation that will connect the Al Mirfa onshore converter station to Al Ghallan, an artificial offshore island in the Arabian Gulf, located off the Abu Dhabi coast, in the United Arab Emirates. The project comprises both a subsea route of 124 km of submarine HVDC cables to be installed at water depth of up to 35 m and a land route of 3.5 km of HVDC land cables. The commissioning of the project is scheduled for 2025.

Under the LNTP, Prysmian shall perform engineering works, secure manufacturing capacity, proceed with partial production of the HVDC cables in advance of the full Contract Award and Notice to Proceed (NTP), scheduled for the third quarter of 2022 and remains subject to Samsung C&T receiving its related NTP under the Main EPC Contract.

"This is the largest HVDC submarine cable project in the Middle East, which confirms Prysmian's role as a partner of reference for power transmission projects in the region," stated Hakan Ozmen, EVP Projects, Prysmian Group.

Thanks to this new HVDC link, the energy currently generated offshore will be replaced by a green source and the energy generated onshore will reduce both the environmental impact and CO2 emissions, supporting ADNOC's objective to decarbonize its offshore production operations.

All HVDC submarine cables will be produced at Arco Felice, Italy, a Prysmian Group's center of excellence for the production of these type of cables, while the HVDC land cables will be manufactured at the Pikkala plant, Finland. The submarine fibre optical cables will be produced at the Nordenham plant, Germany, whilst Prysmian will leverage its in-house asset management and electronics portfolio to supply a range of cable monitoring solutions.

With regards to the full Contract Award and NTP scheduled for the third quarter of 2022, Prysmian is also expecting to enter into a parallel installation agreement with Jan De Nul Group for the submarine cable laying works, where the offshore installation activities will be performed by the Group's cutting-edge DP cable-laying vessel Leonardo da Vinci, with the shallow water activities being performed by the Group's advanced cable-laying barge Ulisse.

The state-of-the-art *Leonardo da Vinci* vessel will ensure time efficiency and CO2 emission reduction, further confirming the Company's ability to execute complex and complete installation projects.

NO-UK ACHIEVES RECORD-BREAKING 800GB/S LINE RATE WITH CIENA

NO-UK has achieved a record-breaking 800Gb/s line rate using Ciena's GeoMesh Extreme, powered by WaveLogic 5 Extreme coherent optical technology.

This will allow NO-UK to deliver its customers greater capacity, faster speeds and a greener offering through lower energy consumption.

NO-UK's open submarine cable system, featuring eight fiber pairs, runs for 700 km between Stavanger (Norway) and Newcastle (UK) and is the shortest low-latency direct submarine route between the two nations. The system was developed by Altibox Carrier, which owns and operates fiber-optic cables, and supplied by Xtera, a turnkey provider of subsea systems. The project is managed by specialist consultants SubSea Networks Ltd.

Altibox selected Ciena's GeoMesh Extreme, leveraging Ciena's WaveLogic 5 Extreme technology and 6500 Packet-Optical Platforms, supporting up to 35Tb/s per fiber pair—the highest capacity achieved to date across a repeatered submarine network. The design and cable validation exercise was conducted according to the new International Telecoms Union (ITU) submarine cable standard for open cables, known as ITU-T G.977.1.

Svein Arild Ims, Director at Altibox Carrier, said: "NO-UK has been developed to support the evolving requirements of businesses in Norway. We wanted it to deliver the highest bandwidth and capacity available across a submarine network in a sustainable way, and Ciena's GeoMesh Extreme, combined with Xtera's unique wide-bandwidth and low-noise repeater design, has achieved exactly that. The network has exceeded our expectations in every way and sets the standard for future connectivity between Norway and the UK."

Ian Clarke, Vice President of Global Submarine Solutions at Ciena, added: "Ciena continues to push the limits of submarine cable networks, achieving 800Gb/s line rate—another industry first. With more capacity and lower cost-per-bit, lower power consumption and lower ongoing operational costs, the solution provides a modern and environmentally friendly network for Altibox's NO-UK customers."

FIBERSENSE, SOUTHERN CROSS CABLE NETWORK ANNOUNCE CABLE MONITORING SOLUTION

Deep-tech fiber sensing company FiberSense and critical infrastructure owner Southern Cross Cable Network (SX) have announced successful testing of the world's first subsea cable monitoring service that can co-exist on a live traffic carrying fiber.

The FiberSense DigitalAsset™ Marine system is the first of its kind to proactively defend critical subsea assets. With increased range, the FiberSense DigitalAsset™ Marine service can easily cover the shore-end network, all the way from the cable landing station to the first repeater.

For SX, this enhanced 24x7 real-time monitoring would add significant protection, deterrence, and new maintenance advantages without the need to reserve scarce dark fibers. This innovative solution has now been rigorously field tested from our New Zealand cable station and is available from FiberSense for commercial release. Subsea telecommunication cables are vital—they carry the cloud and the internet between continents. Cable breaks are increasingly causing large enterprise, government and consumer disruptions with enormous total costs to the community. More cables are being built as the Internet/Cloud/SaaS demands sees exponential growth in data use that in turn presents steeply rising implications when an outage occurs.

"Submarine cable infrastructure is the only capital infrastructure that once deployed to the ocean floor is completely invisible from the surface. It has been that way since the first trans-Atlantic cable was installed in the 1850's. Today, around 70% of damage to submarine cables is due to anchor drag and fishing net trawling. High-risk areas are also found at cable protection zones and near landing stations where there is increased risk of multiple cables being taken out by the same event. For SX, implementing the FiberSense marine innovations across our marine plant shore ends, we can now see and mitigate a range of threats that were virtually impossible to detect before. These threats include cable strumming, cable un-earthing, anchor drag, fishing net drag, shunt fault location and subsidence. I predict that this will become the de facto standard for all marine cables over the next decade," said Dean Veverka, Director Networks & VP Operations, SX.

Founder and CEO of FiberSense, Mark Englund, said: "Dean Veverka and the SX team have a rich history in being at the vanguard of supporting new technologies into the submarine space. We are delighted to be partnering with SX in launching DigitalAsset™ Marine today. DigitalAsset™ Marine is a big deal for subsea cable resilience and maintenance. Being able to see for the first time these types of events in real time by location along the cable allows the cable operator to action mitigation strategies exactly where the risk is detected. The fact that our services run over existing live traffic paths opens up the potential for all existing telecommunications submarine cables with no spare capacity to be protected in this way. The maintenance implications have also turned out to be significant in the development of DigitalAsset™ Marine and alongside the protection and deterrence effects, we're really excited about the total impact this capability is going to have on resilience and maintenance of an increasingly vital piece of critical infrastructure like submarine cables across the oceans of the world."

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

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

GRID TELECOM PLACES CRETE ON INTERNATIONAL BROADBAND MAPS

Crete is placed with emphasis on the international broadband network maps, as Grid Telecom proceeds to assign formal names to its subsea fiber optic cables that connect the island with the Greek mainland, in parallel with the subsea electrical interconnections to Peloponnese and Attica regions.

