MARINE TECHNOLOGY REPORTER

March/April 2026
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PORT & HARBOR SECURITY

DEFENSE FROM ABOVE AND BELOW

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AI for Maritime Training
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Oceanology International 2026
Product Roundup

Volume 69 Number 3

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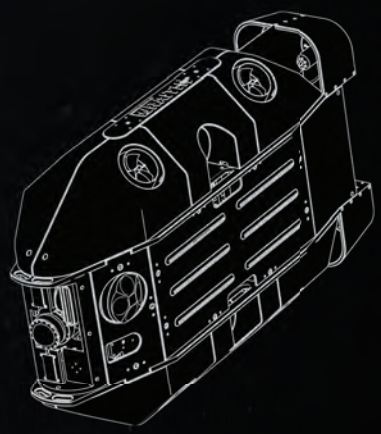

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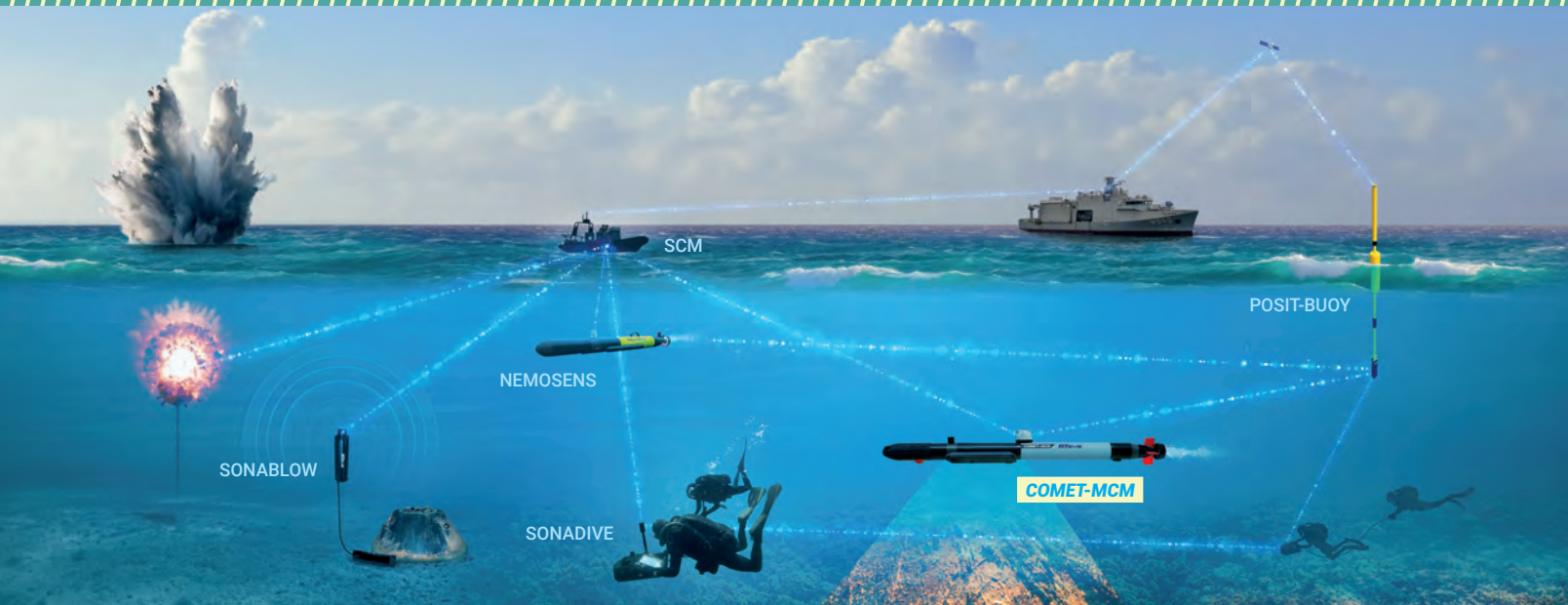

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U.S. Navy photo by Mass Communication Specialist 2nd Class Alex Perlman/Released

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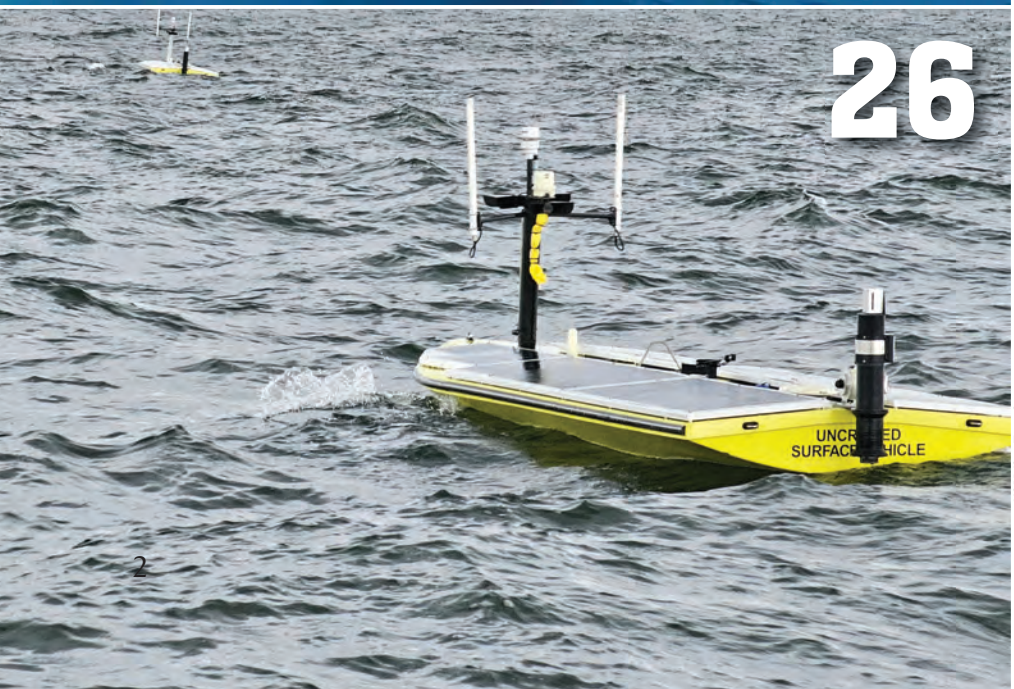

USM/SeaTrac Systems

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Image courtesy Ocean Aero

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Editorial

Scan the QR code to access the **Marine Technology TV** YouTube page:

This month, we focus heavily on defense and security, topics that are inarguably mirrored in current events around the world. More specifically, we highlight port security, whose growing importance is driving new technologies and other solutions. Starting on page 8, David Strachan explores the December 2025 explosion at Russia's Novorossiysk Naval Base, the responsibility for which was taken by the Ukrainian Security Service. Using this basis, he explores port and harbor defense solutions currently on the market. Similarly, on page 20, Wendy Laursen draws on other recent global developments and examines subsea defense in harbors from a multi-domain approach.

This issue also focuses on ocean instrumentation and sensors across multiple applications. On page 17, we explore a case study conducted by Shell Brasil, Petrobas, Sonardyne, and SENAI CIMATEC for the On-Demand Ocean Bottom Node program, a solution for improved 4D seismic surveillance. Later, on page 26, the University of Southern Mississippi and SeaTrac Systems spotlight the role of USVs and sensor technology in hypoxia mapping. And on page 30, you can learn how YellowScan's Navigator top-bathymetric LiDAR systems monitor the impact of submerged structures designed to minimize coastal erosion.

On page 12 is another installment of Lander Labs by Kevin Hardy, in which he explores pressure relief valves and purge ports, including commonly asked questions and lessons learned. Page 18 dives into another application of artificial intelligence in the subsea industry, featuring a human-AI autonomous training platform. Near the end of the issue, we cover recent updates on vessels and company news within the industry (pages 40 and 44, respectively).

Last, but certainly not least, we reflect on a busy and productive Oceanology International in London earlier in March. We caught up with friends, met new companies, and learned about innovative solutions, many of which are featured in a product roundup on page 34. We also conducted numerous interviews, highlighting individuals and technologies, which you can view on our YouTube page, Marine Technology TV.

We hope you enjoy and we'll see you in May.

Celia Konowe
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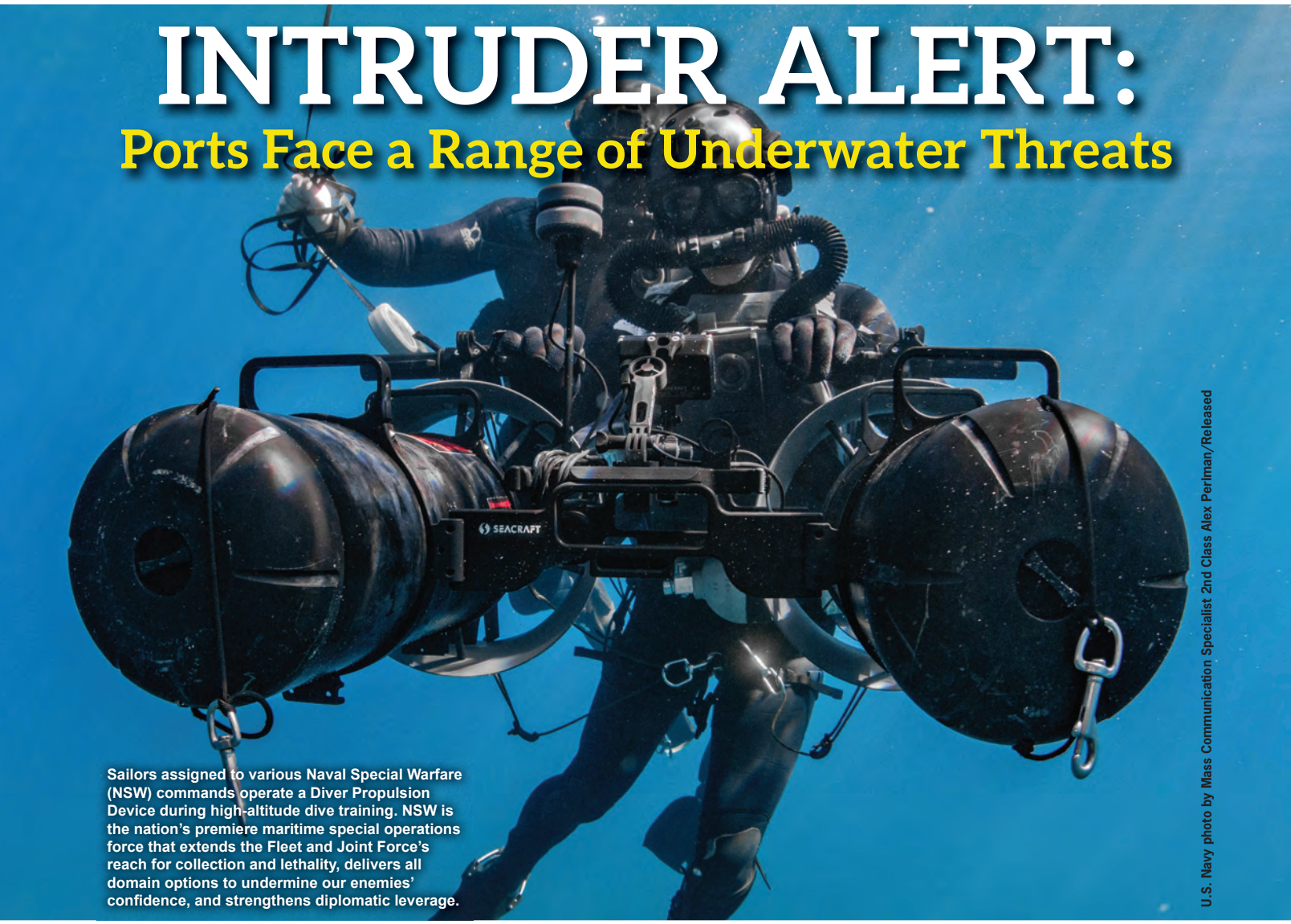
INTRUDER ALERT:

Ports Face a Range of Underwater Threats



Sailors assigned to various Naval Special Warfare (NSW) commands operate a Diver Propulsion Device during high-altitude dive training. NSW is the nation's premiere maritime special operations force that extends the Fleet and Joint Force's reach for collection and lethality, delivers all domain options to undermine our enemies' confidence, and strengthens diplomatic leverage.

U.S. Navy photo by Mass Communication Specialist 2nd Class Alex Perlman/Released

By David Strachan, *Strikepod Systems*

On December 15, 2025, footage from a hacked security camera at Russia's Novorossiysk Naval Base captured a powerful underwater explosion rocking a berthed Kilo-class submarine. The Ukrainian Security Service (SBU) subsequently took responsibility for the attack, claiming that it had been carried out by a previously undisclosed uncrewed underwater vehicle (UUV), "Sub Sea Baby." While Ukraine has been quite open about its efforts to deploy combat UUVs (an armed "Marichka" may have been used in an underwater strike on the Kerch bridge in June of 2025), the Novorossiysk attack represents the first known instance of a UUV conducting a submerged strike inside a defended naval port.

Beyond the implications for Russia's Black Sea Fleet, the episode highlights a broader, urgent reality: ports and harbors are increasingly vulnerable to hostile underwater uncrewed systems. Advances in autonomy, navigation, and energy storage have enabled relatively small underwater platforms to operate at ranges and with precision that would have been difficult to achieve only

a decade ago. At the same time, the lines separating mines, torpedoes, and UUVs are blurring as these systems increasingly converge in both capabilities and mission sets. For ports and naval facilities, where ships, logistics infrastructure, and critical undersea assets are concentrated in confined areas, this convergence introduces new vulnerabilities. Even as many ports have implemented robust security measures against air and surface threats, and cybersecurity has received increasing attention in recent years, the underwater environment remains comparatively difficult to monitor and defend.

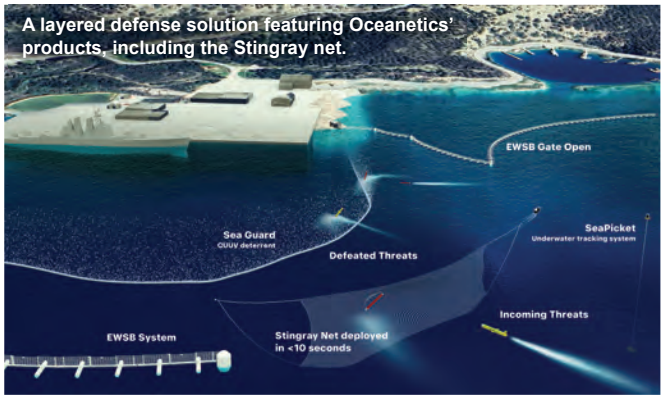
A Subsea Threat Matrix

Ports and naval bases face a diverse set of potential underwater threats, each with distinct operational characteristics and detection challenges. Combat divers represent the most traditional of these. Operating either with open-circuit scuba equipment or closed-circuit rebreathers, divers can deploy from outside the harbor perimeter, approach a target covertly, and emplace limpet mines or other explosive devices on hulls, piers, or subsea infrastructure.

Diver propulsion vehicles (DPVs) are small battery-powered scooters that allow divers to travel faster and with less fatigue than swimming alone. DPVs extend the operational range of combat swimmers and support covert reconnaissance, mine placement, or infrastructure sabotage. A larger and more capable variant of this concept is the swimmer delivery vehicle (SDV). SDVs are small submersibles enabling special operations forces to covertly infiltrate defended areas from stand-off range, often launching from submarines or surface vessels operating well outside a harbor's surveillance perimeter.

Increasingly, however, the most consequential threat may come from UUVs. Advances in autonomy, navigation, and battery technology have enabled relatively compact UUVs to operate with considerable range and precision. These vehicles can carry sensors for reconnaissance or payloads designed to damage ships or infrastructure, all without risking human life. Their low acoustic signatures make them difficult to detect in the acoustically cluttered environments typical of busy ports, and they can infiltrate harbors autonomously using advanced navigation systems. And the growing affordability and accessibility of UUV technologies means underwater strike capabilities are no longer limited to specialized military units, and may increasingly enter the toolkit of both state and non-state actors.

