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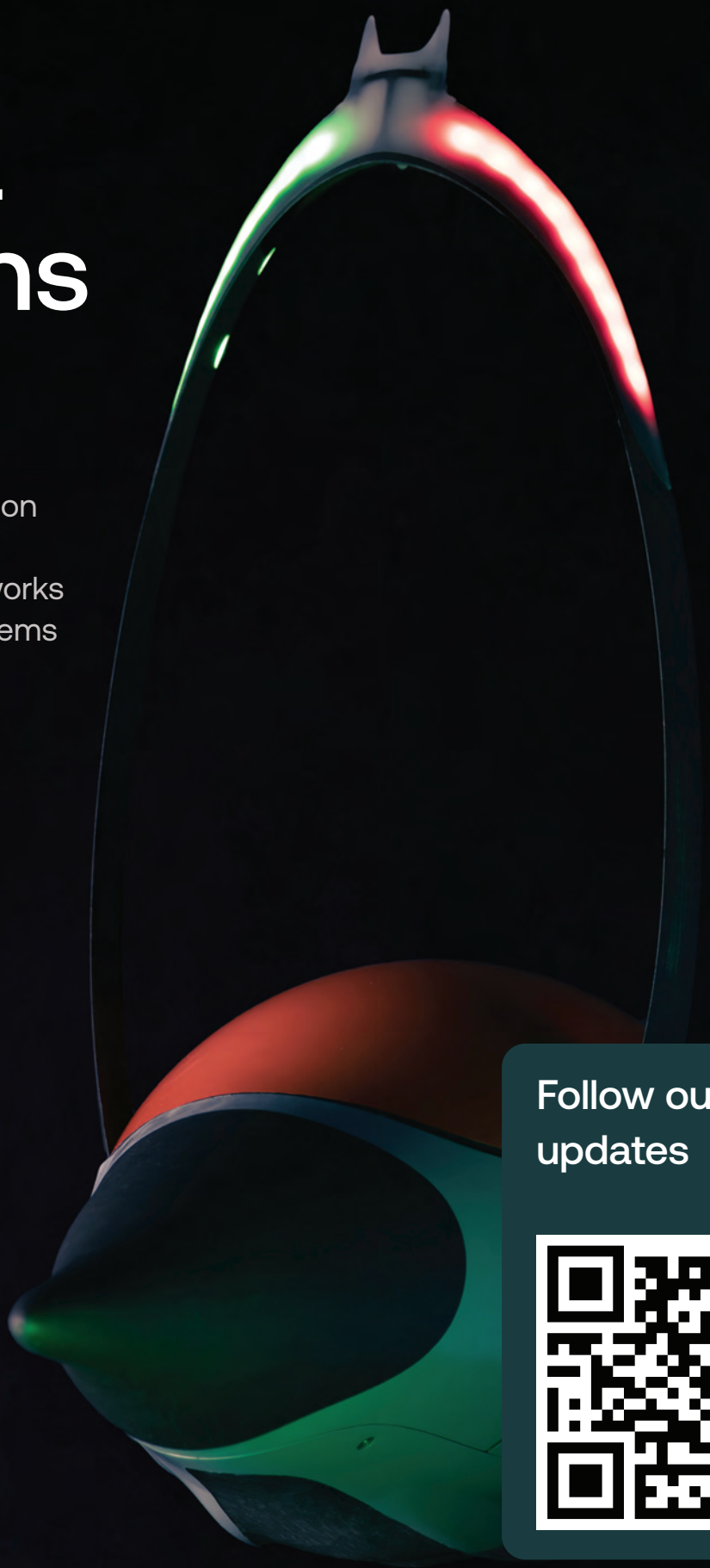