With this move, which is of strategic importance and is aligned with international good practices, Grid Telecom, as a wholly owned subsidiary of the Independent Power Transmission Operator of Greece, increases the prospects of commercial exploitation of its state-of-the-art telecommunications infrastructure. At the same time, it enhances the "visibility" of the cables landing in Crete, promoting the island as a regional telecommunications hub, along the corridors of the international subsea cable systems, passing through the Mediterranean.

The double fiber optic cable system that connects Crete with the Peloponnese region, which is already in operation, has been assigned the names MINOAS-EAST and MINOAS-WEST. Accordingly, the double fiber optic cable system that has recently been installed between Pachi, Megara in the Attica region and Heraklion in Crete, in parallel with the electrical interconnection under construction, has been assigned the names APOLLO-EAST and APOLLO-WEST.

Utilizing the fiber optic cables of total length 940 km, interconnecting the island of Crete with the broadband networks in mainland Greece and other European destinations beyond, Grid Telecom accomplishes to add capacity of hundreds of Tbps for data transfer, through four geographically alternative routes.

In this way, Grid Telecom offers important telecommunications corridors of high capacity and reliability with diversity, further consolidating its position as a major carrier-neutral wholesale provider in Greece, creating the foundations for the development of digital infrastructure of strategic importance and great geopolitical value in Crete.

The Director of Grid Telecom, Mr. George Psyrris, said: "Our initiative to formally identify the subsea fiber optic cable systems landing in Crete with names inspired by the Greek mythology, increases visibility and recognition for these critical systems, significantly expanding prospects for their commercial exploitation, attracting new business partnerships with telecommunications organizations, inside and outside Greece. Grid Telecom, through an extensive optical network of high availability that exceeds 4,000 km, is constantly developing and expanding new alternative national and international systems, strengthening its position in the wholesale telecommunications market."

» *Nexans Aurora loading cable for the Crete-Attica system in December. (Photo credit: Nexans)*

UNCREWED TECHNOLOGY TO DEFEAT DEADLY SEA MINES

By George Galdorisi,
Director of Strategic Assessments and Technical Futures at the Naval Information Warfare Center Pacific

For centuries, sea mines have presented an affordable and effective option in naval warfare. That remains even truer today. However, what has become more concerning is the relatively recent use by terrorist groups and other non-state actors who have used sea mines—"weapons that wait"—to hazard commercial vessels and disrupt peaceful commerce on the oceans. Unless or until nations and navies can find a way to defeat deadly sea mines without putting sailors in harm's way inside a minefield, the unimpeded sea commerce that undergirds globalization will no longer be assured.

NOT A NEW CHALLENGE

Mine warfare is not new. Precursors to naval mines were first invented in Imperial China. The first plan for a sea mine in the West was drawn up by Ralph Rabbards, who presented his design to Queen Elizabeth I of England in 1574. Since the invention of the Bushnell Keg in 1776, mines have been an important instrument of naval warfare.

Modern naval mines were widely used for the first time over a century ago, during the Russo-Japanese war in 1904-1905, and again in World Wars I and II with great success. During Operation Desert Storm in 1990-1991, the threat of mines hazarded all coalition forces operating in the Arabian Gulf. Indeed, Operation Desert Storm highlighted the importance of mine warfare with the near catastrophic damage to USS *Samuel B. Roberts* (FFG 58), USS *Princeton* (CG 59) and USS *Tripoli* (LPH 10).

In terms of availability, variety, cost-effectiveness, ease of deployment, and potential impact on naval operations, mines are some of the most attractive weapons available. Today, more than 50 countries possess mines, of which 30 have demonstrated a mine production capability and 20 have attempted to export these weapons.

The use of sea mines adjacent to maritime choke points presents a threat that is at once ubiquitous and deadly. Mines represent one of the most vexing military challenges. Sea mines are hard to find, difficult

» *The U.S. Navy is evaluating several USV platforms, like the T38 Devil Ray, for a range of uncrewed missions. (Photo credit: Mr. Jack Rowley)*

to neutralize, and can present a deadly hazard to any vessel—even those ships specifically designed to hunt them.

NO LONGER NAVY VERSUS NAVY

In the past several decades, rogue states have indiscriminately employed sea mines. Libya used mines to disrupt commerce in the Gulf of Suez and the Strait of Bab el Mandeb. Iran laid mines to hazard military and commercial traffic in the Arabian Gulf and Gulf of Oman. Iran continues to threaten to use mines to stop commerce through the narrow Strait of Hormuz.

Today, the mine threat no longer comes from just sovereign nations, but from terrorist groups of all stripes. Within the past year, a Maltese-flagged tanker was damaged by a mine in the Yemeni port of Bir Ali, a mine in the Red Sea off the coast of Saudi Arabia exploded

» *The T38 features an aft-mounted tow station which can house either a mine-hunting sonar system or a mine neutralization system (MNS) ROV. (Photo credit: Mr. Jack Rowley)*

damaging a Greek oil tanker, a Singapore-flagged tanker berthed at Jeddah, Saudi Arabia was damaged by a mine, and an oil tanker off the coast of Iraq discovered a mine attached to its hull. More recently, the Arab Coalition announced that they have removed 157 naval mines placed in the south end of the Red Sea by Iran-backed Houthis.

In the modern-day context, there is only one way to completely nullify the threat that sea mines present to human life: leverage uncrewed technologies to hunt and destroy mines from a distance. In the past, unmanned vehicle technologies were not mature enough to be considered to take on the complex mine-hunting and mine-clearing task. Today they are, and commercial-off-the-shelf (COTS) technologies are at the forefront of providing such a solution.

NEAR-TERM, COTS, MCM SOLUTIONS

In a series of U.S. Navy and Marine Corps exercises over the past several years, unmanned surface vehicles (USVs) have been evaluated as potential mine-countermeasures (MCM) solutions that can be operated autonomously. These platforms were used to perform the "dull, dirty, and dangerous" work previously done by Sailors and Marines in the hazardous littoral zone.

One of the systems that performed well during these MCM events was the T38 Devil Ray USV. It is this USV that can be combined with surface and subsurface mine-hunting and mine-neutralizing equipment to provide an over-the-horizon "single sortie detect-to-engage" MCM capability.

The U.S. Navy is evaluating several USVs like the Devil Ray for potential use for a variety of missions, but most importantly, for MCM. One of the key attributes of this USV is the fact that the T38 has an aft-mounted tow station which can house either a mine-hunting sonar system or a mine neutralization system (MNS) remotely operated vehicle (ROV). These towed subsystems are installed on two rails aft to allow autonomous launch and recovery.

The single-sortie MCM mission will require two T38s to work in concert with each other. In a full minefield search scenario, multiple T38s with mine-hunting sonars will be supported by one or two T38s with the MNS neutralization payload. Additionally, both craft will have an onboard multi-beam sonar search capability to augment the towed vehicles.