As these risks grow, coastal installations are increasingly adopting layered security approaches combining deterrence, surveillance, and response.

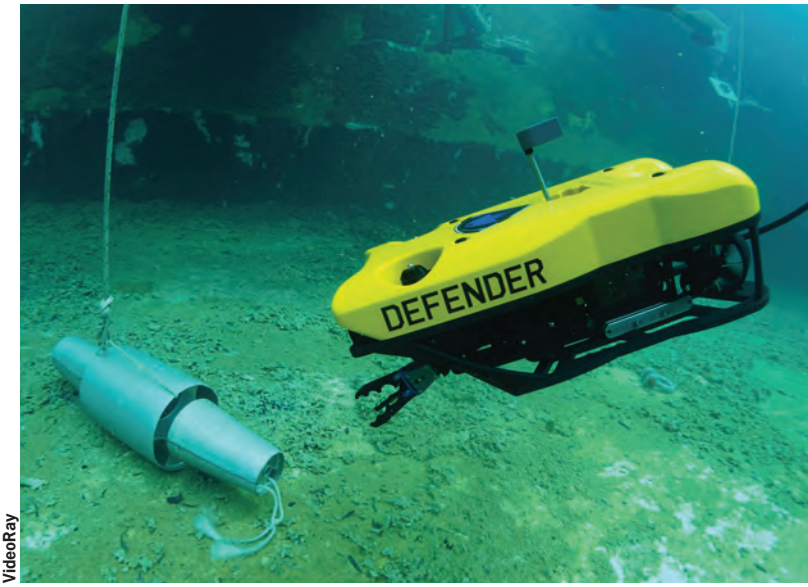


A layered defense solution featuring Oceanetics' products, including the Stingray net.

Credit: Oceanetics

Norbit's GuardPoint solution

Norbit



VideoRay

VideoRay Defender

Deterrence: Barriers to Entry

The first layer of port security is highly visible deterrence measures that signal to potential adversaries that an area is actively monitored and defended, increasing the perceived risk of detection and interdiction. Crewed patrol vessels remain an important component of this deterrent posture, providing a visible presence that discourages unauthorized activity, as well as a rapid response capability. Surface operations may also contribute to underwater surveillance, as radar, EO/IR sensors, or human observers might detect UUV wakes or communications masts, particularly during calm water conditions.

Physical barriers provide another important deterrent. Floating security booms are widely used to restrict access to sensitive areas of ports and naval bases. These systems typically consist of surface pontoons connected by cables with mesh netting or fencing that extends downward to the seabed. Several companies market integrated surface and underwater security barrier systems to naval bases, offshore facilities, and commercial ports, such as RBtec Perimeter Security Systems, Halo Arabia, JF Brennan, and Ultrasea. Notably, a floating barrier was likely disengaged during the Novorossiysk attack. Whether due to port operations, maintenance, or complacency remains unclear, but it highlights how gaps in barrier coverage can easily be exploited by a tech savvy and motivated adversary.

Beyond physical barriers, ports could explore the use of acoustic countermeasures to disrupt malicious UUVs. Bubble curtains, for example - commonly used in offshore construction to dampen sound emissions - create dense walls of air bubbles that scatter and attenuate acoustic energy. (The U.S. Navy's Prairie-Masker radiated noise reduction system, which releases air along a ship's hull to obscure its acoustic signature from sonar, is an example of bubble curtain tech.) In theory, such a system might degrade acoustic navigation systems by scattering soundwaves transmitted by echosounders, Doppler velocity logs, or obstacle-avoidance sonars. Bubble curtains may also introduce optical turbulence that complicates the operation of underwater cameras and other optical sensors.

Surveillance: The Unblinking Eye

While deterrence measures and physical barriers form the outer layer of port security, underwater surveillance systems provide the means to detect and track intrusions beneath the surface. The most widely deployed technology for this purpose is the intruder detection system (IDS), which uses high-frequency active sonar to detect the presence of divers, SDVs, and increasingly small UUVs. Products such as the Forcys Sentinel, AquaShield from DSIT Solutions, and Norbit's GuardPoint offer integrated solutions that combine sonar sensors, signal processing software, command-and-control interfaces, and even underwater loudhailers.

These systems are typically arranged as networks of sonar nodes positioned along harbor entrances, piers, and critical infrastructure. Each sonar head scans a defined sector of the underwater environment, with overlapping coverage from multiple sensors allowing operators to detect, classify, localize, and track targets, creating a persistent, real-time, multistatic surveillance perimeter. The Forcys Sentinel IDS integrates passive sonar as well, and can detect divers, AUVs, or SDVs at ranges of up to 1.5 kilometers.

Imaging sonar also plays a role. Many ports conduct routine inspections using high-resolution imaging sonar similar to those used in mine countermeasures (MCM) operations. These surveys establish a baseline map of the seabed and enable operators to detect new objects, such as mines or improvised explosive devices.

Response: The Pointy End of the Spear

If deterrence fails and an intruder is detected, port security must quickly investigate and, if necessary, engage the threat using kinetic or non-kinetic effects.

Non-kinetic effects could involve the use of "soft kill" capture systems to disable threats, such as the Stingray intruder interception net from Oceanetics. This system deploys a rapidly expanding net across the path of an underwater vehicle, entangling and immobilizing it. Other non-kinetic effects could involve activating prepositioned acoustic countermeasures to disrupt or spoof the navigation systems of an inbound UUV.

Kinetic effects could be delivered by interceptor vehicles such as the Skelmir S6 Compact Modular Underwater Effector from Vatn Systems, a small, hard-kill UUV that can be deployed from crewed or uncrewed surface vessels. Or the Leonardo Black Scorpion, a 20kg mini-torpedo that can deliver a 2.8kg warhead from a variety of surface, air, and underwater platforms. For static threats located during seabed survey operations, ROVs such as the VideoRay Defender can be deployed from patrol vessels or dockside launch points to investigate, or in the case of the Atlas Electronic Seafox, provide a single-sortie inspection, identification, and neutralization capability.

A Wake-Up Call

The lesson of Novorossiysk is clear: as underwater technologies continue to evolve, so too must the systems designed to protect the ships, infrastructure, and personnel that depend on secure harbors. While coastal facilities have sought to identify and mitigate threats from the air, surface, and cyber domains, the undersea domain is increasingly a viable attack vector as well. Advances in autonomy, navigation, and endurance are democratizing underwater capabilities once limited to major naval powers, making them accessible to a wider range of actors. In an era of proliferating underwater technologies, the next major challenge in maritime security may not come from above the waterline, but from below.

Vatn Systems

Photo courtesy: Dr. Peter Worcester, Scripps Institution of Oceanography/UCSD

APPLICATION NOTE:

PRESSURE RELIEF VALVES AND PURGE PORTS

By Kevin Hardy, MTR Columnist, President, Global Ocean Design LLC

James Cameron's second AVATAR movie introduced viewers to "The Way of Water." It's especially important for ocean engineers to "think like water." Observe, study, and learn the way.

Fluid power refers to both liquid and gas. Two fluid power components to consider in controlling gas flow are the **check valve**, and the **pressure relief valve**. A check valve is an automatic one-way valve that constrains air flow to one direction. They can be useful in purge ports.

A pressure relief valve (PRV), sometimes called a pressure safety valve (PSV), or pop-off valve, is a safety device designed to protect a housing by venting high internal air pressure to the sea. The PRV automatically opens when pressure exceeds a predetermined differential limit, say 5psi over ambient, allowing pressure to vent in one direction. However, it can be shown that venting excess pressure and sealing out water are two different things.

Graphically, the different parts are represented by the symbols:

When a PRV opens in a topside shipboard environment, interior overpressure generally vents into an air-filled environment. Underwater, however, a PRV opens and vents directly into the ocean. It is literally like opening a door or window to the sea. It can be done, such as in a diver lock-out submersible (Figure 3), but it takes some thought before you do.

PRVs have a few simple parts, like a screen door closer. Push against the spring, the door opens. Release and the spring closes the screen door.

For undersea application, PRVs have the added requirement to withstand substantial external pressure. Undersea PRV designs typically place the compression spring on the interior side lowering the PRV's exterior profile and minimizing materials in contact with seawater. Size the PRV for maximum expected flow. As with any component that is part of a pressure housing, material selection (e.g., avoid dissimilar materials) and surface finish

Figure 1 (above)

A pressure-compensated low-frequency source is deployed by Scripps Institution of Oceanography personnel off the USS Safeguard (ARS-50), circa 1986. Note the circular source in the standing equipment cage. It is pressure compensated by the four large compressed air flasks below it. Primary lithium cells and control electronics are in the vertical cylinders flanking the source to either side. The author is pictured on the far left. Lab mates Brian Dushaw, Steve Abbott, Doug Peckham, and Bob Truesdale join USN personnel on deck.

(e.g., passivation, hard anodize) requirements still apply. Marine PRV designs generally utilize the stem as the adjusting screw.

Two projects I worked on at Scripps incorporated pressure compensation systems for operation to a max depth of 1,500m (2,220 psi). We experienced some relevant mechanical behaviors.

The first was a buoyancy canister for a free-vehicle Mid-Ocean Float in the mid-1970's. We jokingly called ourselves "the MO-Fia." The free-vehicle tracked internal waves by measuring the vertical oscillations of an identified thermocline. A piston in a cylinder of a side-mounted pressure-compensated buoyancy canister provided variable displacement, which changed the density of the vehicle, which made the vehicle sink and rise, pulling a sting of fast-response thermistors behind it. After anchor drop, the vehicle was on it's way back to the surface. The buoyancy canister vented internal pressure through a single PRV positioned at the bottom of the canister. The excess air always vented, and the unit always returned with a dry interior.

Some years later, the ATOC program used a moored low-frequency (150-Hz) source (Figure 1) made by HydroAcoustics (Rochester, New York) adapting an emerging environmental diagnostic technique known as Acoustic Thermometry to measure the volumetric average temperature of the ocean. The HLF-5 source utilized an open sump hydraulic system. The interior was pressure compensated to ambient pressure at operat-

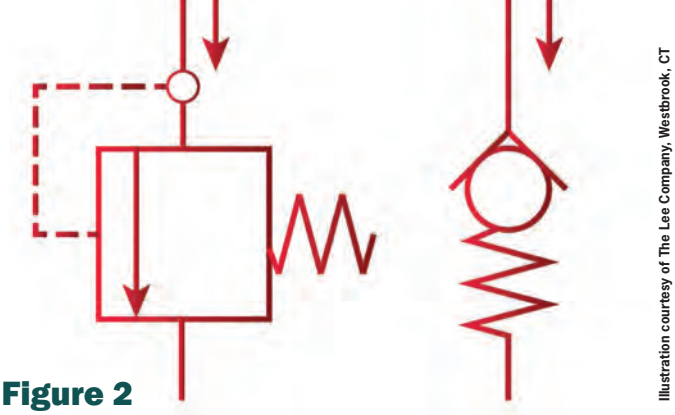


Illustration courtesy of The Lee Company, Westbrook, CT

Figure 2

A PRV is represented graphically on the left. An adjustable PRV would show a diagonal arrow through the spring. A check valve is represented graphically on the right. Minimal spring force reduces the back pressure on the system.

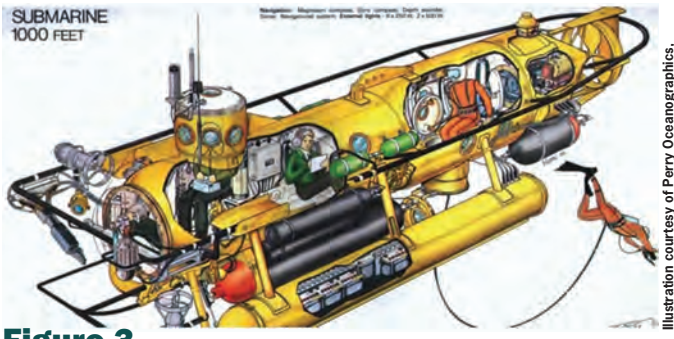


Illustration courtesy of Perry Oceanographics, Riviera Beach, FL

Figure 3

Perry Oceanographics' submersible **Deep Diver**, first introduced in 1973 as a diver lock-out sub, primarily operated in the North Sea oil fields.

ing depth using dry, compressed air. Two pressure relief valves, one a back-up for the other, vented internal air pressure as the system ascended to the surface at the end of the experiment. The PRVs were placed high to vent air, while the hydraulic oil was low and therefore not exhausted into the ocean. A graphite burst disk provided a third emergency pressure relief method which gratefully never ruptured. The two PRVs, positioned at the 10 and 2 o'clock positions, always worked.

Post-deployment, however, a saltwater trail was evident on the interior coming from the PRVs. Seawater in the open sump hydraulic oil confirmed a significant problem. Because the source was off at the time of recovery, no water was pumped through the hydraulic system.

With a little more study, we understood the inherent problem. Pressure relief valves have a "cracking pressure" and a "reseating pressure." The opening and closing pressures are different due to hysteresis.

When open, a direct path from the interior to the exterior allowed excess internal air pressure to vent. Now think like water. Imagine a cup held upside-down in a pail of water. Air displaces water, water stays out. With the PRV placed on the bottom, interior air pressure that causes the PRV to open will prevent water from entering the housing, whether the seal is engaged or not. Placed anywhere else, a leak is likely, if not guaranteed, at the cracking and reseating pressures, exactly when forces are balanced. The PRV o-ring or gasket requires compression to seal, but right at the point where forces are balanced, just prior to or after the seal is engaged, water does what water does. It seeps in and flows downhill.

Our solution with the HLF-5 was to run a high-pressure hose from the air exhaust ports at the 10 and 2 positions to the bottom of the source where we placed the PRVs. Now the entry for the air to the PRV was at the high point well above the open sump oil on the interior, while the exhaust was at an exterior point below the lowest point of the interior, preventing water entry. Boom. Problem solved. No oil lost to the sea, no seawater inside.

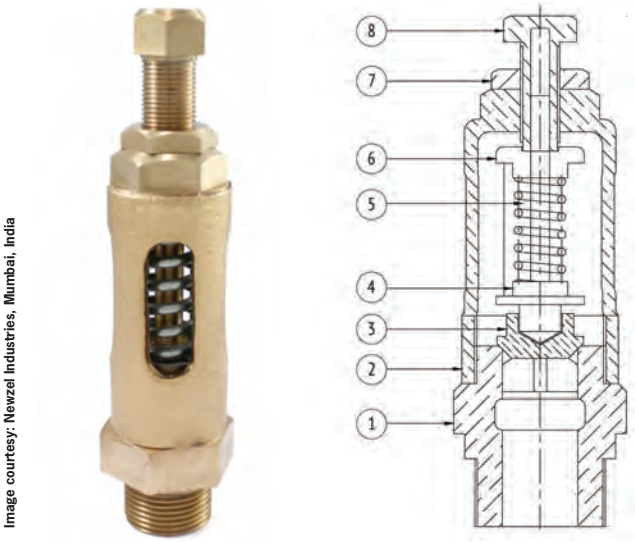


Image courtesy: Newzel Industries, Mumbai, India

Figure 4

Cross-section of a bronze, industrial spring-loaded open-discharge pressure relief valve. Parts, top-to-bottom: 8) Adjusting screw, 7) Locking Nut, 6) Spring disk, 5) Compression Spring, 4) Stem, 3) Sealing Disk, 2) Spring Chamber, and 1) Body

Lesson 1: PRVs should be placed low.