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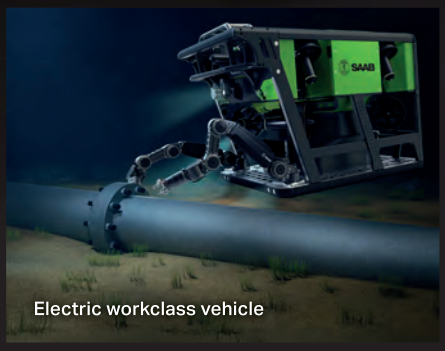
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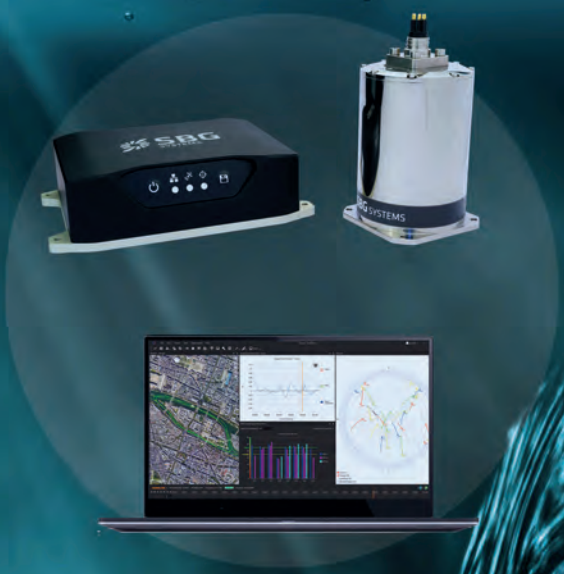

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Vehicles and vessels are at the very heart of this issue. We look at uncrewed, autonomous and remotely operated vehicles (ROVs) ranging greatly in size — all the way to ultra-large underwater vehicles. We explore launch and recovery systems, manipulator arms and inertial sensing solutions. And we highlight recent vessel news and achievements across maritime technology companies.

Starting on page 8, David Strachan chronicles the U.S. Navy's recent call for the design, building and testing of an ultra-large autonomous underwater vehicle (UL-AUV). And on page 18, an interview with Brian Connon, VP of Ocean Mapping, details their three classes of USV, as well as how the company is meeting the growing demands of maritime defense.

This issue, we also dive into case studies, watching 'vehicles' do what they do best — explore harsh conditions and collect critical data. On page 12, Kevin Hardy continues his series on ocean landers — this one number 15 of the series — taking a deep dive on the development and use in research at the Universidad de Concepción in Chile. Later, on page 30, we meet *Rhody*, the University of Rhode Island's ROV that documents Westward-expansion era shipwrecks in Lake Ontario.

On page 24, Wendy Laursen explores launch and recovery systems and the challenges with bringing costly and delicate vessels back to shore. And on page 38, SEAMOR Marine shares a custom gripper design, collaborating with Canada's National Underwater Recovery Training Center.

The moral is, no matter the mission, ocean vehicles are up to the challenge. With new technologies to make them more efficient and bestow advanced capabilities, the future of maritime defense, survey and exploration is chock full of opportunity.

Finally, I'd be remiss to omit a few shoutouts to upcoming happenings. The **MTR 100**, now in its 20th year, is quickly approaching. We'll be highlighting the top of the maritime industry's leaders, technologies and companies, and you don't want to miss out. See page 40 for details, the application link and deadline. And lastly, if you're attending the OCEANS 2025 Great Lakes conference in Chicago, September 29-October 2, give us a shout and let's connect.

We hope to see you there, in the pages of the **MTR 100**, or both.