The mine-hunting system is a commercial-off-the-shelf technology embodied in a towed-body-mounted sonar. Several available commercial sonars, both installed and in tow, for this mission have a resolution sufficient to search for mine-like objects (MLOs). An important feature these sonars possess is automatic target recognition to identify MLO anomalies.

The second component of a COTS MCM solution is the MNS ROV. Once the area search is complete, the MCM-MNS T38 joins the search and transitions from hunting to neutralizing through the launch of its tethered MNS ROV, which provides real-time video validation of mine-like objects. The MNS ROV autonomously executes the MLO route for final classification and man-on-the-loop validation of each MLO. This process is repeated until the field is cleared. This COTS-based MCM solution can perform sweeps 24/7/365 with minimal human intervention allowing for a safe and effective MCM solution.

THE FUTURE OF EFFECTIVE MCM

If nations and navies want to buy-down inherent technical risk and challenge the paradigm of long-cycle acquisition in the deadly serious business of MCM, it is time to field a near-term, uncrewed COTS solution. Once operators see this solution, we will be well on our way to fielding a system to defeat today's—and tomorrow's—mine threat.

To be clear, this is not a platform-specific solution, but rather a concept. When operators see a capability with *any* uncrewed COTS platforms in the water successfully performing the MCM mission, they will likely press industry to produce even more-capable platforms to perform the autonomous mine-hunting and mine-clearing task.

» *COTS-based MCM solutions like the T38 can perform sweeps 24/7/365 with minimal human intervention. (Photo credit: Mr. Jack Rowley)*

VESTDAVIT TO SUPPLY DAVITS TO FINNISH NAVY'S NEW COMBAT VESSELS

Persistence paid off for Vestdavit in winning its first order with the Finnish shipyard Rauma Marine Constructions (RMC) to supply davits for a series of the Finnish Navy's four newbuild multi-role combat vessels, thereby bolstering its position in the wider Nordic naval market.

The Pohjanmaa-class corvettes are to be constructed at RMC's shipyard in Rauma, Finland as part of the navy's $1.36 billion Squadron 2020 project to replace seven ageing vessels and each will be equipped with two of Vestdavit's high-specification davits.

The advanced warships, with a length of 114 m and beam of 16 m, have an ice-strengthened hull for work in ice-bound waters and will be deployed on a diversity of missions including anti-surface warfare, anti-air warfare, anti-submarine warfare, surveillance and mine-laying.

Consequently, they required efficient davits with a high level of reliability and redundancy for rapid-response launch and recovery of interceptor and life-saving boats intended for such tasks.

» *Vestdavit will supply a total of eight telescopic davits to the four corvettes being constructed for the Finnish Navy. (Photo credit: Finnish Defense Forces)*

"Adaptability to work in harsh environments with high sea states and compliance with shock requirements were important criteria in winning this major davit award on one of the Finnish Navy's biggest newbuild projects to date," said Vestdavit area sales manager Martin Sundgot Hansen.

"It is very positive for us to be chosen to supply davits for an entire new class of ship and demonstrates both RMC's and the navy's confidence in our ability to deliver mission-critical equipment."

Early-phase work

Vestdavit will supply a total of eight high-performing telescopic davits for the corvette quartet. The groundwork for this key davit contract was actually laid around four years ago when Vestdavit first started working with RMC on the project, according to Hansen.

"Being able to enter the project at an early stage has enabled us to better understand the navy's davit requirements on the newbuilds and tailor davit designs according to its specific needs," he added.

Hansen mentioned RMC required an "extensive volume" of information on davit specifications in advance of the contract award and Vestdavit was able to call on its available resources based on an extensive track record of similar naval deliveries over the past three decades.

"These deliveries have enabled us to develop standardized documentation for RMC and this gives us a competitive advantage as we can provide the required information without prolonging the preliminary contractual process. Investing these resources in the early phase provides confidence for RMC that we can deliver a turnkey solution in line with the proposed cost and workscope, which saves time both in the vessel planning and construction phases."

The contract will also require Vestdavit to establish a service base in Finland to support this delivery, as well as further possible orders in the wider Nordic region.

HII COMPLETES INITIAL SEA TRIALS OF VIRGINIA-CLASS SUBMARINE MONTANA (SSN 794)

Huntington Ingalls Industries (HII) recently announced the successful completion of the initial sea trials of fast-attack submarine *Montana* (SSN 794). The *Virginia*-class submarine, built at HII's Newport News Shipbuilding division, spent several days at sea to test the ship's systems and components.

Testing included submerging the submarine for the first time and high-speed maneuvers while on the surface and submerged. HII teams will continue the testing program and will deliver the boat to the U.S. Navy later this year.

"We are very proud to say the *Montana* and her crew performed exceptional," said Jason Ward, Newport News Shipbuilding vice president of *Virginia*-class submarine construction. "Taking the ship to sea for the first time is a huge milestone for everyone involved. The crew, thousands of suppliers from around the country and shipbuilders from HII and Electric Boat can be proud the ship was successfully brought to life and will soon be part of the world's greatest Navy."

Construction of *Montana* began in 2015. The boat—the 21st *Virginia*-class submarine built as part of the teaming partnership with General Dynamics' Electric Boat—was christened in September 2020.

BAE SYSTEMS AWARDED MAJOR CONTRACT FROM US MARINE CORPS

The U.S. Marine Corps has awarded BAE Systems a contract modification for the second lot of full rate production of Amphibious Combat Vehicles (ACVs). The contract award of US$169 million is for 33 vehicles.

The ACV is proven and highly mobile, capable of conducting rapid ship-to-objective maneuvers and delivering enhanced combat power to the Fleet Marine Forces. Developed with teammate IVECO Defense Vehicles, the ACV represents the optimum balance of sea and land mobility and survivability, with future growth potential.

"BAE Systems is dedicated to helping the Marines meet their expeditionary and Force Design 2030 needs," said John Swift, director of amphibious programs at BAE Systems, referring to the Marine Corps' force structure goal for combat operations in a rapidly-evolving future environment. "This follow-on contract is a testament to our commitment of getting this critical capability to the warfighter and supporting the Marine Corps' priorities."

BAE Systems is already under contract to deliver two variants of the ACV Family of Vehicles to the Marine Corps: the ACV personnel variant (ACV-P) and the ACV command variant (ACV-C). The company has also received a design and development contract for a 30-mm cannon variant (ACV-30), and a recovery vehicle (ACV-R) is also planned. In addition, BAE Systems has received task instructions from the U.S. Marine Corps to complete a study of incorporating Advanced Reconnaissance Vehicle Command, Control, Communication and Computers/ Unmanned Aerial Systems mission payload into an Amphibious Combat Vehicle (ACV) variant.