There is a subtle problem with placing PRVs low: loose debris such as solder splatter, stripped wiring insulation, or lint falls with gravity and may land on the PRV interior side. If air is being directed over an open PRV seal, such as when the PRV vents, debris may land and stick on the sealing surface, compromising its ability to reseal. (See "Sealing Disk", Figure 4). If there is a need to vent high interior pressure, that's part of the deal. If the PRV is being used as a vacuum leak test/purge port it's still part of the deal. Parker's O-ring Handbook (ORD-5700) advises, "Cleanliness is vitally important to assure proper sealing action and long O-ring life. Every precaution must be taken to ensure that all component parts are clean at time of assembly. Foreign particles — dust, dirt, metal chips, grit, etc.— in the gland may cause leakage and can damage the O-ring, reducing its life."

Sources of seal contamination on PRVs returned from deployment may also include biofouling, marine biogenic calcification, and salt build-up. Contact the PRV manufacturer for recommended post-deployment/pre-redeployment maintenance.

Here's the catch: the interior PRV seal is impossible to inspect directly. A leaky PRV seal could be found if a vacuum leak test were performed from a separate purge port. End-users are otherwise left to hope, luck, chance, and wishful thinking. "It's probably OK" are not words to speak when facing King Neptune. Davy Jones keeps what he covets. You need to know for sure. An internal pressure sensor connected to an external read-out is another solid means to confirm seal integrity.

Suggestions from motivated sales personnel that a PRV can perform a dual use play into this problem. One PRV manufacturer offers an interior filter to help reduce the potential of debris falling into the PRV, which is helpful. An end-user could improve their odds by rotating the housing on the bench so the PRV is high while performing the purge function using the PRV.

This brings us to the second caveat to the dual use approach. With some marine PRVs, attaching the purge port adapter can inadvertently change the pop-off setting. This is because the center stem of the PRV may also be used as the adjustment screw to set the cracking pressure. Some manufacturer's instructions carry a clear warning to end-users to be careful, such as, "Install the vacuum/fill accessory by pushing it down over the body of the relief valve. … Once aligned, push down lightly on the plunger puller and turn it approximately 4 times clockwise <to> engage the threads in the … PRVs plunger. DO NOT continue turning until tight, as this will result in altering the set point of your … PRV." This company also provides instructions on how to reset the cracking pressure. Add that to your pre-deployment checklist.

This second problem may be limited as the adjustable cracking pressure range is 5-15 psi, more or less. But confirm with the PRV manufacturer so that you know for certain.

Lesson 2. Only use PRVs for their intended purpose: venting internal overpressure.

Which brings us to purge ports. There are two kinds of purge ports: open and self-sealing. The open purge port has a small orifice behind a sealing plug or screw. The small orifice controls the rate of flow through a small diameter center hole while the final seal screw or sealing plug is installed. The intention is to be quick about it so not too much vacuum is lost by moist marine air re-entering the housing. Air being drawn into the housing may also carry debris across a greased o-ring sealing surface where it may compromise the final o-ring seal. (See Lander Lab #7, "Managing Moisture in SubSea Housings", ***MTR***, March/April 2023.)

A self-sealing purge port, such as made by Global Ocean Design (San Diego, CA), incorporates an interior check valve. When the purge system adapter is connected, the check valve is held open and a free flow of air is allowed in two-directions. When the purge system adapter is removed from the self-sealing purge port, a spring-loaded check valve closes, and air flow is cut-off.

A vacuum leak test using the Global Ocean Design Deck Purge Box (Figure 5) can check all seals, including those of a PRV, minus the last one, the pressure proof cap. The final seal, a face seal, can be cleaned, inspected and carefully installed with no rush. There's a very high probability of getting it right if done with care and a close eye.

Purge Systems provide the means to pull a partial vacuum on an undersea housing, remove entrained moisture, vacuum test all the housing seals, and preload the housing o-rings before deployment.

A purge system removes moist entrained air, replacing it with dry air. A focus on backfilling with dry nitrogen is misplaced. It's not oxygen that needs to be removed, it's water vapor. It's the dew point at cold ocean depth we're worried about. Dry air could also come from a SCUBA tank, or CO2 soda maker flask.

If an end-user's housing is constrained to using a PRV as a purge port, the manufacturer's PRV's adapter can easily attach to the Deck Purge Box.

Another danger to avoid: Use of a high-pressure bottle to force air in carries an obvious danger of blowing off an endcap when the PRV is being used as a purge port. Global Ocean Design's Deck Purge Box removes this hazard by utilizing the interior vacuum already made by the vacuum pump to draw air in. Moist marine air is directed over a desiccant cartridge, which removes suspended moisture on contact. It is self-limiting. When interior and exterior pressures are equal, air flow stops. This approach also eliminates the problems of shipping high pressure bottles, then refilling them in a foreign port. If high pressure bottles are

emptied at sea, that's it, no more purging. But if the indicating desiccant is saturated, spares can be swapped in, or a used one can be recharged in the ship's galley's oven in a couple of hours.

Multiple purge cycles to ½ bar remove half the remaining water vapor each time. One cycle takes out 50%. The second cycle takes out another 25% of the original water vapor. A third cycle takes out 12.5% of the original water vapor. Three cycles together remove 87.5% of the original water vapor. So look for a system that can provide multiple purge cycles conveniently.

Sea-going teams also know that loose items need to be tied down before leaving the dock. Global Ocean Design's Deck Purge Box is a single integrated unit, easily secured to a bench top. It incorporates a universal power supply, so it readily adapts to foreign ships-of-opportunity. There are no hazmat components such as high-pressure bottles or biohazardous chemicals. It is CE compliant. It has been in production for over 15 years, and used on housings deployed at all latitudes and all depths, for short and long durations, by worldwide research institutions and industries.

PRVs are a useful device when the potential for high interior pressure needs to be mitigated. PRVs should be used for their primary intended purpose: venting excess interior pressure. The companies that make them do so with the best interest of the end-user in mind. There are important subtleties to understand for their successful incorporation into subsea equipment. Use a dedicated purge port when one is called for.

Figure 5

A Deck Purge Box from Global Ocean Design is an integrated unit without hazmat that performs the vacuum leak test and desiccation process of a housing's entrained air. It is simple to secure to a benchtop of a rolling ship.

Image courtesy: Global Ocean Design LLC

"Lander Lab" is a hands-on column of Ocean Lander technologies and strategies, a unique class of unmanned undersea vehicles, and the people who make them. It is meant to serve the global ocean lander community in the manner of Make Magazine and other DIY communities.

Comments on this article, or suggestions for stories of interest to other Landereans are welcome. Ocean lander teams are encouraged to write in about their work. Please feel free to contact Kevin Hardy <**khardy@marinelink.com**>.

Multiple OD OBN nodes

Social media reproduction

The Saipem Flatfish

Credit: Saipem

ON-DEMAND OCEAN BOTTOM NODE:

A New Era in Deepwater Seismic Monitoring

Shell Brasil, Petrobras, Sonardyne, and SENAI CIMATEC are developing autonomous technology that transforms how Brazil's challenging pre-salt fields are monitored. Now entering a major pilot array phase, the On-Demand Ocean Bottom Node (OD OBN) program promises efficient, cost-effective 4D seismic surveillance, with fewer people and lower environmental impact. This milestone marks a step closer to a fundamental shift in deepwater reservoir management.

The Challenge

Brazil's pre-salt reservoirs lie in more than 2,000m water depth, plus another 3,000m beneath the seabed, making seismic imaging particularly challenging.

Traditional seismic surveys using ocean bottom nodes (OBNs) provide high-quality seismic data, but are often expensive and logistically complex, involving the repeated deployment and recovery of nodes using remotely operated vehicles (ROVs).

These factors can limit the frequency and economic viability of frequent 4D seismic campaigns, which are essential for understanding reservoir dynamics over time.

This is particularly challenging for monitoring large pre-salt carbonate fields where production by alternating water and gas injection (WAG) generates subtle and complex 4D signals that are difficult to measure.

These signals require on-demand monitoring with sufficient fidelity and repeatability to overcome the high levels of survey noise prevalent in conventional node-based surveys.

On-Demand Ocean Bottom Node

Launched in 2018, the OD OBN program is a research and development collaboration between partners Shell, Petrobras, SENAI CIMATEC and Sonardyne, supported under the Research Development and Innovation funding clause of the Brazilian National Agency for Petroleum, Natural Gas and Biofuels (ANP). The On-Demand Ocean Bottom Node (OD OBN) program marks a step in addressing these challenges, providing an approach to time-lapse seismic data acquisition.

The program is a new system for acquiring 4D seismic data, which delivers more efficient and cost-effective surveillance of complex pre-salt fields. At its core is a long-term OBN system that can remain on the seabed for several years, capturing seismic data that can be recorded and harvested "on-demand" using autonomous underwater vehicles (AUVs), without the need for repeated deployment and retrieval cycles.

Significant quantities of seismic data are harvested wirelessly using an AUV like Saipem's 'Flatfish,' which implements the through-water optical interface to interrogate the OD OBNs, as developed under a separate ANP program sponsored by Shell.

This AUV data harvesting approach eliminates the need for node recovery, reducing vessel time, operational complexity and associated costs.

Key Sonardyne technologies include wireless acoustic communications, required for long range recording control and node clock time offset measurement, and Sonardyne's BlueComm extremely high-speed optical communications for short range data harvesting to a nearby AUV or remotely operated vehicle (ROV).

Results

Over 2,000 days of trials of pre-production nodes have been conducted across various pre-salt fields including Sapinhoá, Itapu and Buzios. These have successfully demonstrated acoustic control, high-fidelity data acquisition and optical data harvesting using BlueComm, as well as comparing OD OBN data with that of other commercial nodes.

The final round of tests concluded successfully in 2025, with results presented at the IMAGE '25 conference in Houston and SBGf Rio'25 conference in Rio de Janeiro. Ultimately, the team deployed 84 OD OBN units, the data from which will be harvested and used to generate the first 4D image in this field.

Next Steps

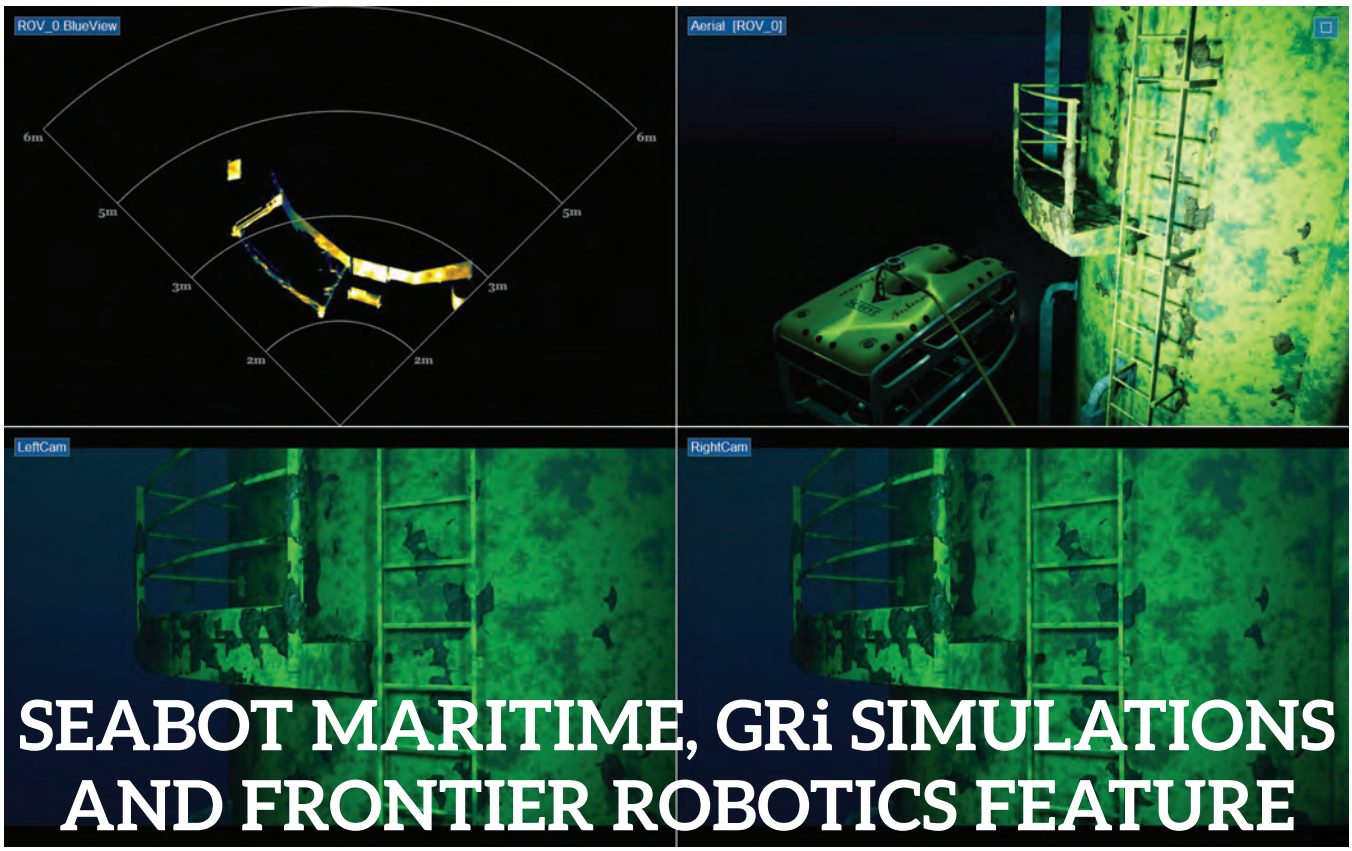
A pilot array of 660 pre-production nodes is currently being produced at a new manufacturing facility in Camaçari, near Salvador, Brazil. Hundreds of these nodes will soon be deployed at the Mero field operated by Petrobras for extended testing and performance evaluation.

The long-term vision is to use autonomy and state of the art communications technologies to enable operators to conduct more frequent 'on demand' seismic surveys, with higher fidelity data, at a fraction of the cost of conventional seismic survey methods.

This capability will provide clearer insights into fluid movements and pressure changes within the reservoir, helping to optimize production strategies, improve decision making and enhance recovery rates in one of the world's most challenging offshore provinces.

OD OBN is not just an incremental improvement, but a shift in how the industry approaches deepwater reservoir management.

Credit: GRi Simulations Inc.



SEABOT MARITIME, GRi SIMULATIONS AND FRONTIER ROBOTICS FEATURE HUMAN-AI AUTONOMOUS MARITIME TRAINING PLATFORM

Across offshore energy, commercial maritime and defense, deploying people and equipment into subsea environments remains complex, specialist and high-risk work, with individual campaigns often exceeding $130,000 per mission. As autonomous systems become central to maritime operations, SeaBot Maritime, GRi Simulations Inc. and Frontier Robotics have delivered a new simulation platform that enables operators to safely train and validate AI-enabled systems before deployment at sea.

Developed as part of a UK government-funded initiative awarded by the AI Security Institute, the platform allows autonomous subsea systems to be tested within a realistic digital offshore environment prior to live deployment. The project, titled "Evolving Human-AI Competencies: Workforce Development for Building Systemically Safe Cyber-Physical Systems," was led academically by King's College London, with SeaBot Maritime directing operational and training design to ensure real-world maritime relevance.

The initiative strengthens how offshore operations are prepared and delivered, pairing advanced simulation with highly trained operators to enhance safety, readiness and operational resilience.

VROV

At the core of the platform is GRi Simulation's VROV (Virtual Remotely Operated Vehicle) system, a real-time marine operations simulator used globally for subsea training. For the project, GRi configured VROV to create a digital twin of an offshore wind farm inspection using a Saab Seaeye Falcon ROV. Monopile structures were populated with randomized inspection faults including corrosion, marine growth, anode damage and subsea cable defects, ensuring no two simulated missions are identical. Environmental variables such as sea state, current, turbidity and sonar noise can be adjusted to reflect real offshore conditions, with dynamic tether modelling and collision detection adding further operational realism.