Celia Konowe
Managing Editor

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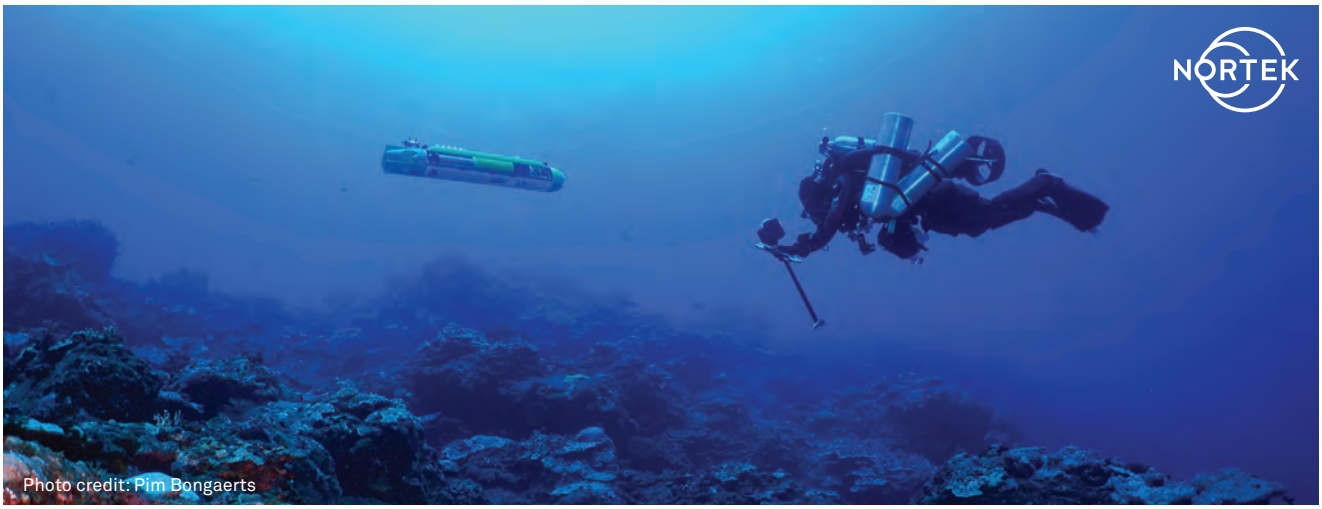


In a collaboration between the Norwegian University of Science and Technology (NTNU), University of Sydney, California Academy of Sciences (CalAcademy), Oceanly, University of Western Australia, and the University of Auckland, supported by Inkfish, the University of Sydney's Seeker AUV, equipped with a Nortek Nucleus 1000, worked alongside divers to create a 3D map of a coral reef off the coast of Tonga.

Nortek Nucleus supports University of Sydney AUV in coral reef photogrammetry project

Mapping coral reefs to investigate genetic diversity

Researchers from NTNU, the University of Sydney, and CalAcademy are working together to investigate how mesophotic reefs support the genetic diversity of corals which are increasingly threatened by climate change.

As part of the Inkfish Coastal Seas expedition, the research team traveled to Tonga in the fall of 2024 to conduct a photogrammetry assessment of reefs in the Hapai area: essentially, create a 3-dimensional map of the reefs which will be used to geo-reference their collected coral samples.

"The genomic sequencing from the samples is combined with the 3D model to study how different coral species breed in mesophotic reefs," explains Dr. Jackson Shields, Research Fellow at the University of Sydney's Australian Centre for Robotics (ACFR).

The team used two Seeker AUVs developed by the ACFR, equipped with Nortek Nucleus 1000 navigation sensors, to aid with the collection of photogrammetry data.

Using AUVs and divers to collect coral reef photogrammetry data

The Seeker AUVs are lightweight AUVs designed to be cost-efficient and easily deployable. They are equipped with an 8MP stereo camera, used to collect image surveys of reef slopes. They covered a total area of over 8000 square meters over one to two days at each site.

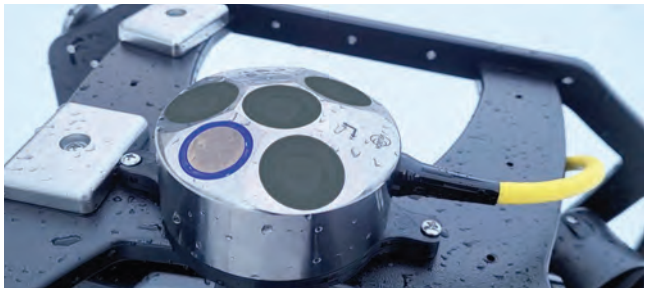
While the AUVs gathered large-scale photogrammetry data, divers from CalAcademy took close-range photogrammetry plots and gathered coral samples from each area.