» *Amphibious Combat Vehicles (ACVs). (Image credit: BAE Systems)*

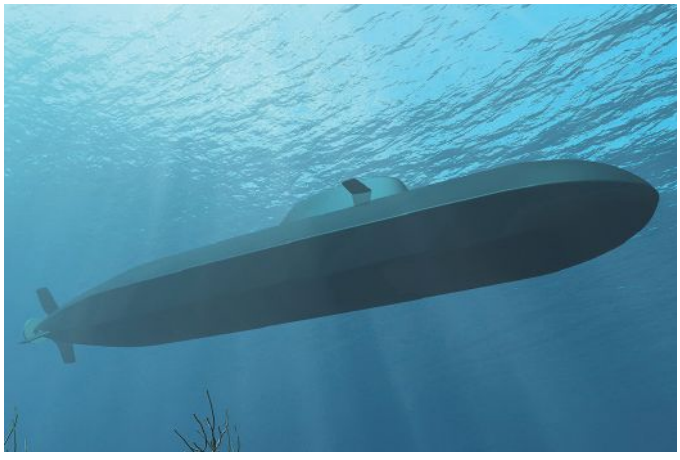
BAE Systems was awarded the first full-rate ACV production Lot 1 contract option in December 2020 for the first 36 vehicles and the second option in February of 2021 for an additional 36 vehicles. Earlier this fall, the ACV team delivered the 100th Low-Rate Initial Production (LRIP) ACV to the Marine Corps and is on schedule to complete LRIP deliveries by January 2022, as ACV fielding to the Fleet Marine Forces continues on time and budget.

HENSOLDT EQUIPS NORWEGIAN AND GERMAN SUBMARINES WITH NEXT-GENERATION OPTRONICS SUITE

Sensor solutions provider HENSOLDT is equipping the German-Norwegian submarine project U212 CD with a fully digital sensor suite. The optronics division of HENSOLDT has now received a corresponding order worth over 50 million euros from kta naval systems, a consortium of Kongsberg, thyssenkrupp Marine Systems and Atlas Elektronik. The order comprises six optronic systems, consisting of an OMS 150 optronic mast system, an OMS 300 and an i360°OS panoramic surveillance system for each of the six submarines of the Norwegian and German navies. With the twin optronic mast solution, the clients opted for the technological leap from the conventional, traditional direct view of a periscope system to a completely hull-penetrating digital system solution.

HENSOLDT Optronics Managing Director Andreas Hülle said: "This combination provides the new submarines with sensor equipment that combines the highest detection capabilities even in poor visibility with a high degree of automation, thus significantly improving the boats' ability to act and survive."

The combination of OMS 150 and OMS 300 is being commissioned for the first time for the U212 CD class. The OMS 150, in its multispectral version, will be used as a search and surveillance optronic mast. The OMS 300 stealth optronic mast takes over the so-called "attack" function. With the OMS 300, the developers at HENSOLDT have created an optronic mast that is difficult to detect visually and via radar, which significantly increases the safety of the crews. This multispectral optronic equipment provides the crew with the best visibility in all light and weather conditions, as well as a very wide range of operations. With this order from kta, HENSOLDT Optronics is further expanding its research and development in the field of optronic masts at the Oberkochen site.



» *HENSOLDT equips the German and Norwegian submarines of the kta consortium with a fully digital sensor suite. (Photo credit: tkms)*

ISRAEL ORDERS THREE NEW SUBMARINES FROM THYSSENKRUPP MARINE SYSTEMS

thyssenkrupp Marine Systems has reached an agreement with the Israeli Ministry of Defense on the framework conditions for the purchase of three Dakar-class submarines. After extensive negotiations, all parties involved agreed to the technical content and contractual provisions on Thursday.

Dr Rolf Wirtz, CEO thyssenkrupp Marine Systems: "We, as thyssenkrupp Marine Systems and Germans, are honored and proud to continue the long cooperation—spanning decades—with the Israeli Ministry of Defense and the Israeli Navy. The new class of submarine will provide Israel with the most advanced capabilities, based on an innovative, cutting-edge technology.

This agreement demonstrates the deep commitment of thyssenkrupp Marine Systems to guarantee Israel's long-term security. It was signed after a thorough and extensive groundwork process, and I would like to thank our partners in the Ministry of Defence and the Israeli Navy for their commitment and professionalism."

The Dakar class will be of a completely new design, which is to be specifically engineered to fulfil the operational requirements of the Israeli Navy. The three submarines will replace the first batch of Dolphin-class submarines.

"In the last joint project with the Israeli Navy, the SA'AR-6 project, we delivered four corvettes on time and within budget. In this respect, we are very much looking forward to working with our longstanding partner again," added Wirtz.

Before the contract comes into effect, thyssenkrupp Marine Systems will have to hold intensive talks with its suppliers.

In preparation for the expected order, thyssenkrupp had already agreed to investments of about 250 million euro for thyssenkrupp Marine Systems in 2019. Kiel is thus securing its location as an international center of competence for conventional submarine construction. Construction of a new shipbuilding hall and a fuel-cell production facility is already visible on the shipyard site.

» *thyssenkrupp Marine Systems has reached an agreement inks contract with the Israeli Ministry of Defense. (Photo credit: thyssenkrupp Marine Systems)*

» *DIVE-LD is a modular and customizable AUV that can be optimized for a variety of defense and commercial. (Photo credit: Dive Technologies)*

ANDURIL INDUSTRIES ACQUIRES DIVE TECHNOLOGIES

Defense technology company Anduril Industries has acquired Boston-based start-up Dive Technologies, a pioneer in autonomous underwater vehicles (AUVs). This acquisition expands Anduril's suite of autonomous systems, extends its unmanned capabilities to the undersea domain, and significantly accelerates the company's strategic growth.

Dive Technologies enables safe and successful access to the greatest depths of the world's oceans with reliable flexible AUVs. Their industry-leading DIVE-LD is a modular and customizable AUV that can be optimized for a variety of defense and commercial mission types such as long-range oceanographic sensing, undersea battlespace awareness, mine countermeasures, anti-submarine warfare, seabed mapping and infrastructure health monitoring.

"The world beneath the ocean is completely different than the one above. It requires different types of sensors, modalities and problem solving than the work we are doing in, land and space," said Anduril co-founder and CEO Brian Schimpf. "The Dive Technologies team brings unparalleled, deep domain expertise under the sea as well as a shared commitment to transforming US and allied military capabilities with advances technology. We are thrilled to have them onboard".

Dive utilizes Large Format Additive Manufacturing (LFAM) techniques and a novel system architecture to rapidly produce the DIVE-LD at a fraction of the time and cost of existing AUVs. Once integrated into Anduril's autonomy software, Lattice OS, the next iteration of DIVE-LD will further disrupt this segment of the market.

"We built Dive to make undersea exploration safer, smarter, and cheaper, and to offer customers the highest level of customization. In four years, we reinvented AUVs by building a new system architecture from the ground up and bringing 3D printing to subsea robotics," said Dive Technologies co-founder and CEO Bill Lebo. "With Anduril, we will rapidly scale our team, technology, and production to ensure our military partners have the best, most strategic advantage and our commercial customers have the most reliable tech in the greatest depths of the world's oceans."