VROV supports live integration of external autonomy control systems, creating both a sophisticated training en-

Image above: Screenshot of GRi Simulations' VROV marine operations simulator configured to model offshore ROV inspection missions and support testing of AI-enabled subsea autonomy systems.

vironment and an autonomy validation test bed. During the project, Frontier Robotics integrated its autonomous navigation software into the simulator, moving from small-scale physical tank testing to expansive virtual ocean environments. The integration enabled testing of autopilot-assisted navigation, multiway point mission planning, SLAM-based localization, obstacle avoidance and both semi-autonomous and fully autonomous inspection workflows within a realistic offshore setting.

The platform also allows deliberate introduction of failure states, including autopilot degradation, camera malfunction and environmental disturbances. Operators can rehearse emergency intervention scenarios and assess how humans and autonomous systems perform together under pressure, without the cost or risk of offshore deployment.

GRi Simulation's proprietary physics engine (GRiP) delivers high-fidelity dynamics and behavioral realism, including dynamic tether modelling, collision detection and interaction, and configurable environmental conditions.

SeaBot Maritime is now leading the commercial translation of the platform into structured training and competency pathways for offshore operators.

An Intelligent Future

"We've demonstrated, for the first time, that one operator can safely and effectively oversee multiple ROVs across complex subsea environments," said Gordon Meadow, CEO of SeaBot Maritime. "The future is about empowering highly trained onshore operators to lead intelligent, connected systems rather than continuing to scale offshore crews."

"Interfacing Frontier's autonomous control system with GRi's VROV simulation platform, created a realistic testbed for advancing safe, AI-supported offshore inspections. This demonstrates how simulation can be used to accelerate development while reducing cost," added Russ Pelley, President of GRi Simulations.

While the funded case study focused on subsea inspection operations, the underlying architecture supports wider maritime autonomy applications. GRi's VROV platform has demonstrated integration capability with autonomous surface vessel control systems, including the GuardianAI control system developed by Marine AI, highlighting its adaptability across both subsea and surface domains.

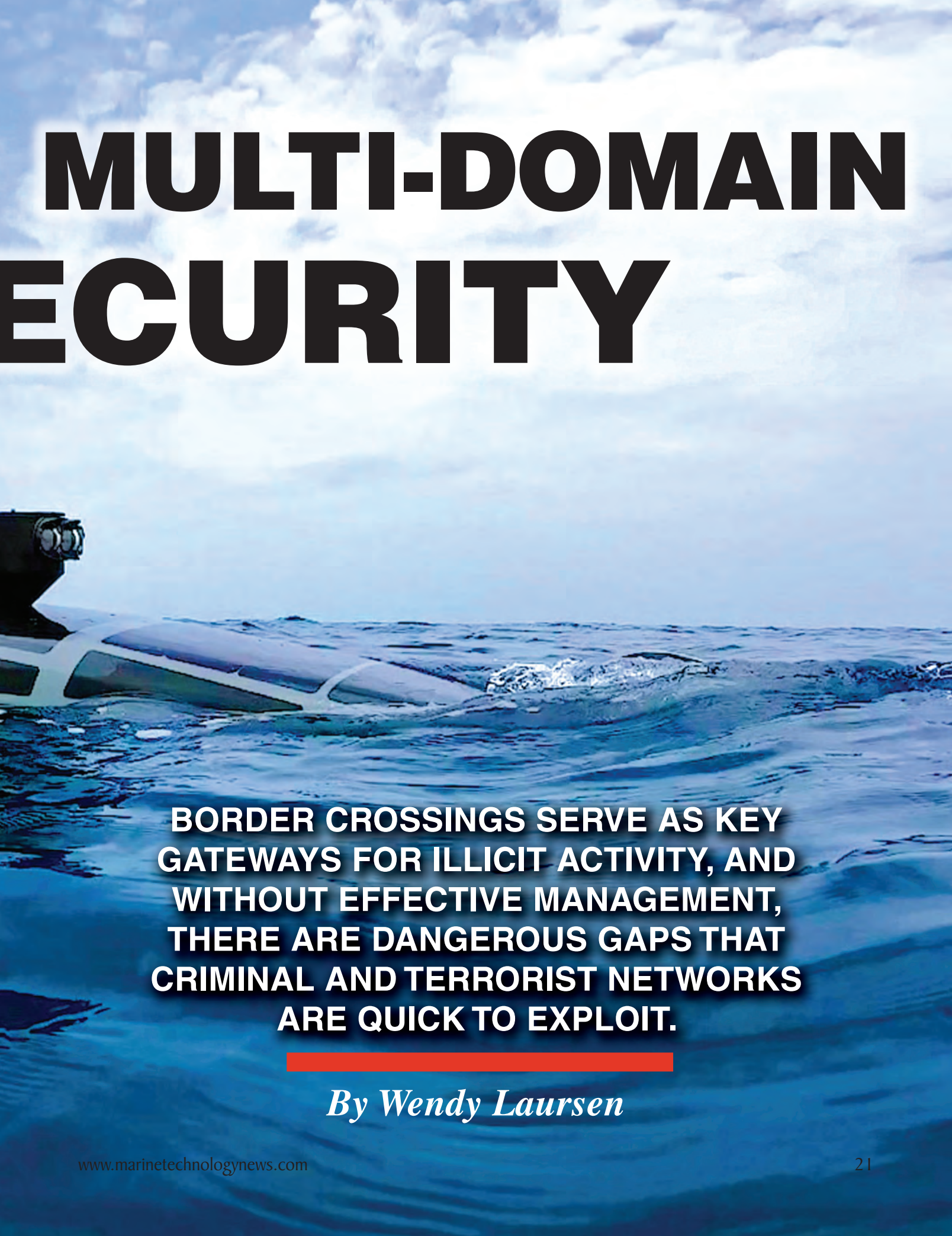
As AI adoption accelerates across offshore energy, defense and critical infrastructure inspection, the safe integration of autonomous systems is becoming one of the sector's defining challenges.

INTEGRATED, PORT SI

Credit: Ocean Aero

Ocean Aero's Triton autonomous underwater and surface vehicle (AUSV) was taken up by the Port of Gulfport last year.

MULTI-DOMAIN ECURITY



BORDER CROSSINGS SERVE AS KEY GATEWAYS FOR ILLICIT ACTIVITY, AND WITHOUT EFFECTIVE MANAGEMENT, THERE ARE DANGEROUS GAPS THAT CRIMINAL AND TERRORIST NETWORKS ARE QUICK TO EXPLOIT.

By Wendy Laursen

An Australian Federal Police commander, noting the billions of drugs intercepted as they entered Australia last year, said: "No matter how creative these criminals attempt to be, our message is clear – we are on to you."

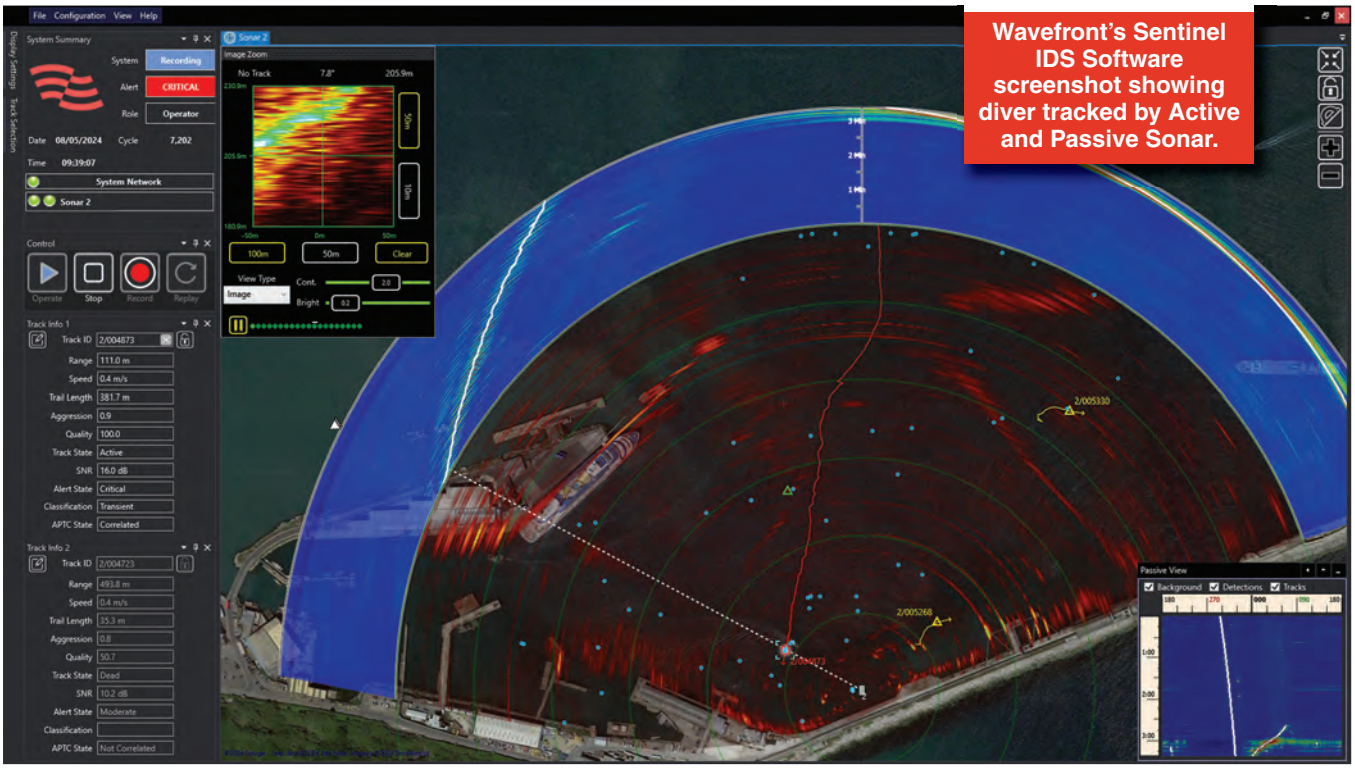
It's a challenge that Lemvos Robotics offers help for. The company's LM450 multirole USV supports sonar, ROV/AUV launch systems and UAV docking, enabling environmental monitoring, defense/security and seafloor mapping tasks. It operates remotely or semi autonomously via satellite or 5G, carries over 300 kg and can stay on mission for weeks.

For drug detection on ships hulls, it's a lot faster to deploy that divers, says Lemvos co-founder Daniel Severinsen, so security services can be more proactive in checking suspicious targets. A key feature is the vehicle's ability for remote, autonomous docking. "For short missions, the time it takes for someone to get down to the vessel can be just as long as the mission itself. Autonomous docking is useful in this scenario. Someone can log onto a computer and start operating the vessel immediately."

One of the newest and most potent threats to border security comes from autonomous vehicles approaching covertly from beneath the water's surface, says Simon Goldsworthy, Global Business Development Manager – Intruder Detection Systems at Wavefront, and what's required to manage this is persistent autonomous multi-domain situational awareness and response.

Wavefront Systems, MARSS and Forcys recently provided a week-long demonstration of their combined underwater and multi-domain security systems, hosted at Portland Port, UK. Observers were able to watch the threat unfold in real time as Wavefront's Sentinel Intruder Detection Sonar (IDS) and MARSS' NiDAR Command and Control platform worked in tandem to detect, track, classify and respond to a range of hostile events from underwater and the air.

NiDAR is a sensor-agnostic, multi-domain surveillance and security platform that integrates data from a wide array of sensors including sonar, radar, radio frequency and electro-optical/infrared.



Wavefront's Sentinel IDS Software screenshot showing diver tracked by Active and Passive Sonar.

Images on spread courtesy: Wavefront

Wavefront's Sentinel IDS sonar head being deployed from a RHIB.

The demonstration showed the power of integrating both passive and active sonar data, using Wavefront's SInAPS system, when tracking low target strength drones or very slow-moving targets in the highly cluttered seabed conditions typical of some harbors.

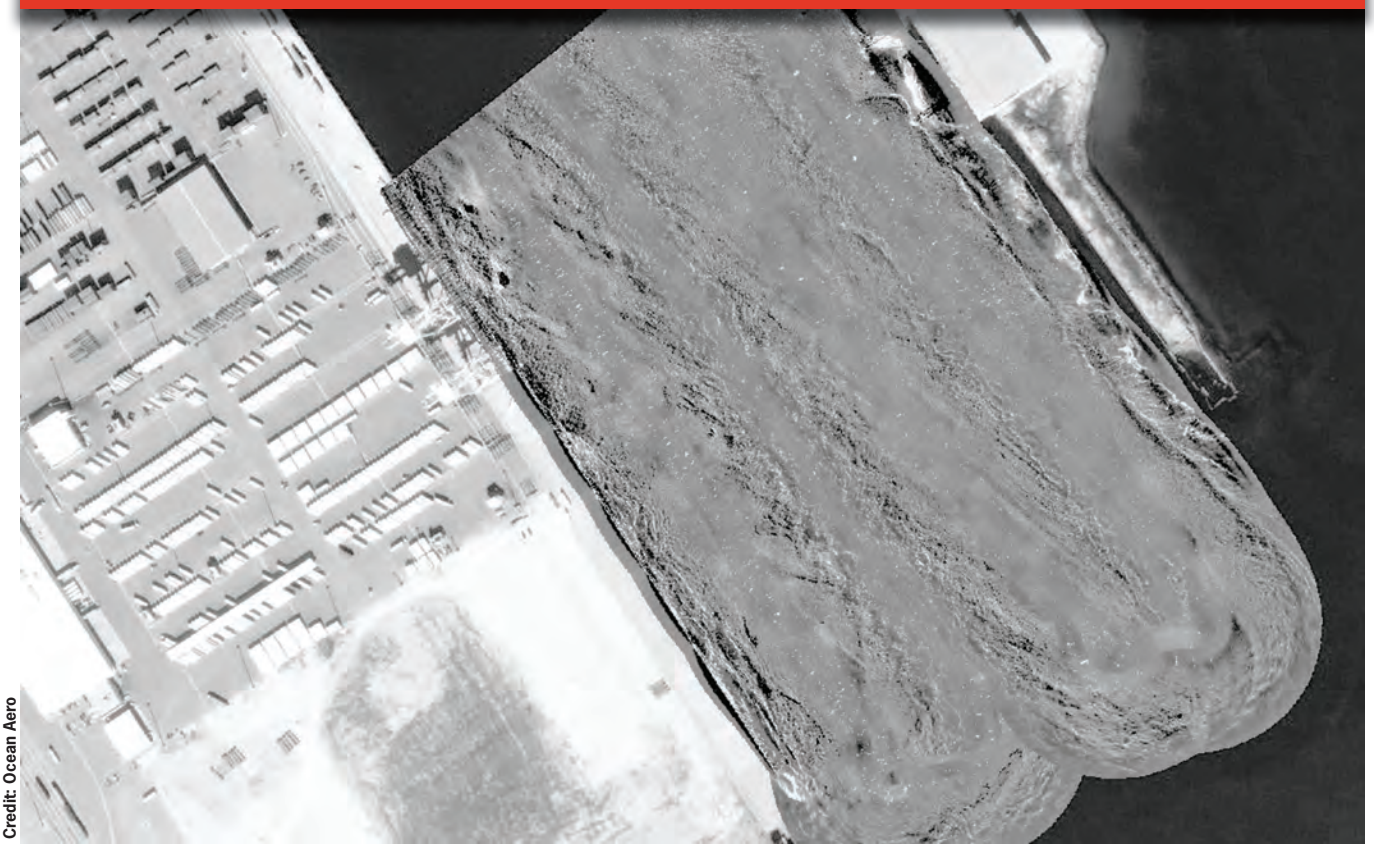
"SInAPS's real power lies in its ability to classify and then establish threats that would previously have taken much longer to identify," says Goldsworthy. "For our clients, the unique benefit is that a threat can now be 'heard' wherever they are. This applies to any intruder hiding in a sheltered area or somewhere that reflects active sonar—for example, a pipeline or harbor wall where detection is difficult with a traditional sonar solution. Sentinel's SInAPS technology capability also gives superior tracking ability of submersibles and drone targets, from a single point sensor."