Navigating the AUV with a Nucleus 1000

The Seeker AUVs used a combination of USBL and the Nucleus 1000 sensor for navigation. The Nucleus is designed for use on small AUVs like this one, and provides DVL information, has a designated altimeter beam, a pressure sensor and a pre-synchronized AHRS.

The ACFR team fuses the data streams from the Nucleus into their Kalman filter for vehicle navigation. This data, combined with data from the USBL, kept the vehicle on track while mapping the area.

"The Nucleus is convenient as it provides the DVL, a depth sensor and an IMU in a compact package," says Shields.



Nucleus 1000 navigation sensor package, shown here on a small ROV

Using AUVs for future coral research

"Our long-term research goals are to use robotic systems to automate the sampling too, to extend this science beyond diver depths," says Shields.

Continuing to explore and better understand important underwater ecosystems like these will rely on modern subsea technology, including easily deployable AUVs with reliable navigation sensors.

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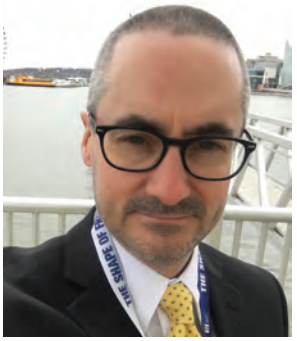

Laursen
Wendy Laursen has 20+ years of experience as a journalist. In that time, she has written news and features for a range of maritime, engineering and science publications. She has completed a Master of Science research degree in marine ecology as well as diplomas in journalism, communication and subediting.

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The Honorable Tim Gallaudet, PhD, Rear Admiral, U.S. Navy (ret) is the CEO of Ocean STL Consulting and host of *The American Blue Economy Podcast*. He serves on several boards, is a fellow at The Explorer's Club, and is a strategic advisor for a few dozen startups, research institutions, and nonprofits in the ocean, weather, climate, and space sectors. Gallaudet is a former acting Undersecretary and Assistant Secretary of Commerce, acting and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA), and Oceanographer of the Navy. He has a bachelor's degree from the U.S. Naval Academy, and master and doctoral degrees from Scripps Institution of Oceanography.

Hardy

Kevin Hardy is President of Global Ocean Design, creating components and subsystems for unmanned vehicles, following a career at Scripps Institution of Oceanography/UCSD. He holds patents in the field of ocean landers. He is on the academic advisory board of Instituto Milenio de Oceanografía at the Universidad de Concepción, Chile. Hardy received an honorary Doctor of Science degree from Shanghai Ocean University in 2018. He proposed making thick wall glass spheres to Nautilus Marine Service/Vitrovex (Germany) that opened the hadal depths to routine exploration. He writes for the *Journal of Diving History* and the *MTR*.

Credit: Richard Allen/US Navy/NUWCD Newport

SUPERSIZE IT:

THE U.S. NAVY IS SEEKING AN ULTRA-LARGE AUV

By David Strachan, Strikepod Systems

Image above: Deployable from the dry deck shelter of a submarine, Snakehead provides guidance and control, navigation, situational awareness, propulsion, maneuvering and sensors in support of the intelligence preparation of the operational environment mission.

In late May of this year, the Office of Naval Research (ONR) issued a broad agency announcement (BAA) seeking the rapid design, build, and testing of an ultra-large autonomous underwater vehicle (UL-AUV) capable of conducting long-range, high-endurance missions while carrying large modular payloads. The initial demonstrator vehicle, "Ocean Explorer" (OEX), will establish the technical feasibility of such an unprecedented platform, and will also inform development of the associated infrastructure required to support a full squadron of UL-AUVs. ONR is also seeking unspecificed, innovative UL-AUV-related technologies, as well as rapid design and fabrication capabilities.