USCG LEVERAGES THE SAIL-PLAN PLATFORM

SailPlan, the maritime cleantech company that helps ports and ship operators reduce emissions and improve air quality, announced that the United States Coast Guard (USCG) has partnered with SailPlan to monitor Aids to Navigation (ATONS) in the Chesapeake Bay. By utilizing SailPlan's technology, the USCG can easily monitor real-time high-resolution weather, air quality, and other data affecting navigation and make it available to mariners while reducing the cost of ATON maintenance to the USCG.

The deployment is part of SailPlan's rapidly expanding portfolio of customers seeking to accelerate the connectivity of marine infrastructure and systems. The agreement provides a testbed for real-time monitoring and sharing of weather, current, tide, sea state, and air quality data while also providing real-time station-keeping data to the USCG.

"The U.S. Coast Guard is pleased to join SailPlan in this project as this work supports the worldwide "Successful Voyages, Sustainable Planet" effort led by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)," said Dave Lewald, Program Analyst—Navigation Systems, USCG.

SailPlan and the USCG will collect data, perform studies, and increase infrastructure resilience while reducing ATON maintenance costs. The deployed technology will ensure that critical marine infrastructure remains on-station and in good working order without the need for routine in-person inspections.

» *SailPlan's technology will help the USCG monitor real-time high-resolution weather, air quality, and other data affecting navigation. (Photo credit: SailPlan/USCG)*

"ATONs present a compelling opportunity to improve maritime transportation efficiency and resiliency by providing them with a digital presence. This contract with the USCG brings legacy marine infrastructure into the 21st century," said Jacob Ruytenbeek, Founder and CEO of SailPlan. "SailPlan will benefit not only the USCG but also port authorities looking to monitor emissions compliance and air quality."

STEALTH MARINE TECHNOLOGY COMPANIES WINNERS OF THE NAVY'S HACKTHEMACHINE UNMANNED COMPETITION

Composite Energy Technologies, Inc. ("CET") recently announced a joint success with Spear AI and Current Lab after being named winners of the Navy's HACKtheMACHINE Unmanned competition, sponsored by the Office of Naval Research (ONR), multiple naval program executive offices, and industry partners.

HACKtheMACHINE Unmanned offers a unique digital experience where Navy and leading-edge technologists from across the public and private sectors work together to develop innovative approaches to complex problems and build lasting networks for real solutions to address critical challenges of our time. HACKtheMACHINE Unmanned builds on efforts by the Navy's 2021 Unmanned Task Force to develop and integrate unmanned and autonomous technology at scale.

CET is a global authority on enterprise quality engineering, manufacturing, and integration solutions for long endurance carbon fiber Unmanned Underwater Vehicles (UUVs). During the competition, Spear AI developed a Reinforcement Learning model to test Navy Force Packages and CET delivered a working visual representation of this RL Environment.

Chase Hogoboom, President of CET, said: "The transformation from digital to real life is a complex undertaking that is accelerated by accurate visualization of data. The partnership with Spear AI yields unique multidisciplinary results by merging expertise in artificial intelligence and real-world operations. Our success depended upon knowledge of best-in-class technology solutions and best-in-class capabilities to provide an effective integration and deployment of a complex model." Hogoboom went on to say that CET's motivation to "develop a solution for HACKtheMACHINE was driven by our vision for performance and functional application of Navy technologies and partnering with other talent to provide integrated solutions. CET's ability to rapidly integrate and configure technologies and systems is incredible and a testament to this company's talent and skill to apply our expertise."

Participating and winning HACKtheMACHINE has allowed CET and its partners in the competition, Spear AI and Current Lab, to accelerate their current commercial applications. CET has been working on the research, design, engineering, integration, and manufacturing of Unmanned Underwater Vehicle (UUV) hull structures, systems, and components since 2008. The company's work has focused on operational environments, including littoral, full ocean depth, and sub-polar ice cap, and winning HACKtheMACHINE demonstrates CET's capability of bringing the digital world to reality.

IARPA SELECTS BAE SYSTEMS TO ADVANCE MACHINE LEARNING TO ASSURE DATA SECURITY

BAE Systems has been awarded a US$14 million contract from the Intelligence Advanced Research Projects Activity (IARPA) to develop tools to decipher an ever-growing number of radio frequency (RF) signals in order to quickly and accurately help secure mission-critical information.

BAE Systems will advance machine learning and artificial intelligence technology and techniques to identify signals in the RF spectrum under the terms of the contract, which is part of the Securing Compartmented Information with Smart Radio Systems (SCISRS) program. The technology will provide enhanced situational awareness, help to target threats, and secure communications against malicious attacks.

"In uncontrolled environments, secure communications can be jeopardized by RF signals that are almost impossible to manually find and identify in real time," said Scott Kuzdeba, chief scientist for BAE Systems' FAST Labs™ research and development organization. "Our technology will identify RF signals in increasingly crowded electromagnetic spectrum environments, providing commercial or military users with greater automated situational awareness of their operating environment."

Intelligence Community and Department of Defense missions require that information and data be securely generated, stored, used, transmitted, and received. This needs to be the case even when originating in unsecured and uncontrolled environments. The goal of the SCISRS program is to develop smart radio techniques to automatically understand these environments in order to enable securing our data, including detecting and characterizing complex RF anomalies and unexpected signals. The specific types of anomalies include hidden, altered, or mimicked signals, and abnormal unintended emissions.

DARPA SELECTS PERATON LABS TO CREATE MULTI-DOMAIN NETWORK ORCHESTRATION SOLUTION

Peraton Labs has been awarded a contract under the Defense Advanced Research Project Agency's (DARPA) Mission-Integrated Network Control (MINC) program to design, develop, integrate, test, and evaluate a multi-domain network orchestration solution.

The solution will enable real-time, autonomous discovery and configuration of interconnected military networks and support on-demand connectivity in the most challenging tactical environments. The contract is worth up to $20 million over a 42-month period.

The goal of MINC is to ensure that critical data finds a path to the right user at the right time in highly contested, highly dynamic, and heterogeneous communications environments. Peraton Labs' solution will replace static configuration of individual tactical networks with automated, mission-driven, and secure control across diverse networks of networks.

"Peraton Labs will develop and deliver an automated network discovery and control solution that can dynamically compose data pathways across multiple warfighting and networking domains to support missions in all-domain warfare," said Petros Mouchtaris, Ph.D., president, Peraton Labs. "With intelligent, mission-driven control and the ability to interoperate across a heterogeneous mix of legacy and future systems, our solution will provide reliable communications capability to our warfighters."

Peraton Labs' solution will orchestrate control across all available resources – communications, compute, and storage – by combining novel technologies, including:

- A secure, always-on control overlay to discover network resources
- A distributed orchestration framework that reasons over battlespace resources
- A framework for automatically translating mission intent to networking objectives, and
- An intuitive, flexible interface to deliver rapid situational intelligence and reduce the cognitive load on operators.