Late last year, Ocean Power Technologies (OPT) announced a partnership with Mythos AI to integrate advanced AI-driven autonomy software across OPT's fleet of WAM-V autonomous surface vehicles (ASVs) and its PowerBuoy platforms that will be able to charge them. The aim is to accelerate the range of integrated aerial and subsea solutions the company can deliver to customers in defense, security and commercial sectors. The systems will leverage real-time edge processing, multi-sensor fusion and adaptive learning for enhanced situational awareness, obstacle avoidance, multi-vehicle coordination, and, in later phases, advanced vehicle-buoy collaboration.

It's challenging to defend against uncrewed systems, says Jason Weed, SVP Commercial Sales at OPT, so many ports are now focused on change detection. However, every port has different pain points, so solutions are adapted accordingly. A key advantage of the PowerBuoy system is that it can provide a radar and camera perspective far from shore, pushing the decision space out for organizations like the Department of Homeland Security and the US Coast Guard. "You now change the calculus for deterrence. If a ship is dumping drugs off the coast, for example, they are going to have to do something different now. Sometimes just having those sensors in place changes behavior."

Ocean Aero's Triton autonomous underwater and surface vehicle (AUSV) was taken up by the Port of Gulfport last year. The AUSV runs ongoing scans using a variety of subsea payloads including bathymetry, side-scan sonar and magnetometers to produce high-resolution comparative datasets for real-time change detection. The initiative is designed to detect irregularities in both port traffic and infrastructure, a feature

Ocean Aero's AUSV runs ongoing scans using a variety of subsea payloads including bathymetry, side-scan sonar and magnetometers to produce high-resolution comparative datasets for real-time change detection.



Credit: Ocean Aero

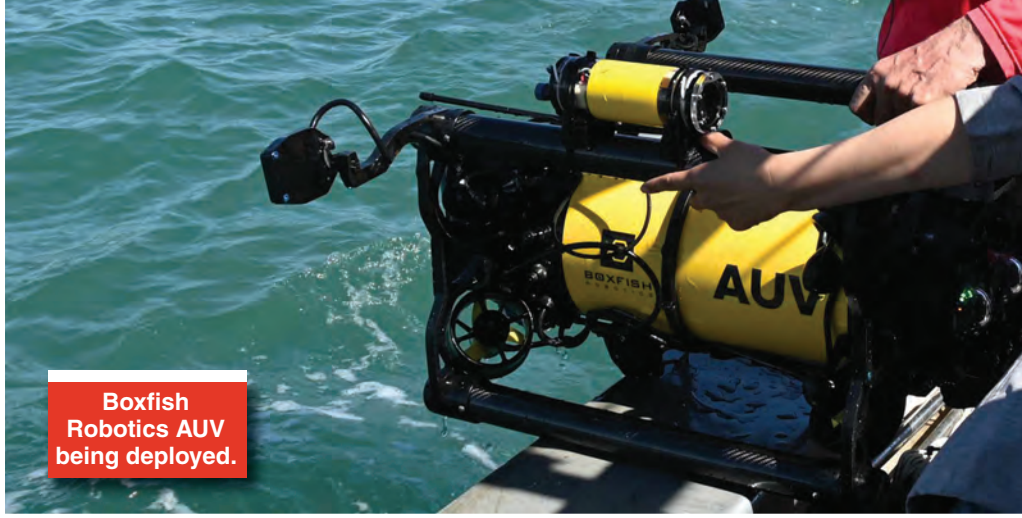
that port CEO Jon Nass says has the potential to save the port millions. It can also play a crucial role in post-hurricane recovery, identifying debris and potential threats to port infrastructure in the aftermath of severe weather events. Ensuring the channel and harbor are clear for ship traffic is critical to the rapid reopening of a port.

AUVs from Boxfish Robotics are providing change detection in a different context – environmental rehabilitation within port waters – for Ports of Auckland, New Zealand. Ongoing harbor health monitoring and environmental compliance in the Rangitoto Channel requires repeatable seabed video transects with sufficient image quality and positional accuracy to support environmental assessment and long-term comparison. Traditional approaches, including diver surveys, towed camera systems and tethered ROVs, can struggle to deliver consistent altitude, lighting and spatial repeatability, particularly in currents, says Vera Bronza, marketing and sales manager at Boxfish.

Seabed transects were executed using a hovering Boxfish AUV programmed to autonomously navigate between predefined waypoints across the Rangitoto Channel. The mission was planned in advance and executed without tether or piloting, relying on onboard navigation. Identical missions can be re run months or years apart. This consistency supports time series monitoring and change detection, which are core requirements for many scientific and regulatory programs.

"We see a global trend for ports to add biodiversity in recovery zones to boost their sustainability," Bronza said. "Our AUVs are a very effective way of doing benthic surveys to make sure the changes are positive."

The AUV can also be trained to identify invasive species, including on ships hulls, and can be fitted with manipulators to then remove them. It can also be fitted with lighting designed specifically to check sea chests where either invasive species, drugs or other illegal objects could be otherwise difficult to detect.

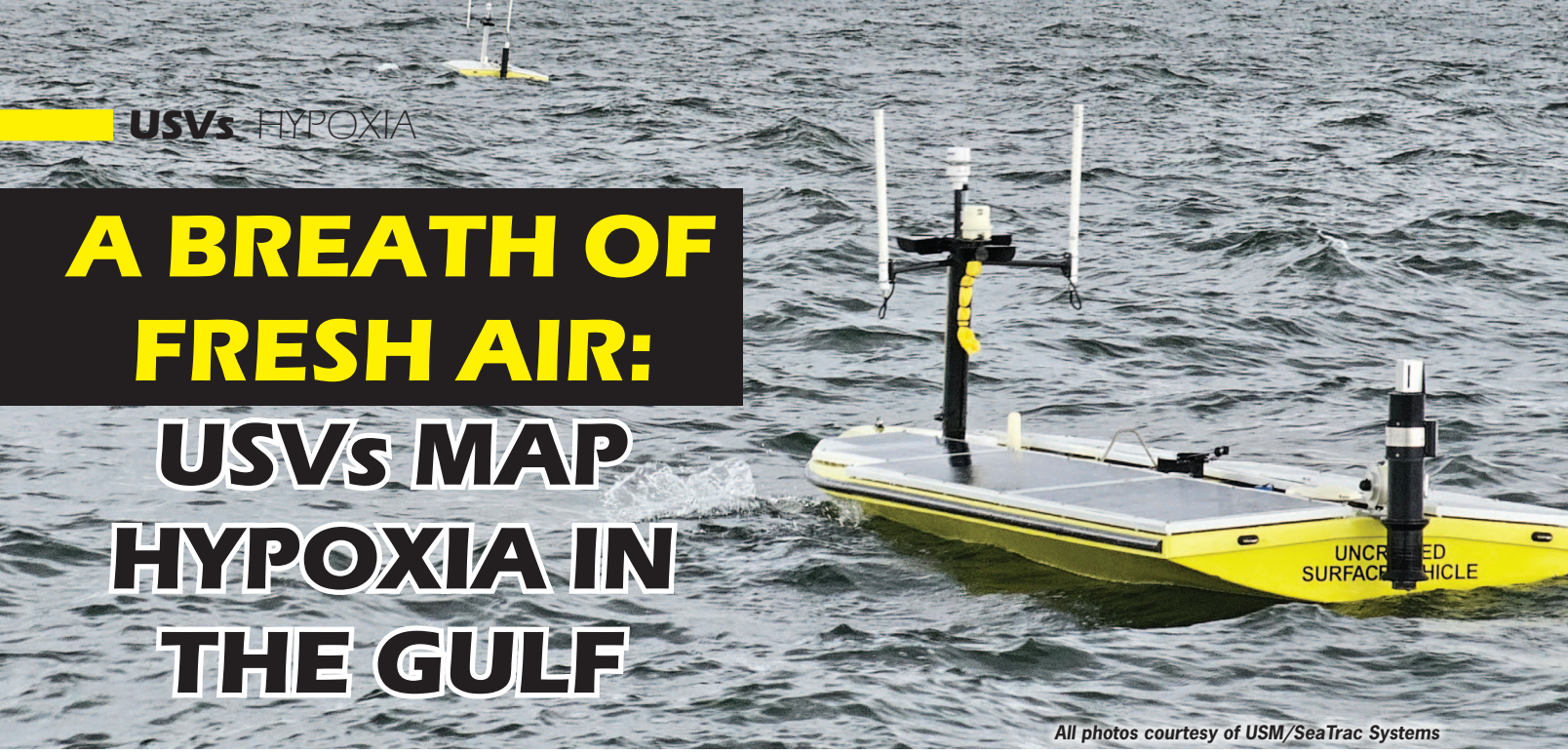


Boxfish Robotics AUV being deployed.

Boxfish Robotics are providing change detection for environmental rehabilitation within port waters.

Credit: Boxfish Robotics

A BREATH OF FRESH AIR: USVs MAP HYPOXIA IN THE GULF



All photos courtesy of USM/SeaTrac Systems

By Celia Konowe

The scientific method serves as a standard for research, guiding analytical and investigative projects. Though taught to generations of students, its steps are far from ancient, as technological advancements help researchers to develop and modernize each of its steps, saving time, money and even lives. Data collection, the middle step of the scientific method, is no exception. Many projects require robust datasets, often collected from extreme environments or over lengthy periods of time. The University of Southern Mississippi (USM), with the help of SeaTrac Systems, has turned to autonomous solutions while conducting hypoxia research in the Gulf of Mexico.

The partnership, which includes the National Oceanic and Atmospheric Administration (NOAA), maps potential hypoxia in the Gulf and how it impacts local fisheries and fish populations. Hypoxic zones, also known as dead zones, are areas of water in which oxygen levels are decreased due to nutrient pollution, often significantly impacting aquatic life. The collaboration recently completed a successful phase two of the project, building on an earlier phase and moving beyond proof-of-concept to deploy multiple SP-48 uncrewed surface vehicles (USVs). "It's a very labor-intensive, crude operation with a large research vessel," said James Thompson at USM. "We approached that from an uncrewed vehicle standpoint; we can modernize that with the tools that are available now."

The SeaTrac SP-48 USV

The Pickup Truck of USVs

The star of this research is the SP-48 USV, which stands for "solar powered" and "4.8 meters." At roughly 15 feet long and about 650 pounds, it can run 24/7 for months at a time thanks to a large array of solar panels on the deck that charge an internal battery. It is designed to run both near- and off-shore; within the scope of this project, the USV could be as near as five miles or as far as 40 miles. "The boat itself is really a platform for data collection," said Hobie Boeschenstein, director of operations and business development at SeaTrac. "We think of it as a pickup truck, where the platform itself isn't all that useful for anyone. It's really all about the payloads you can put on it and being able to quickly swap those out and put on different items—either sonar units or water quality sensors or oceanographic sensors."

Across the phases of the project, SeaTrac and USM saw changes to the USV to make it more versatile and robust in its data collection abilities. "Specifically for this one," Boeschenstein added, "the big development effort on our side was the winch and being able to support profiling down to the seafloor. Throughout the course of the project, layering on additional communications like the Starlink Mini was a big addition from when we first started."

"It's so versatile as far as what we can put on it. We tested cameras, we tested some collision avoidance tech—a lot of different things while we ran this hypoxia mission. That just

goes to show you how flexible this boat is," Thompson confirmed. "One of the other things that we collected, just because we could, was acoustic current data. It really is a pickup truck. You can put so many things onboard and with the size of the battery and the ability to generate so much solar power, it's a game changer."

Phase One

Phase one of the project served primarily as proof-of-concept, testing the vehicles and various sensors and their ability to collect the necessary data. "We learned a lot of what we needed to tweak to make that function," Thompson said. "And we did it, and much better than we expected."

The logical progression was testing longer duration surveys, assessing different sensors setups and running multiple USVs at once in different configurations. "What we learned," Thompson added, "was that the vehicle could produce all this power, but we weren't taking full advantage of that." They switched the sensors to be powered or recharged by the USV, which made a significant difference in terms of how much data they could collect. "We didn't have to limit ourselves based on the power available in the sensors. We could collect more and more data. And it showed the advantage of being able to not just hit the certain coordinates that we'll hit every year, but also find where that boundary of hypoxia changes, zero in on that by taking additional data samples."

SeaTrac was heavily involved at the start of this project, developing new features like a winch to take sensors from the surface to the seafloor. "A very important part of the hypoxia mapping is getting all the way to within a meter of the seafloor," said Boeschenstein. "Otherwise, you'll miss important data. A big development effort on our part was, how do we

MARINE TECHNOLOGY TV

Hobie Boeschenstein
Director of Operations and Business Development, SeaTrac

James Thompson

ensure that the sonde gets all the way down there? We worked closely with the USM team to look at some different ways of doing that, and ultimately came up with a system that would use a set of software parameters to detect slack in the line and know that, 'Okay, the sound is actually on the bottom; can't get any closer than that.'"

"When we're looking for the largest effect of hypoxia on the fisheries, you're looking at that layer that's right there near the bottom where all of the bottom dwelling critters are. Obviously if they can't swim up and out of that, then it's going to affect their metabolism and productivity," Thompson explained.

"By being able to get the sensors all the way down there to the bottom and know with certainty that we got them in that bottom layer of water, and then being able to look at that in real time and say, 'Yes, we're still detecting low oxygen here, move further south and see if we can find that edge where we're back to oxygenated water again.' Being able to adjust the mission on the fly and know that we're getting the data that's relevant was absolutely critical."

Phase Two and Beyond

During phase two, USM deployed multiple SP-48s simultaneously, overseen by a single shore-based operator. The team collected 123 verified hypoxia data points thanks to extended endurance, rapid adaptive sampling and platform reliability, even in challenging Gulf conditions that included a tropical weather system passing through the operational area.

"One of the things we really have been moving towards each time is improving the integration of sensors and improving that data flow," Thompson said. "Phase one was very much testing that can be done; phase two was improving the way it was done. That included things like more rapid turnaround on the data flow side of things, getting that data from the sensor to the boat, and from the boat over satellite to our system so that we could share that with NOAA in real time as we were going."

Another difference, Thompson pointed out, was that the sensors were developing at their own pace, meaning new features could be taken advantage of to further advance data collection. "AML Oceanographic, the company that makes the profiling instrument, has developed a wireless charging ability for it," added Boeschenstein. "Traditionally, we would have to balance, 'We're going to turn the sonde on, collect the data, pull it off, and then put it back to sleep,' which would make it challenging and eventually it runs out of battery. It limits what you're able to do with it." When AML Oceanographic rolled out this new capability, the USM team didn't need to swap out fresh batteries part way through, creating the potential for extended surveys over longer durations.

"It's a safety issue, too," Thompson added. "You're removing people from having to go service a vehicle out at sea, which in itself is a precarious stance."

Looking forward, the team hopes for another summer of data collection, aiming to add a third SP-48 to the lineup. On the data processing side, the researchers continue to develop automation to include additional quality control steps and are looking to add a 3D model of dissolved oxygen for the entire survey area.

A phase three would further the work of phases one and two, collecting critical hypoxia data and highlighting the use of USVs in offshore data collection and monitoring. Even more, this project showcases something less commonly observed—how incremental technological updates, such as wireless charging, energy management, and sensor payload, can be integrated in real time to modernize and advance research.

Tracking the paths of USVs.

Lineup Ocean's SURFREEF Project in Palavas-les-Flots

The Mediterranean coastline faces significant ecological and economic challenges. The Gulf of Lion, which has been studied for erosion and flooding risks for over 15 years, exemplifies these issues. The reduced sediment supply from rivers—including the Rhône—flowing into the gulf has intensified coastal erosion, a problem further exacerbated by climate change.