A critical part of this work effort will be to develop a software development kit to provide for the sustained development of "MINC-enabled applications" beyond the program.

"To build this capability, Peraton Labs leverages deep expertise and extensive experience in machine learning, virtualization, software-defined networking, and tactical communications," said Mouchtaris. "Our solution will not only enable joint all-domain operations, but also provide a "leave-behind" capability for continued development, integration, and use by third parties."

AMERICAS

Floating Wind Solutions
Houston, TX » March 1-3
https://floatingwindsolutions.com/fws-22/

Caribbean Oil & Gas Virtual Summit (CARIVS)
Virtual » March 15-16
https://carivs.com/

AUVSI XPONENTIAL
Orlando, FL » April 25-28
https://www.auvsi.org/events/xponential/auvsi-xponential-2022

International Partnering Forum (IPF)
Atlantic City, NJ » April 26-28
https://www.offshorewindus.org/2022ipf/

Offshore Technology Conference (OTC)
Houston, TX » May 2-5
https://2022.otcnet.org/

Canadian Hydrographic Conference
Ottawa, Canada » June 6-9
https://www.chc2022.org/en

US Floating Wind
San Francisco, CA » June 7-8
https://reutersevents.com/events/offshore-wind/content-san-francisco.php

H2O Conference
Halifax, Nova Scotia » June 14-16
https://www.h2oconference.ca/

US Offshore Wind
Boston, MA » July 18-19
https://reutersevents.com/events/offshore-wind/content-boston.php

EUROPE

Seabed Mapping & Inspection
Geilo, Norway » March 9-11
https://www.tekna.no/en/events/seabed-mapping-and-inspection-2022-42041/

Oceanology International
London, UK » March 15-17
www.oceanologyinternational.com

WindEurope
Bilbao, Spain » April 5-7
https://windeurope.org/annual2022

MCE Deepwater Development
London, UK » April 12-14
https://mcedd.com/

Deep Sea Mining Summit
London, UK » April 26-27
https://deepsea-mining-summit.com

World Dredging Congress (WODCON)
Copenhagen, Denmark » May 16-20
https://wodcon2022.org/

Submarine Networks EMEA
London, UK » May 17-18
https://www.terrapinn.com/conference/submarine-networks-world-europe/index.stm

EEEGR Southern North Sea
Norwich, UK » May 25-26
www.eeegr.com/events/sns2022/

Undersea Defence Technology (UDT)
Rotterdam, The Netherlands » June 7-8
www.udt-global.com

OTHER REGIONS

OTC Asia
Kuala Lumpur, Malaysia » March 22-25
https://2022.otcasia.org/

Telecoms World Middle East
Dubai » May 24-25
https://www.terrapinn.com/conference/telecoms-world-middle-east/index.stm

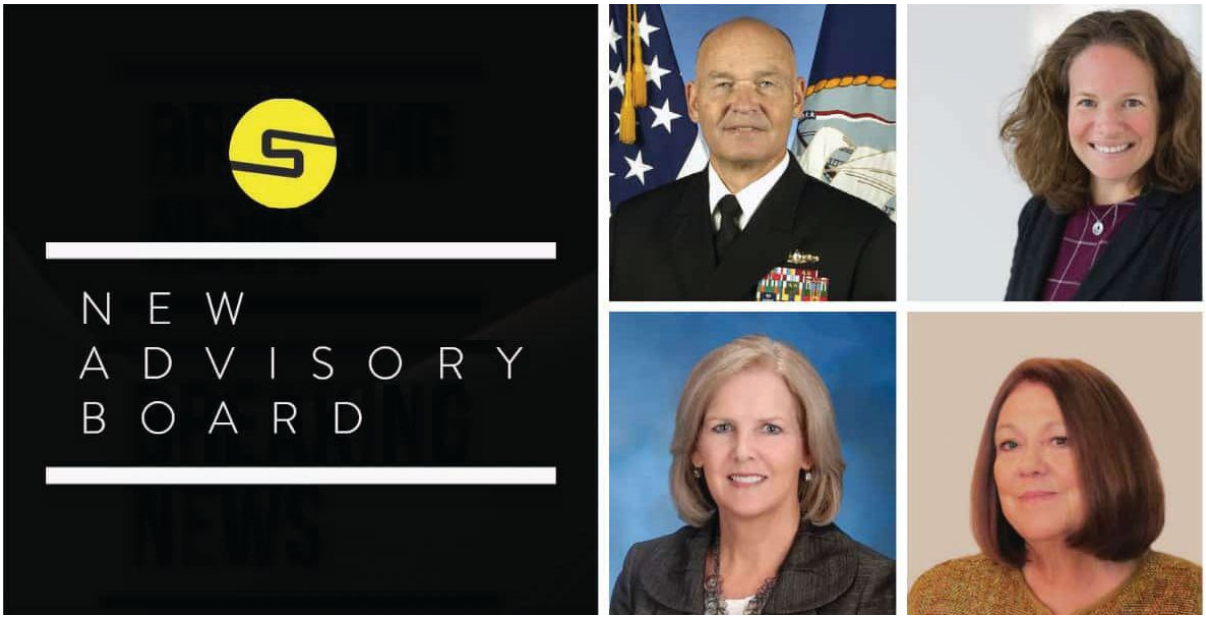
Submarine Networks World
Singapore » September 7-8
https://www.terrapinn.com/conference/submarine-networks-world/index.stm

Mediterranean Offshore Conference
Alexandria, Egypt » October 18-19
www.moc-egypt.com

Telecoms World Asia
Bangkok » November 2-3
https://www.terrapinn.com/conference/telecoms-world-asia/index.stm