The increasing frequency and intensity of storms have accelerated beach erosion. Artificial structures built to mitigate this phenomenon, such as rock groynes and breakwaters installed since the 1970s, have often reached their limits. While these structures have helped stabilize sandbanks locally, they degrade over time and prevent the natural regeneration of beaches.

In the 2010s, significant beach replenishment projects were undertaken using dredgers. These efforts, costing millions of euros, were intended to provide sand for several years or even decades, according to local stakeholders. However, the effects of storms quickly undermined these projections, reducing their effectiveness to less than five years.

The SURFREEF Project

The Lineup Ocean team has extensively studied the processes affecting Mediterranean coasts. With the SURFREEF project, they are testing a new generation of submerged structures designed to limit coastal erosion. Inspired by the natural mechanisms of mangroves, this eco-designed innovation aims to dissipate the energy of destructive waves and promote the regeneration of sandbanks.

The UpBlock modules, 3D-printed from a bio-based material (low-carbon shell mortar), represent a promising French advancement. They are designed to enhance a beach's natural resilience while supporting local biodiversity.

For YellowScan, the technical challenge of the SURFREEF project is both inspiring and stimulating. The team supported Lineup Ocean by deploying its topo-bathymetric LiDAR system, the Navigator.

Establishing a Baseline

The first phase of the project focused on creating a comprehensive baseline, integrating physical and biological indicators. Topography was a major component of this coastal project. As part of this, the Navigator system was used to model the entire beach, including breakwaters, under calm sea and clear water conditions.

Bathymetric LiDAR uses green laser pulses. These enable the measurement of the distance from the water's surface to the seabed. From a flying platform, a laser scanner emits green radiation that passes through the water and is reflected on the bottom of the seabed. The laser scanner collects the reflected radiation of the pulse and calculates the time elapsed between the emission and reception to obtain the distance to both the water surface and seabed. The maximum water depth that can be measured using the Navigator is 2 Secchi depths.

Image above: A view on Palavas-les-Flots coastline with waves.

A Carefully Managed Mission

The mission required adherence to numerous parameters. The Navigator system needed a drone capable of carrying a 4 kg payload. The flight scenario chosen was S1, due to the drone's total weight. The mission utilized a DJI M600, a drone proven for bathymetric LiDAR missions.

Given the urban context and the presence of an air corridor, flight authorizations were obtained, and all legal requirements were followed. Palavas-les-Flots, a popular seaside resort near an airport, also presented logistical challenges. To minimize disruptions, the mapping was conducted at sunrise, with support from the municipal police to secure the area.

To create a comprehensive cartographic baseline, data density was crucial. The plan involved covering the 8-hectare experimental site in less than 20 minutes, at an altitude of 50 meters and a speed of 5 m/s. In practice, the protocol was adapted with three distinct takeoff and landing zones to maintain the maximum allowed distance between the drone and the pilot.

Throughout the operation, the drone pilot, LiDAR operator, and members of the Lineup Ocean and YellowScan teams ensured the smooth execution of the flights. Pedestrians, athletes, and residents were informed about the SURFREEF project and the ongoing mission.

Data Processing

The point clouds generated by the Navigator were processed and classified, then cross-checked with control points (GCP) and, for the terrestrial part, with photogrammetry data. Given the nature of the project and the mapped area, half a day was allocated for data processing.

The topo-bathymetric LiDAR point cloud was processed automatically using YellowScan CloudStation software. The point density underwater was at least 20 points/m². This software was used for classification and filtering to export the seabed as a Digital Terrain Model (DTM).

Comparing LiDAR data with topographic surveys acquired using a GNSS rod (GCP) demonstrated centimeter-level accuracy. This precision is essential for detecting sandbank movements and any changes or displacements of future UpBlock structures or existing breakwaters.

Terrasolid software was thenused to overlay the processed data. Lineup Ocean had conducted photogrammetric modeling in April 2025, while LiDAR acquisition took place in June 2025. The observed differences in the beach profile were attributed to seasonal changes, such as winter storms. Fixed structures and breakwaters served as reference points, showing that the beach profile had evolved between April and June. The LiDAR acquisition revealed a level drop of nearly 20 cm in some areas of the emerged beach, a phenomenon attributed to the establishment of a "summer profile" by the Lineup Ocean team.

Conclusions and Future Prospects

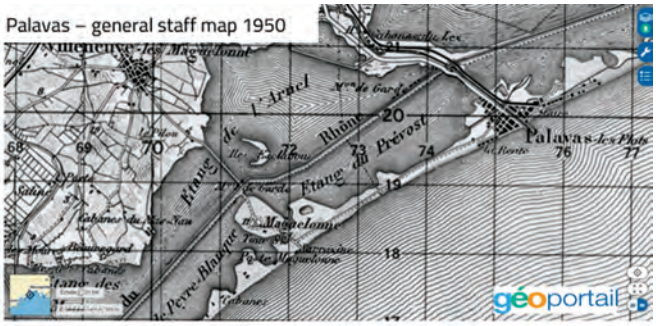
The operation in Palavas-les-Flots, combining a new methodology and a baseline assessment before development, validated the operational capability of the Navigator. This tool effectively fills gaps in bathymetric data while ensuring the continuity of topographic data with centimeter precision.

The flight protocol, approved by authorities, will serve as a reference for future operations. The next data acquisitions will occur during the installation of a demonstrator segment of UpBlock modules and after the first storm, to measure sandbank movements on the site. YellowScan will participate in these operations as a technical partner.

YellowScan thanks the Lineup Ocean team for their trust and openness to new technologies, as well as the municipality of Palavas-les-Flots and the Directorate General of Civil Aviation for their support.

Palavas - Cassini map 1756-1815

Palavas – general staff map 1950



Palavas – general staff map 1820-1866

Palavas – IGN Map 2025

©Geoportail

A simulation view of the UpBlock modules integrated to enhance a beach's natural resilience.

© Lineup Ocean

The YellowScan Navigator mounted on a DJI M600 before the mission.

© YellowScan

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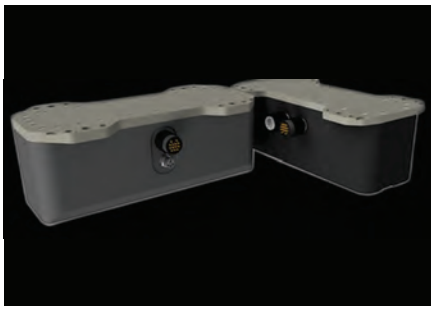
Oceanology International 2026 Celebrates New Technologies Across the Industry

With March come and gone, we'd be remiss without reflection on the month's highlight, Oceanology International 2026 (Oi26). Held at ExCel London from March 10-12, companies across the global subsea industry launched and displayed new products and solutions.

Kongsberg Discovery



Kongsberg Discovery Launches HISAS2020 Synthetic Aperture Sonar, Expands Multibeam Echosounder Portfolio

Kongsberg Discovery has launched the HISAS2020 synthetic aperture sonar and expanded their multibeam echosounder portfolio with the launch of two new EM2042 variants.

Previously available exclusively as part of integrated payloads on Kongsberg Discovery's HUGIN AUV family, HISAS can now be implemented across any platform, including all relevant AUVs, USVs, ROVs and towed assets, delivering clear, centimeter-level resolution, robust system design for long-term reliability, and real-time data processing. The solution, suitable for an array of defense, energy and ocean science applications, was officially showcased at Oi26.

HISAS2020 operates in the 120–210 kHz frequency range, delivering ultra-high-resolution imagery, alongside co-registered bathymetry, in a single pass. A key advantage is its real-time, GPU-enabled processing architecture, allowing data to be processed on the fly, transforming raw acoustic returns into actionable insights during the mission itself, rather than through post-processing onshore.

For users, this means seeing more detail, detecting smaller objects, and understanding underwater environments with both greater confidence and speed — whether the task is seabed mapping, surveys of critical underwater infrastructure, or target identification.

Defense operators benefit from precise seabed awareness for mine countermeasures, harbor protection, search and rescue operations, and overall maritime domain awareness. Energy companies gain improved inspection capability for pipelines, cables and offshore assets, supporting both maintenance and integrity assessments. Ocean scientists and hydrographers can capture highly detailed maps of habitats, archaeological sites and geological features, enabling long-term monitoring and environmental research.

EM2042 Expansion

The new EM2042 DR600 and EM2042 BNS build on the EM2042 platform, sharing its next-generation acoustic architecture, while addressing two operational needs: deep-rated subsea vehicles (spanning platforms from AUVs, ROVs, ROTVS to submarines) and demanding naval environments. Both products were showcased at Oi26.

The EM2042 DR600 offers the same performance as the standard EM 2042 but is engineered specifically for underwater vehicles and deep unmanned platforms. With a depth rating of 600m, thanks to pressure resistant titanium housing and subsea-qualified electronics, the system delivers ultra-high-resolution mapping in a lightweight, energy-efficient package optimized for subsea vehicles with limited power budgets.

Its vehicle agnostic design and single cable connectivity offer flexible, simple integration, while its unique dual RX and single TX configuration enables up to 220° swath coverage on subsea platforms. Other features include multi-transmitter/multisector technology, with full 4D motion compensation for precise mapping, even on maneuvering vehicles, and QuadSwath ready technology for increased coverage and faster operations.

Complementing the DR600 is EM2042 BNS, a naval-optimized multibeam solution developed to enable optimal underwater domain awareness, critical infrastructure protection, rapid environment assessments and a wide range of defense applications.

Built for harsh environments, with military-grade robustness, the BNS variant

iBULe Photonics
From left: Dr. Sang-Goo Lee, CEO of iBULe Photonics, Richard Watson, Consultant, Higgin Ko, Vice President of iBULe Photonics.

GeoAcoustics

combines high-resolution bathymetry with co-registered backscatter, enabling accurate seabed modeling, change detection and target tracking in the water column. Its wideband frequency coverage (150-700 kHz) and advanced motion stabilization, deliver precise mapping even on fast-moving or unstable platforms, while a single-cable architecture simplifies installation and reduces topside complexity.

iBULe Photonics Unveils First 3rd-Generation Single Crystal Submarine Hydrophone

iBULe Photonics unveiled the world's first submarine hydrophone sensor utilizing 3rd-generation piezoelectric single crystal technology at Oi26.

The new acoustic sensor represents an advancement in underwater detection capability. By harnessing the enhanced properties of third-generation single crystal materials, the hydrophone delivers 9 dB greater sensitivity compared with conventional ceramic PZT hydrophones. This improved performance enables longer detection ranges and clearer signal processing, particularly in complex and noisy undersea environments.

Designed for next-generation naval sensing systems and advanced ocean monitoring applications, the technology supports improved situational awareness and more precise acoustic detection for submarines and underwater platforms.

During the exhibition, iBULe Photonics, a global leader in piezoelectric single crystal materials, also outlined its strategic ambition to expand into the North American defense market, capitalizing on the role of high-performance acoustic sensing technologies such as iBULe Photonics's single crystal hydrophone in enhancing detection capabilities for future submarine fleets. Among the company's potential collaborations are opportunities linked to the Canadian Patrol Submarine Project (CPSP), a major procurement program which will replace the Royal Canadian Navy's Victoria-class submarines with a new fleet of modern long-range patrol submarines.

Visitors to the iBULe Photonics stand during Oi26 were also introduced to a visual presentation highlighting the company's technological development and its long-term vision for delivering advanced sensing solutions that support a safer and more connected ocean.

GeoAcoustics Launches Two New Tech at Oi 2026

Sonar manufacturer GeoAcoustics Ltd has expanded its portfolio with the launch of GeoMB, its first multibeam echosounder, and the Geomulse LF 101, a new low-voltage boomer system. GeoMB also celebrated its first sale at Oi26 by Australian channel partner No Humes.

Featuring an embedded Applanix AP+ integrated GNSS/IMU solution as well as a Sound Velocity Sensor, GeoMB is an all-in-one multibeam solution engineered for performance, reliability and data integrity. With integrated auxiliary sensors, it delivers bathymetric data in a compact and efficient package.

Operating at 400 kHz, GeoMB produces dense depth data with wide swath coverage and vertical resolution, supporting hydrographic surveys that meet demanding accuracy requirements. The system features 512 beams and swath coverage of more than 140 degrees, balancing coverage and detail for precision seabed mapping. Sounding depths extend from 0.2 m to beyond 200 m, enabling operations from shallow inshore environments to deeper coastal waters.

Designed for practical deployment, GeoMB is optimized for small survey vessels, vessels of opportunity and uncrewed surface platforms, combining low power consumption with a robust mechanical design. The compact transducer measures 220 mm square and 181 mm high, weighing 7.5 kg, with a 3 kg deck unit, making installation straightforward on constrained platforms.

Through its partnership with GeoAcoustics, No Humes aims to make advanced multibeam technology more accessible to the Australian market, enabling customers to deliver reliable survey results more economically than many traditional systems. The first GeoMB system ordered by No Humes will form part of its rental fleet, with demonstration and hire availability expected from May 2026. The company is also offering the GeoMB for direct sale to customers across Australia.

The GeoPulse LF

Designed as a safe and practical solution for marine seismic survey, GeoPulse LF 101 operates up to a maximum of 1000 V DC, lower than traditional boomer systems that can run at up to 4000 V. This lower voltage architecture supports improved handling safety and simplifies vessel integration, particularly on smaller platforms. A compact, portable energy source and lightweight cable reduce mobilization demands, enabling deployment for diverse applications including subsea construction, in addition to wind farm, cable route and

Sonardyne

infrastructure surveys.

The launch expands GeoAcoustics' existing sub-bottom profiler range, complementing the GeoPulse 2 and GeoPulse Compact systems by introducing lower-frequency capability for deeper penetration in more challenging ground conditions. Together, the portfolio provides surveyors with a toolkit spanning high-resolution shallow work through to deeper geophysical investigation. The company also draws on experience in deep-water systems as the OEM for Kongsberg Maritime's TOPAS sub-bottom profilers.

Sonardyne Launches Intelligent Subsea Monitoring Tool

Sonardyne has launched Observer, a new monitoring system for real-time integrity management of subsea infrastructure across the offshore energy industry.

Observer combines high and low frequency motion and position monitoring, powerful in-built analytics and wireless communications to deliver live insight into how subsea assets are truly behaving.

This means unseen process and environmental challenges, from pipeline expansion and contraction to vortex and flow induced vibration, can be addressed before they become a problem, lowering risk and intervention and costs, while extending asset life.

Out the box, it's ROV-deployable, can interface with a wide range of third-party sensors, and can be deployed for up to 10 years at 3,000 m, according to the company.

Observer is designed for use on all subsea assets, through the water column,

Voyis Imaging

including pipelines, risers, moorings, umbilicals, wellheads and associated infrastructure, helping integrity managers to reduce uncertainty and strengthen decision-making.

Voyis Launches the Discovery Stereo Perception Series to Enable Subsea Autonomy

Voyis Imaging Inc. announced the launch of the Discovery Stereo Perception Series, a new class of subsea stereo vision systems engineered to enhance piloting awareness and enable autonomous underwater operations through real-time 3D perception.

Three years ago, Voyis introduced the Discovery Inspection Series, establishing a new benchmark for subsea stereo imaging and 3D inspection. Since then, Discovery systems have supported hundreds of survey projects worldwide across a range of ROV platforms and subsea environments.

As subsea operations continues to evolve, the demand for autonomy has intensified. However, a critical technology gap has remained. Forward looking sonar systems, while essential for long-range detection & avoidance, do not provide the spatial resolution required for fine manipulation or close-range navigation. Conversely, traditional monocular-camera systems lack the 3D depth perception necessary for reliable autonomous behaviors. Subsea autonomy requires dense, real-time spatial understanding, a capability not previously available in a compact, vehicle-integrated optical system.