MONTH & DEADLINES	EDITORIAL FOCUS & SHOW DISTRIBUTION	CONTENT FOCUS & PRODUCT/SERVICE
JANUARY **Editorial:** Dec. 17 **Ad:** Jan. 13	» **Uncrewed Surface Vehicles** Floating Wind Solutions / March 1-3 Oceanology International / March 15-17	**Content Focus:** Remote Marine Operations, Force Multiplication, Ocean Research, Search & Rescue, Tooling **Product/Service:** A/USV manufacturers, multibeam echosounders, side scan sonars, control systems, thrusters, positioning systems, thermal cameras, communication systems
FEBRUARY **Editorial:** Jan. 24 **Ad:** Feb. 10	» **Naval Defense & Security** Undersea Defence Technology / June 7-9	**Content Focus:** Intelligence, Surveillance & Reconnaissance (ISR), Mine Countermeasures (MCM), Harbor Security, Anti-Submarine Warfare (ASW) **Product/Service:** AUVs, USVs, marine robotics, search and rescue technologies, underwater tracking & communications
MARCH **Editorial:** Feb. 21 **Ad:** Mar. 10	» **21st Century Marine Survey** AUVSI XPONENTIAL / April 25-28 IPF / April 26-28 OMAE / June 5-10 💻 H2O Conference / June 14-16	**Content Focus:** Hydrographic Survey, Sensor Innovation, Research Vessels **Product/Service:** Sensor manufacturers, UAVs, multibeam echosounders, sonars, software & analytics, deck handling equipment, survey companies, research vessels
APRIL **Editorial:** Mar. 21 **Ad:** Apr. 07	» **Green Energy** US Offshore Wind / July 18-19	**Content Focus:** Renewable Offshore Energy (Wind, Solar, Tidal & Wave), Green Hydrogen, Power Storage Supply Chain **Product/Service:** Offshore wind supply chain, alternative offshore energy technologies, subsea batteries, hydrogen powered vessels
MAY **Editorial:** Apr. 18 **Ad:** May 05	» **Subsea IMR Technology** Canadian Hydrographic Conference June 6-9	**Content Focus:** Shore-based Command Systems, Subsea Residency, Digital Twins **Product/Service:** AUVs, ROVs, robotic tooling, buoyancy materials, cameras & lighting, pressure sensors, propellers, tethers, simulation software
JUNE **Editorial:** June 06 **Ad:** June 23	» **Oceanography** Dredging Summit & Expo / July 25-28	**Content Focus:** Data Collection, Transmission & Communication, Data Analytics & Software Platforms **Product/Service:** Buoys, drifters, acoustic modems, releases & transponders, magnetometers, subsea cables, connectors, weather stations
JULY **Spotlights:** June 14 **Ad:** July 11	» **Uncrewed Vehicles Buyers' Guide** 💻	**Content Focus:** Special Edition
AUGUST **Editorial:** July 25 **Ad:** Aug. 11	» **Submersibles & The Deep Sea**	**Content Focus:** Deep-sea Exploration, Seafloor Archaeology, Deep-sea Science, Ocean Mining **Product/Service:** Crewed submersibles, support vessels, mining machines, geotechnical technologies
SEPTEMBER **Editorial:** Aug. 22 **Ad:** Sep. 08	» **Artificial Intelligence & Remote Marine Operations**	**Content Focus:** Swarm Technology, Control Systems, Automation, Ocean Health, Maritime Efficiency **Product/Service:** Uncrewed vehicles, simulation & modelling platforms, cloud-based data analytics
OCTOBER **Editorial:** Sep. 19 **Ad:** Oct. 06	» **Offshore Energy**	**Content Focus:** Sector Diversification, Seabed IMR, Sensor Innovation, HSSE, Decommissioning, Oil Spill Response, Renewables **Product/Service:** Marine survey, oil spill response, renewable energy technologies, geotechnical services
NOVEMBER **Editorial:** Oct. 17 **Ad:** Nov. 03	» **Underwater Imaging**	**Content Focus:** Bathymetric Mapping, IMR, Habitat Characterization, Acoustic Sensing **Product/Service:** Observation ROVs, AUVs, cameras, lights, diving innovation, tracking & positioning systems, optical and acoustic sensors
DECEMBER **Editorial:** Nov. 14 **Ad:** Nov. 18	» **The Future of Ocean Technology**	**Content Focus:** Special Edition

💻 Digital Issue



SEA MACHINES ANNOUNCES NEW STRATEGIC ADVISORY BOARD

Boston-based Sea Machines Robotics, a leading developer of autonomous command and control systems for commercial vessels, has announced the formation of a strategic advisory board made up of internationally recognized industry leaders who will bring vast experience and valued guidance to the company. Continuing the company's rapid pace of growth, Sea Machines will rely on this board as it develops new products and creates high-profile partnerships that are firmly establishing the company as the leading developer of autonomous and advanced perception systems for boats and ships.

Sea Machines' advisory board is made up of the following respected leaders, who each bring a wealth of knowledge and decades of real-world experience to the company. They include:

• Rear Admiral Mark Buzby, administrator of the U.S. Maritime Administration (MARAD) and retired rear admiral U.S. Navy: "I chose to participate in this board because I have a long-standing interest in fostering and improving the maritime industry in ways that make it safer and more efficient for our seafarers and more able to serve our nation," said Buzby.

• Kathleen Haines, independent director of Genco Shipping & Trading Limited and principal of Holbridge Capital Advisors: "It's important for our industry to embrace challenges head on, which include lowering our carbon imprint, attracting the best and brightest talent, and making our industry safer," said Haines.

• Denise Kurtulus, vice president of global marine business, Rolls-Royce business unit Power Systems: "Because Rolls-Royce is partnering with Sea Machines strategically and long-term, we as a company also wanted to support it to be successful," said Kurtulus.

• Rear Admiral Mary E. Landry, director at Norwegian Cruise Line Holdings, Ltd. and United Services Automobile Association (USAA), as well as retired rear admiral U.S. Coast Guard: "We need more cutting-edge technologies and innovation to meet the demands that are here now and ahead of us," said Landry. "Sea Machines is ready to add tremendous value and capabilities to fill a gap that exists in areas such as human factors engineering, fuel efficiency, and waterways management and safety."

Immediate priorities for the board members include providing real-world feedback for product development and positioning; direction on market challenges and opportunities; and forward-thinking counsel on the company's larger goal of developing an innovative network of autonomous and connected vessels that will revitalize the oceanic supply chain.

"I am honored to welcome these industry leaders to our advisory panel," said Sea Machines' CEO Michael G. Johnson. "Formation of the panel is a direct reflection of our commitment to embedding practical and forward-thinking expertise into not only our product development processes, but also on all matters pertaining to the growth of the company and technology sector. I have full confidence that this team will provide diverse and valuable guidance as we continue our work in transforming the maritime industries with modern technology."

EC-OG PREPARES FOR GROWTH WITH NAME CHANGE TO VERLUME

EC-OG, an intelligent energy management and storage technologies specialist, has changed its name to Verlume to prepare for large-scale growth at pace and emphasise its position as a clean technology leader, having delivered energy transition projects since 2013.

As part of a strategic evolution, the brand refresh highlights the company's capability to deliver decarbonization through intelligent energy management in a range of energy sectors including underwater, offshore and onshore.

Having built a strong reputation for innovation and commercialization of clean energy technologies, the new Verlume brand provides a platform for further growth into domestic and international markets. The company has a growing global customer base, most recently delivering the first commercial Halo battery energy storage system for a world-first autonomous offshore power sea trial off the coast of Hawaii. The testing at the US Navy Wave Energy Test Site will begin later this quarter.

Richard Knox, managing director and founder of Verlume said: "Our new name serves as a signpost for our clean-tech ambitions, demonstrating how our core technologies of intelligent energy management and storage can be applied across various sectors.

"We were ahead of the curve with our team's passion for the energy transition beginning back in 2013 when the company was founded. Changing our name to Verlume emphasises our continued commitment to being a front-runner in sustainable solutions to build the future of energy."