Designed to function as the eyes of subsea vehicles, the Discovery Perception Series replaces traditional single-

Teledyne Marine

camera configurations with realtime stereo vision and 3D depth perception. Wide-angle stereo imaging combined with onboard processing generates dense depth maps and live point clouds, delivering reliable spatial awareness in complex underwater environments.

The Perception Series provides low-latency video for piloting, high-quality still imagery, and true-scale depth data simultaneously. This enables operators to improve vehicle positioning, monitor proximity to assets, and maintain situational awareness with enhanced confidence. By delivering depth perception directly on the vehicle, the system supports advanced capabilities such as station keeping, manipulator assistance, and the development of autonomous control frameworks.

Beyond piloting and autonomy, the Discovery Perception Series also supports photogrammetric workflows for general 3D estimation. Captured stereo imagery can be processed to generate indicative 3D models that allow operators to assess object size, geometry, and relative change over time. This capability supports visual screening and prioritization in applications where certified inspection accuracy is not required, expanding operational insight without introducing additional system complexity.

The Discovery Perception Series is available in two models, the P300 and the P3000, designed to accommodate varying depth ratings and platform requirements. Both models deliver wide field-of-view stereo imaging and onboard depth computation optimized for real-time performance.

Robosys Automation

Silicon Sensing

Kongsberg Discovery

Teledyne Marine Unveils SeaBat D100 Deepwater Multibeam Sonar

Teledyne Marine has launched the SeaBat D100, the first model in its new D Series, a deep water multibeam product line, ahead of Oceanology International 2026.

Drawing on decades of deepwater multibeam deployment, the SeaBat D100 delivers the data quality, resolution, and reliability of the SeaBat portfolio in a compact, highly flexible deep-water configuration.

Designed specifically for surface vessels operating on water depths down to 3000 meters, the D Series has been developed with portability in mind. The smallest configuration (2°x1.5°) makes it suitable for Vessel of Opportunity (VoO) or even USV type projects. Unlike traditional deep-water systems that typically require dedicated survey vessels and permanent installation, the SeaBat D100 features a compact sonar head and a compact topside processor.

Its reduced footprint enables pole mounting makes it ideal for temporary mobilizations and multi-vessel operations. Supplied with installation-optimized cabling as standard, an optional mounting bracket is also available to further streamline deployment and minimize integration time. While the D100 can also be hull-mounted, its pole-mount capability provides operators with greater flexibility across fleets.

The SeaBat D100 features beam stabilization technology, automatically compensating for vessel motion to maintain uniform swath coverage and consistent data quality, even in challenging sea states. Multi ping capability further enhances performance by increasing along-track density, increasing coverage rates and improving productivity to ultimately reduce ship time. A modern user interface also improves usability and operational control.

Robosys Automation Unveils VOYAGER AI Simulator at Oi26

Robosys Automation, unveiled its new VOYAGER AI Simulator at Oceanology International 2026, a maritime simulation environment designed to work with Robosys' VOYAGER AI Autonomous Navigation System.

The VOYAGER AI Simulator enables advanced testing, validation, mission planning and rehearsal for autonomous and remotely operated vessels by creating a Digital or Virtual Twin of a vessel or USV (Unmanned Surface Vessel).

The simulator enables operators and manufacturers to create digital twins of vessels or USVs by simulating engine performance, onboard sensors and navigational data. This allows teams to replicate real-world vessel behavior within a controlled virtual or immersive environment. The platform also supports the modelling of multiple vessel tracks, enabling users to build complex maritime traffic scenarios and conduct quantitative testing and analysis.

The system supports the testing of COLREGs-compliant collision avoidance behavior in simulated maritime environments, while enabling both shore-based simulation and immersive operational testing. In addition, the platform can ingest live maritime traffic data and generate augmented traffic scenarios for enhanced operational testing and training.

The simulator also enables complex seaborne mission rehearsal planning, allowing operators to design, test and refine operational scenarios before vessels are deployed in real-world conditions.

The VOYAGER Simulator incorporates an integrated ENC display, providing accurate chartbased navigation environments to support realistic maritime simulation. Its drag-and-drop scenario creation tools allow users to quickly build and modify simulation scenarios, enabling rapid configuration and testing.

The platform also supports Remote Piloting (RP) testing and can integrate with third-party hardware controllers to replicate realistic remote vessel operations. In addition, the system supports testing at Degree 4 autonomy, enabling comprehensive validation of advanced autonomous navigation capabilities.

Kongsberg Discovery, Silicon Sensing Systems Collaborate on MEMS Solution

Kongsberg Discovery has unveiled a north-seeking micro-electromechanical system (MEMS) solution, which was showcased at Oi26.

With a solid-state design tailored for high volume production and cost-conscious pricing, the unit delivers performance across a wide temperature range, in vibrating and dynamic environments.

Kongsberg Discovery has a long-standing co-operation with Silicon Sensing Systems. The result is a small, robust and highly cost-effective solution that demonstrates north-seeking capabilities, based on Kongsberg Discovery's proprietary IMU design.

Market requirements for north-seeking gyroscopes increasingly demand low size, weight, power and cost (SWaP-C). The combination of Silicon Sens-

MacArtney

ing's micro electro-mechanical systems (MEMS) sensor technology with Kongsberg's electronics and software expertise now offers a solution with potential application in many markets and for many critical operations.

The new Kongsberg Discovery device uses Silicon Sensing's latest generation inductive silicon MEMS gyroscope, the SGH03. This sensor is at the heart of Silicon Sensing's product range, including the tactical grade DMU41 9 degrees of freedom (DoF) inertial measurement unit and CRH03 single axis gyro.

MacArtney Introduces TrustLink Data Solution

TrustLink Data is a complete harness solution that delivers assured 10Gbit/s data transmission across cable assemblies up to 10 meters, tested and qualified to operate at 600 bar. Designed for modern sensors, sonar platforms and real-time underwater operations, it preserves signal integrity throughout the connection for advanced systems in marine and offshore, ocean science and naval applications.

TrustLink Data combines a 19-contact connector, a specifically designed data cable and controlled termination to perform as a single integrated unit. Within this configuration, the core transmission section functions as a cable harness composed of CCP–Cable–CCP, while the complete TrustLink Data assembly includes FCR/BCR terminations at each end.

The development of TrustLink Data reflects two years of engineering, built on research, stepwise prototyping and repeated testing across multiple cable configurations. MacArtney's in-house pressure-testing capabilities enabled validation under realistic subsea conditions and guided precise refinements to the cable, connector and termination assembly.

Tested to the RFC 2544 and ITU-T Y.1564 standards, TrustLink Data supports subsea applications, including sonar systems, imaging platforms, advanced sensors, ROVs, AUVs, and long-term monitoring solutions.

Greensea IQ

Greensea IQ Launches Bayonet AUGV Training Simulator

Greensea IQ announced the launch of a new simulator designed to help operators learn, practice, and refine their skills using the company's Bayonet Autonomous Underwater Ground Vehicles (AUGVs).

Developed in-house, the training simulator is built in a virtual game environment providing a realistic experience with an accurate physics engine. The game engine integrates with the operator's console of the Bayonet robot, taking the place of a live robot, and simulates a fully operational system. Operators interact with the simulated system just as they would with a deployed robot, utilizing Greensea's operating software, conducting real-life mission scenarios, responding to environmental events, and supervising the robot in both autonomous modes of operation as well as piloting the system in open-loop modes of operation.

The Bayonet AUGV simulator is designed for training scenarios and supporting operational work-ups of real-life missions. Trainers can specify environmental conditions, import geography and bathymetry, place targets, and create mission objectives. A fish-eye view in the trainer's console allows the trainer to watch as an operator executes a mission. Realistic POV video from the AUGVs camera and simulated high-fidelity sonar data provide the operator an accurate experience while working within Greensea's Workspace software. Operators can use the Workspace software just as they would in a live exercise, practicing scenarios, learning the software, and understanding their role as partners with an autonomous system.

All of Bayonet's autonomous features are fully enabled and available, from mission execution, obstacle avoidance, and target interrogation, to Automatic Target Recognition. Workspace's data management systems are also fully functional, supporting data recording and playback as well as integration with TAK systems and Greensea's post mission analysis toolchain.

The Bayonet AUGV Simulator is built on Greensea's new simulation engine for Greensea's software systems. Training simulators for Greensea's EOD Workspace and EOD Edge software platform available on the Mission Specialist Defender ROV systems by VideoRay (an AeroVironment company) and well as training simulators for Greensea's RNAV system for combat swimmers will be available in the spring of 2026.

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■ Oceaneering International

■ All American Marine

■ Oceaneering Debuts New Electric Propulsion Work Class ROV

Oceaneering International, Inc. announced that its Subsea Robotics segment has debuted the newest addition to its Remotely Operated Vehicle (ROV) portfolio, the Momentum Electric Work Class ROV.

The Momentum Electric ROV was developed using a reliability-driven, data-informed design approach that re-engineered the work-class platform around electric propulsion to improve efficiency and simplify system architecture.

The vehicle is designed for 30-day continuous subsea operations, enabling extended support for drilling, inspection, maintenance, and repair (IMR), surveys, and construction work scopes. Featuring plug-and-play sensors, advanced 360-degree vision, automation, strong thrust, and high payload capacity, the Momentum Electric ROV delivers the power and control required for demanding work-class operations. Offering backwards compatibility with Millennium Plus ROV infrastructure, Momentum supports quick upgrades and scalable deployment.

■ All American Marine Builds University of Texas Marine Science Institute Research Vessel

All American Marine (AAM) has begun construction on a next-gen 78' x 26.7' aluminum catamaran research vessel for the University of Texas Marine Science Institute (UTMSI). The vessel is being built on Teknicraft Design's multi-purpose research platform and is designed to support scientific research, survey, and teaching missions throughout the Gulf of Mexico, including offshore operations up to 150 nautical miles from shore.

Purpose-built for multi-mission flexibility, the twin-engine, propeller driven vessel will support a broad range of scientific operations including coastal and offshore ecology research, seismic surveys, gravity coring, water chemistry analysis, fisheries surveys, and undergraduate and graduate instruction. The platform integrates an adjustable hydrofoil system, modular deck equipment, and dedicated wet and dry laboratory spaces to accommodate evolving research requirements across diverse operating profiles.

Powered by twin 803hp CAT C18 Tier 3 diesel engines delivering cruising speeds of approximately 20 knots and fuel-efficient survey speeds as low as 3 knots. Fuel capacity is 1,600 gallons, allowing for long range missions, and the vessel will be inspected to USCG Subchapter T standards.

The vessel is defined by Teknicraft's hydrofoil-assisted aluminum catamaran hull, delivering stability at cruising and survey speeds, reduced resistance, and superior offshore efficiency. The adjustable hydrofoil system actively manages lift and drag, resulting in a smoother ride, lower fuel consumption, and consistent performance across a wide range of operating conditions.

The vessel is designed to carry up to 30 scientists, students, and crew on day trips, and up to 14 personnel on extended offshore missions.

Operations will include near-shore research based out of Port Aransas, Texas, as well as multi-day expeditions across the Gulf of Mexico. These missions will span near-coastal waters to deep-water environments, including the Texas shelf, the Mississippi, Trinity, and Sabine River Deltas, Salt Dome, and the Flower Garden Banks.

To support this work, the vessel is outfitted with a suite of scientific systems that allow researchers to collect water samples, study marine life, map the seafloor, and conduct geophysical surveys. Specialized equipment—including sampling systems, nets, seismic instruments, and coring tools—can be installed or removed as needed, allowing the vessel to be quickly reconfigured between research programs while maximizing time on the water.

■ EdgeTech Introduces the Trace Side Scan Sonar for Micro-UUV, ROV, USV

EdgeTech has recently expanded their OEM side scan sonar product offering to meet the needs of small and micro sized autonomous vehicles.

EdgeTech designed the new Trace OEM side scan sonar specifically with micro-UUV, small ROV and shallow water USV in mind. The Trace system is a small form factor (13cm

■ EdgeTech

■ HydroSurv

■ ACUA Ocean

x 7cm), low power, high quality EdgeTech OEM side scan sonar solution for small and micro vehicles.

The dual frequency Trace system can be configured to operate at a range of frequency pairs including: 540/1600 kHz or 540/850 kHz or 850/1600kHz with standard cabled arrays or customized vehicle-specific arrays. The system is ideal for shallow water survey applications, providing an excellent combination for range and resolution. With an average power draw of only 7-10W the 12-24 v DC system has been optimized for size, power and weight.

Integrators can choose RS232 communications for navigation devices and other sensors. External triggering is also available. The Trace system has an ethernet interface to connect to the host platform and comes with a common EdgeTech command and control interface. EdgeTech's sonar data is streamed from the Trace system for storage on the host platform.

■ HydroSurv Delivers REAV-25 USV to Skanska Norway

HydroSurv has announced the sale and delivery of its latest REAV-25 Uncrewed Surface Vessel (USV) to Skanska Norway AS, marking a milestone in Skanska's expansion of uncrewed survey capability for infrastructure projects across the country.

Skanska is a civil engineering and construction company with works spanning inland waterways, ports and harbors, and coastal environments. Supporting the successful delivery of these projects is Skanska's in-house survey and inspection unit, where the REAV-25 will play a key role in strengthening inland hydrographic survey operations.

The USV will be primarily deployed to deliver high-resolution bathymetric surveys using a Norbit iWBMS multibeam echo sounder, supporting the design, construction and long-term maintenance of infrastructure located over, under and alongside the water. The acquisition reflects Skanska's growing adoption of uncrewed technologies to improve data availability, operational efficiency and safety, while reducing the environmental footprint of survey activities.

Designed for zero-emission day operations, the REAV-25 is a sheltered-water, multipurpose USV capable of supporting a wide range of hydrographic and environmental data collection campaigns. The vessel is equipped with twin 2.5 kW rim-driven thrusters, minimizing the risk of entanglement or damage during shallow-water operations, and is powered by a 6-kWh lithium battery system enabling full-day endurance. As a commercial-grade platform, the REAV-25 features HydroSurv's Virtual Watchkeeper Vessel Control System (VCS) alongside the Dynautics Spectre autopilot.

The USV, named Saga, will complete trials in the UK in March 2026 and is expected to enter operational service with Skanska in Norway in early spring.

■ ACUA Ocean Unveils FleetMind Integrated Platform Monitoring System for Autonomous Vessels

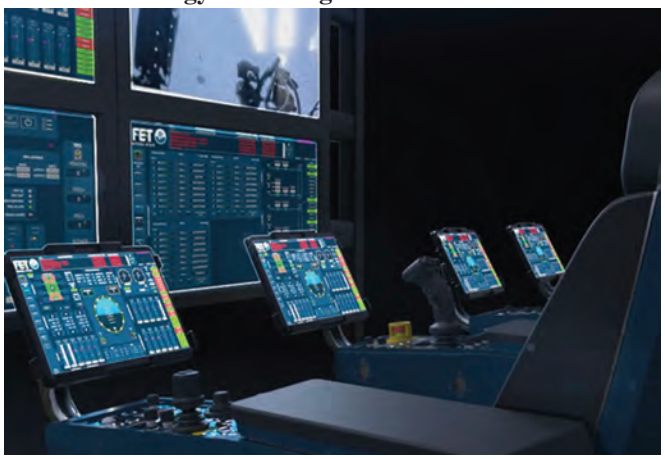
ACUA Ocean has announced the launch of FleetMind, an integrated platform monitoring system for autonomous vessels, filling a gap in the medium and large unmanned surface vehicle (USV) management capability.

While existing autonomy software solutions focus on command and control, navigation and collision avoidance, end users are consolidating the number of systems being deployed. This necessitates a modular approach to the C2 software integration layer, allowing focus to be spent on reducing the operating burden of vessel management and maintenance. ACUA's FleetMind solution provides vessel operators with hardware/software interface needed to enable high-level software to control the vessel while also providing intelligent platform engineering.

While many existing USV designs are optimized as lightweight, mission-specific craft, the next generation of larger work-boat and ship-based autonomous platforms demands a different architectural approach. For these high-endurance assets, the complexity of the onboard engineering systems—propulsion, power management, and structural health—is as critical to mission success as the navigation and C2 software. FleetMind addresses this by prioritizing the "engineering stack" alongside traditional autonomy.

FleetMind delivers scalable modular data aggregation of vessel systems (NMEA, PLCs, Sensors, Networks, etc.) into data

■ **Forum Energy Technologies**



■ **Sonardyne**

L-R, Richard Mills, Cellula's Chief Commercial Officer, and Aidan Thorn, Marine Robotics Business Development Manager at Sonardyne.

lakes, enabling insights into vessel performance, maintenance and characteristics. This capability is being developed to include vessel simulation and virtual test environments.

First deployed onboard ACUA Ocean's USV Pioneer in Q2 2025, FleetMind has since completed over 7,000 hours of on water operations, collecting over 25 billion datapoints, providing sub second insights to over 13,000 series during its first six months of at sea operations.

Vessel data optimization enables real time "stateful tracking" that powers predictive maintenance and smarter automatic management, connecting vessel systems and performance data to the wider business requirements.

Insights gathered from FleetMind will increasingly enable future multi-vessel integration for a single view of fleet or swarm engineering management via the Remote Operations Centre. This user centric design approach reduces operator cost and complexity, while enhancing decision-making. FleetMind was developed in consultation with the Lloyd's Register Human Factors team to ensure that as vessels scale in size and complexity, the interface remains intuitive, mitigating the cognitive load on shore-based operators and satisfying the stringent requirements of UK Workboat Code 3 regulations.

■ **FET Launches Remote Control Station for Subsea ROV Operations**

Forum Energy Technologies (FET) has introduced a new remote control station designed to allow remotely operated vehicle (ROV) systems to be operated from any location.

The system operates using the ICE Unity ROV control platform released in 2025 and enables remote operations, live streaming of survey data and monitoring of ROV systems.

The package includes FET Subsea advanced control chairs, Remote-Connect gateway enclosures and VisualSoft's video streaming and network player technology. It can be supplied with new ROV systems or installed as an upgrade to existing systems operating with ICE Unity.

According to FET, the system allows operators to control subsea operations remotely while maintaining system performance. The approach is intended to improve operational flexibility, enable access to specialist expertise and reduce costs while enhancing safety.

FET demonstrated the technology at Oceanology 2026, where an ROV was piloted from the company's headquarters in Kirkbymoorside, North Yorkshire, while the control station was located at the conference in London, more than 300 kilometers away.

The hardware for the system is manufactured and delivered from Kirkbymoorside. FET said the technology is intended to support subsea operations across offshore energy, defense and other underwater sectors.

■ **Cellula Robotics Selects Sonardyne for Long-Range AUVs**

Autonomous subsea robotic systems developer Cellula Robotics has chosen Sonardyne navigation and positioning technology for its long-range autonomous underwater vehicle (AUV) platforms.

For a number of AUV programs, the company has ordered multiple Sonardyne SPRINT-Nav X navigation systems, Sonardyne's highest grade and underwater navigation system.

The company has also selected Sonardyne's AvTrak 6 for tracking, communications and mission control. Part of the package/purchase is multiple Sonardyne Ranger 2 Ultra-Short BaseLine (USBL) positioning and communications systems for both AUV end users and demonstration and testing.

Cellula's range includes the almost 12 m-long hydrogen fuel-cell powered Guardian and Porter AUVs, supporting long-range surveillance and cargo delivery respectively. Both have up to 45 days endurance and a 5,000 km range enabling extended deployments, with 5,000 liter capacity payload bays for flexible configuration.

Cellula has the 8.5 m-long Envoy AUV. Also hydrogen fuel cell powered, it's designed for surveillance and data gathering, including by anchoring at the seabed for periods.

Cellula's Ranger 2 systems are Gyro USBL variants. These combine heading, pitch, roll and an acoustic transceiver in one pre-calibrated unit, simplifying vessel deployment and boosting accuracy.

2026
Editorial Calendar

MARINE TECHNOLOGY REPORTER

01 | Jan/Feb 2026
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Underwater Vehicle Annual

- Research Vessel Fleet & Technology
- Subsea Defense
- Autonomous Navigation
- Battery Technology

Event Distribution
Oceanology International London – London, UK
Subsea Expo 2026 – Aberdeen, Scotland
IPF 2026 – New York, NY
IADC/SPE Intl Drilling Conf & Exhibition – Galveston, TX

DEEP DIVE
PODCAST: Underwater Vehicle Tech

02 | February 2026
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Oceanographic

e-Magazine Edition

Tech Focus: Sonar, Telemetry & Data Processing Software

DEEP DIVE
PODCAST: Digitalization

03 | Mar/Apr 2026
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Oceanographic Instrumentation & Sensors

- Port Security
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- Workclass ROVs: IMR

Event Distribution
Port of the Future 2026 – Hilton University of Houston
OTC 2026 – Houston, TX
UDT 2026 – Excel, London
Sea-Air-Space – National Harbor, MD, USA
Wind Europe 2026 – Madrid
Japan Energy Summit & Exhibition – Tokyo Big

DEEP DIVE
PODCAST: Subsea Survey Technology

05 | May/Jun 2026
Ad close May 21

Dredging Technology

- Universities Review
- Hydrographic Survey
- Scientific Deck Machinery
- Cables & Connectors

Event Distribution
Underwater Technology Conference – Norway
WEDA Dredging Congress & Exhibition – Montreal, Canada

DEEP DIVE
PODCAST: Dredging Technology

07 | Jul/Aug 2026
Ad close Jul 21

Autonomous Vehicle Operations

- Underwater Tools & Manipulators
- GPS, Gyro Compasses & MEMS Motion Tracking
- Deck Machinery & Cranes
- Battery Technology

Event Distribution
Oceans 2026

DEEP DIVE
PODCAST: Subsea Defense

08 | August 2026
Ad close Aug 4

Hydrographic

e-Magazine Edition

Tech Focus: Underwater Communications

DEEP DIVE
PODCAST: Research Vessels

09 | Sep/Oct 2026
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21st Annual MTR 100

Focus on 100 Leading Companies, People and Innovations in the Subsea Space

DEEP DIVE
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11 | Nov/Dec 2026
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Ocean Observation: Gliders, Buoys, & Sub-Surface Networks

- Instrumentation: Profilers, Samplers & Sediment Corer
- Subsea Defense: The U.S. Navy
- Subsea: Electrification
- Cameras & Multibeam Sonar

Event Distribution
Underwater Intervention – New Orleans, LA

DEEP DIVE
PODCAST: Ocean Observation

12 | December 2026
Ad close Dec 4

Subsea Vehicles

e-Magazine Edition

Tech Focus: Underwater Imaging: Lights

DEEP DIVE
PODCAST: Subsea Vehicle Technology

Teledyne Marine

Verlume

L-R: David Clark (CEO), Graceann Robertson (Sales & Marketing Manager), Richard Knox (Founder-CTO), Robert Heron (Operations & Engineering Director), Alan Shanks (Chief Financial Officer).

Teledyne, M Subs Announce Strategic Collaboration for Naval Opportunities

Teledyne Marine, a leader in maritime unmanned underwater vehicles and marine technologies, and M Subs, a UK-based innovator in marine unmanned systems and associated autonomy, have signed a Memorandum of Understanding (MOU) to establish a strategic collaboration.

This partnership aims to leverage the complementary expertise of both organizations to develop and execute business opportunities related to the UK Royal Navy and other international naval programs. The collaboration will focus on integrating advanced technologies, including vehicle platforms, autonomy systems, sonars, acoustic communications, cameras, lighting, and subsea connectors, to deliver solutions for maritime operations.

Efforts are already underway on cooperation with Teledyne SeaBat multibeam sonars successfully integrated and demonstrated on Zero USV platforms at REPMUS 2025. In addition, work has commenced on the deployment of Slocum gliders and Osprey class AUVs from Zero USV systems with demonstrations in the UK and Iceland planned in Q1 and Q2 of 2026.

Key highlights of the partnership include:

- Support for Royal Navy Programs: The collaboration will focus on advancing projects with the UK Royal Navy including possible joint cooperation for Atlantic Bastion and MHC Block 2 while leveraging M Subs and Teledyne's significant UK presence and capability.
- Joint Business Development: Teledyne and M Subs will work together to identify and pursue mutually beneficial opportunities globally.
- Shared Expertise: Both parties will combine their technological capabilities to enhance unmanned systems and autonomy solutions for maritime applications.

Verlume Evolves Leadership to Support Next Phase of Growth

Verlume is evolving its leadership structure to support its next phase of global expansion transitioning from technology commercialization to global scale-up.

After founding Verlume and leading the company as CEO for 13 years, Richard Knox will transition into the role of Founder-CTO. In this position he will focus on customer engagement, innovation and technology strategy. Richard will also continue to play a key role in shaping Verlume's long-term technology roadmap and support strategic customer relationship building.

David Clark has been appointed CEO and will lead the company through its next phase of international growth and operational scale. David brings more than 35 years of international leadership experience in the global energy sector. He holds a degree in Electrical and Electronic Engineering from the University of Strathclyde and began his career with Schlumberger (now SLB), holding operational and management roles across Asia, the Middle East and Europe. He has since held senior executive positions at Technip, Wood and Aker Solutions, where he served as President of UK & Africa and later EVP of the global Service Division. Most recently, David was CEO of Vysus Group following the carve-out of Lloyd's Register's energy division in 2020. He remains a Non-Executive Director of Vysus Group and serves as Convener of Court (Chair) at the University of Strathclyde.

The leadership changes also include the promotion of Robert Heron, a founding member of the Verlume team, to Operations & Engineering Director, alongside the appointment of Alan Shanks as Chief Financial Officer. These follow the recent promotion of Graceann Robertson to Sales & Marketing Manager as Verlume continues to expand its global presence.

As Operations & Engineering Director, Robert Heron will oversee engineering, product development and operational delivery. Robert has played a central role in the design and evolution of Verlume's technology since the company's inception, combining subsea engineering expertise with strong project delivery experience. His leadership will ensure the company maintains engineering excellence while scaling deployments globally.

Alan Shanks, Chief Financial Officer, will lead financial strategy, governance and long-term planning, supporting the company's continued growth and international expansion. Alan has a track record of scaling technology-based businesses and securing the necessary

Cellula Robotics

Cellula UK Team

capital to allow them to achieve their ambitions.

Graceann Robertson, recently appointed to Sales & Marketing Manager, continues to drive global market engagement, brand positioning and customer development as Verlume expands its presence across key offshore energy regions.

Cellula Opens UK Office to Expand European Delivery, Support for Long-Range Subsea Autonomy

Cellula Robotics Ltd. announced the opening of its UK office, expanding the company's ability to support European defense, security, survey, and environmental customers with local delivery, trials coordination, and program execution for long-range autonomous underwater vehicle (AUV) systems and integrated subsea solutions.

The UK office formalizes Cellula's growing engagement across the region and provides a base for in-country collaboration with customers and partners, including project planning, trials coordination, and operational support. The announcement was made during this year's Oceanology International in London.

The UK office is led by Richard Mills, Chief Commercial Officer, who is overseeing Cellula's regional growth and customer engagement across the United Kingdom and Europe. He is supported by a new team combining significant experience in defense programs and offshore operational delivery, alongside expertise in global communications and stakeholder engagement:

Saxon Jones, AUV Operations and Trials Manager, brings experience supporting RAF maritime patrol operations (ASW/ASuW before transitioning to offshore operations. Saxon has led offshore teams across R&D and commercial projects including pipe and cable surveys, as-laid and decommissioning programs, geophysical work, and cable lay operations. He also played a role in supporting the introduction of a new AUV capability through an offshore technical services provider, bringing hands-on experience that connects vehicle integration to real-world offshore execution and trials delivery.

Kira Coley, Head of Marketing & Communications, brings

BIRNS

Sophia Bruner

Kongsberg Discovery

Mark Heine, Fugro CEO, (left) and Auden Berg, EVP, Kongsberg Discovery, sign the agreement at Oceanology International.

leadership in ocean science and technology communications, including advisory roles supporting IOC-UNESCO and the UN Ocean Decade, and leadership positions with global ocean initiatives. She is part of Leading Women for the Ocean and has served as a senior editor for a leading ocean trade publication. With more than a decade in the ocean technology and environment sector as a writer and strategic communications consultant, she supports Cellula's program communications and stakeholder engagement, helping align stakeholders across defense, industry, government, and research communities.

Oliver Morris, Customer Success and Delivery Manager, brings extensive UK defense experience spanning procurement, operational delivery, and systems integration. Previously, Ollie served as the UK Operational Co-ordination Officer in OCCAR, managing program interfaces for the UK MoD, and prior he spent eight years in DE&S delivering deployed engineering and operational leadership as an end user for AUV capability, including seabed data and analysis for defense applications. He later supported mine hunting capability development, including system-of-systems integration strategy and approaches to machine learning exploitation, and contributed to establishing the Maritime Autonomy Centre of Expertise (MASCoE) within DE&S.

BIRNS Announces New Engineering Manager

BIRNS, Inc. has appointed Sophia Bruner as the company's new Engineering Manager.

She leads BIRNS' cross-functional engineering teams, overseeing the design, development, and scaling of products to achieve quality, cost, and delivery objectives. She is also responsible for planning, directing, and coordinating all design and manufacturing engineering activities.

With more than 30 years of expertise across manufacturing, engineering, quality engineering, and operations, Bruner brings both skill and progressive leadership experience to her new role at BIRNS.

Prior to joining the company, she held senior leadership roles including Senior Engineering Manager at Tesla, Director of Quality at Veev by Lennar, and Manufacturing Engineering Manager at Sikorsky Aircraft/Lockheed Martin, supporting complex products in highly regulated and fast-paced environments.

"I'm excited to join BIRNS and to work alongside such a talented team dedicated to delivering high-performance solutions for demanding subsea and nuclear environments," said Bruner. "I look forward to contributing to the continued innovation, quality, and operational excellence that our customers rely on, while helping strengthen collaboration across engineering and manufacturing."

Kongsberg Discovery, Fugro Reinforce Main Supplier Agreement

Kongsberg Discovery and Fugro have signed a new framework agreement that strengthens a decades-long technology partnership between the two companies. The contract, confirmed at Oceanology International in London, positions Kongsberg Discovery as a key supplier of advanced hydroacoustic and positioning technologies across Fugro's global fleet, including the company's expanding portfolio of uncrewed surface vessels (USVs).

The new agreement reinforces Kongsberg Discovery's position as a preferred technology partner for Fugro, providing continued access to the company's solutions, such as the EM2042 multibeam echosounder and Seapath motion and GNSS positioning systems, which have been selected for integration across Fugro's new generation of autonomous survey platforms. Working together, the assets and technology will deliver high-quality, precise hydrospatial data and optimally efficient, safe and sustainable remote operations.

Although the agreement is wide-ranging in reach, Fugro's decision to expand its USV fleet, as announced at Oceanology International, is a natural focal point. The Dutch multinational, which employs approximately 10,000 people in 52 countries, has built an advanced network of Remote Operations Centres (ROCs) to enable USV tasks, helping dramatically reduce emissions (by up 95%), with enhanced safety and 24/7 operational efficiency. Kongsberg Discovery technologies are central to these developments, supporting the precise navigation, seabed mapping and underwater positioning required for autonomous success.

In addition to multibeam echosounders and Seapath INS, Fugro will continue to utilize a broader portfolio of Kongsberg Discovery systems including HiPAP underwater acoustic positioning and communication technology. Together, these solutions provide the high-accuracy situational awareness needed for complex offshore survey projects.

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