Bob MacDonald, chairman of Verlume added: "Verlume is poised for a rapid period of growth and the new name reflects the business' goals and drivers as the energy mix changes. With the company's extensive track record, I look forward to the completion of more industry-first projects around the globe under the new brand name."

» *Verlume leadership team. Sitting L-R: Sharon McGinty, Richard Knox, Paul Slorach. Standing L-R: Bob MacDonald, Jonny Moroney. (Photo credit: Verlume)*

Verlume's flagship Halo product is a scalable, modular battery energy storage system with integrated intelligent energy management, specifically developed for clean energy delivery in the demanding underwater environment. The technology is shortlisted in the Innovation and Technology category at the upcoming Global Underwater Hub Subsea Expo Awards 2022.

SURVITEC'S SEAHAVEN LIFEBOAT SYSTEM SUCCESSFULLY PASSES HEAVY WEATHER SEA TRIALS

Survitec's award-winning Seahaven Advanced Evacuation System has successfully passed heavy weather sea trials (HWST).

Seahaven was deployed from EDT Jane, an 80-m offshore support vessel. The test was carried out in line with the SOLAS requirements for Novel Appliances which requires the test to be performed in conditions that do not drop below six on the Beaufort Scale.

Key representatives from leading classification society Lloyd's Register were in attendance, with observers from UK MCA also onboard the vessel.

Seahaven, a novel lifeboat system that offers Helical slide-based mass evacuation from large passenger vessels, passed the rigorous HWST program.

This is a huge step forward in the critical development of Seahaven which brings this game-changing cruise evacuation system one step closer to full market introduction.

Ron Krisanda, Executive Chairman, Survitec, said: "This is a major milestone in the development of cruise safety technology.

» *Survitec's award-winning Seahaven Advanced Evacuation System passes heavy weather sea trials. (Photo credit: Survitec)*

Passing HWSTs demonstrates that Seahaven has exceeded the highest safety performance standards."

The two craft system has a total capacity of 1,060 persons and can travel independently at six knots for 24 hours.

Survitec now looks ahead to the next steps of this project, working with its customers on the introduction of this game-changing solution to their operations.

The Survitec team will be available at this year's Seatrade Miami, 25 – 28 April 2022, stand no. 4226, to meet with cruise operators and discuss the introduction of Seahaven.

» *Jochen Eickholt, Siemens Gamesa's New CEO*

JOCHEN EICKHOLT TO REPLACE ANDREAS NAUEN AS CEO OF SIEMENS GAMESA

Siemens Gamesa Renewable Energy has appointed Jochen Eickholt, a member of the executive board at Siemens Energy as its Chief Executive Officer. Eickholt will take the reins at Siemens Gamesa on March 1, replacing Andreas Nauen.

"Siemens Gamesa is experiencing significant challenges in its Onshore business in a very difficult market and we have appointed an executive with a strong track record in managing complex operational situations and in successfully turning around underperforming businesses," said Miguel Angel López, Chairman of the Board of Directors of Siemens Gamesa. "The Board would like to thank Andreas for his considerable efforts as CEO as well as for his previous leadership of the Offshore business, which continues to lead the global market."

Jochen Eickholt joined the Siemens Energy executive board in January 2020 where he is responsible for the Power Generation and Industrial Applications businesses as well Asia-Pacific and China. During a career with Siemens spanning more than 20 years Eickholt has held a number of senior management positions including Chief Executive Officer of Siemens Mobility and Chairman and Managing Partner of the Siemens Portfolio Companies.

He studied electrical engineering at the RWTH Aachen in Germany and at the Imperial College of Science, Technology and Medicine in London. After receiving his engineering degree, he went on to earn his doctorate at the Fraunhofer Institute for Production Technology.

Despite the current challenges, the Board of Directors remains convinced by the long-term prospects and value creation potential of Siemens Gamesa. With an order backlog of more than €33 billion, leadership in the growing Offshore market and a strong Service business the company is well positioned for future success. The priority remains to turnaround the Onshore unit.

GTMARITIME GUIDE SETS OUT FUTURE OF MARITIME COMMUNICATIONS

GTMaritime, a leading provider of secure data communications software to the maritime industry, has released a new publication which offers a guide to the background, current state and future development of satellite connectivity and communications at sea.

Available to download free of charge, the Maritime Communications — A look over the horizon guide is split into three sections, covering Basics of Marine Communications, The Connected Ship and Special Services. It examines the different types of satellite systems and network configurations, regulatory requirements, commercial communications and crew connectivity, and highlights key considerations for future communications planning.

Mike McNally, Global Commercial Director at GTMaritime, said: "The GTMaritime guide to maritime communications provides ship owners and operators with comprehensive insights into the full spectrum of connectivity and communications considerations at sea. As the maritime industry continues to become increasingly connected, it is important to have a thorough understanding of satellite communications and the opportunities greater connectivity can bring to a range of operations at sea."

The guide offers perceptive commentary on the impact greater connectivity will have on the maritime sector, considering issues such as cybersecurity, performance monitoring and remote operations. It also looks at the role communications systems can play in online training for crew on-board and the advantages enhanced connectivity can have in areas such as telemedicine.

"Already we are seeing huge increases in the amount of data being transmitted between ship and shore," added McNally. "As technology continues to expand into new areas of ship systems, there is a need for greater connectivity and satellite bandwidth to ensure communications systems can cope with the volume of data being transmitted. A comprehensive understanding of ship to shore connectivity today and tomorrow is fundamental to planning for the future needs of our industry, and essential for meeting its aims on ship efficiency, safety and compliance."

» *Mike McNally, Global Commercial Director at GTMaritime.*

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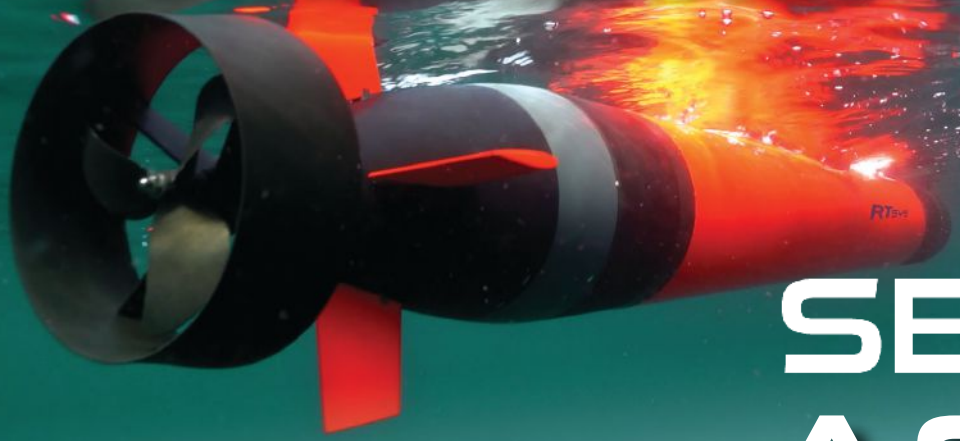

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