Interestingly, the call for a jumbo AUV comes as the Navy's extra-large (Orca) and large (Snakehead) AUV programs are suffering from significant cost overruns, technical issues, and programmatic uncertainty, and as the U.S. submarine workforce is struggling to meet demand for Virginia and Columbia-class hulls. Snakehead's fate has largely been sealed; the prototype vehicle is now designated as a test platform and is unlikely to transition to a program of record, while the Defense Innovation Unit (DIU) has awarded prototype contracts for commercial off the shelf (COTS) large AUVs to Kongsberg, Oceaneering, and Anduril Industries A recent GAO report indicated that Orca continues to suffer from delays and ballooning costs related to challenges with autonomy, navigation, and endurance, and concluded that it too may fail to become a program of record. Prior to the GAO report, in April of this year, DIU had already issued a solicitation for a COTS extra-large AUV—the Combat Autonomous Maritime Platform (CAMP)—suggesting a need to offset or augment the troubled Orca program. Meanwhile, crewed submarine construction is years behind schedule, with limited shipyard capacity, aging infrastructure, and a shortage of skilled labor continuing to cause backlogs across all naval platforms.

Yet, despite these challenges and setbacks, there may be wisdom in pursuing a multi-mission UL-AUV. While the BAA provides no specifics on vehicle construction, objectives, or potential missions, it is possible to infer these by looking at existing AUV systems, analogous platforms like guided missile nuclear submarines (SSGNs), and mission sets that could be enhanced by the greater endurance, range, and internal volume provided by a UL-AUV.

One possible objective of the UL-AUV program would be the development of an "underwater mothership" capable of launching and recovering a wide range of uncrewed underwater systems. With range/endurance remaining a limiting factor in AUV operations for the foreseeable future, a UL-AUV

could provide a forward-deployed charging station to enable a persistent, wide-area, covert forward undersea presence. The Navy's recent successful testing of the Yellow Moray torpedo tube launch and recovery (TTLR) system suggests that, once mature, this technology, or a scaled-up version, could one day be integrated into an autonomous platform like a UL-AUV. A Yellow Moray-type system could also enable a UL-AUV to serve as a forward undersea logistics hub, enabling clandestine resupply via large or XL-AUVs. Taken a step further, a UL-AUV could potentially accommodate a large special operations payload, making it a scaled-up swimmer delivery vehicle (SDV) capable of semi or fully autonomous deployment of multiple teams of expeditionary or special forces, either directly or by launching/recovering smaller SDVs.

One of the more likely objectives is the development of an underwater missile barge or arsenal ship. Vertical launch system (VLS)-equipped guided missile surface platforms are increasingly vulnerable to a range of sophisticated airborne threats — in particular, Chinese anti-ship cruise missiles (ASCMs) and anti-ship ballistic missiles (ASBMs). At the same time, the venerable Ohio-class SSGNs are rapidly reaching the end of their service lives. In a hotly contested environment, submersible platforms fitted with launch tubes containing missiles, uncrewed aerial systems (UAS), or strike AUVs would, like SSGNs, offer a stealthy, survivable, powerful precision strike capability. Possible weapons include Tomahawk land attack cruise missiles (TLAMs), ASCMs, torpedoes/autonomous underwater munitions, loitering munitions/SLUAS launched from encapsulated canisters, or even FPV strike drones. The Russo-Ukraine War has demonstrated the power of massed FPV drones for strike warfare. This was particularly apparent during Operation Spider's Web, which saw covertly inserted FPV drones strike strategic bombers and airfields deep within Russian territory.

But how could such a range of weapons be stored and autonomously deployed? The Virginia Payload Module (VPM) offers one possibility by offering design and cost advantages in terms of modularity, a common architecture, and supply chain logistics. The VPM is a hull extension added to Block V Virginia-class submarines that enables them to serve as multimission platforms capable of performing conventional precision strike, special operations support, and other payload-flexible missions. A VPM can quite significantly enhance strike payload capacity, as it contains four separate payload tubes that are each capable of containing a 7-shot multiple all-up-round canister (MAC) missile launch system, for a total missile loadout of 28 rounds. A squadron of UL-AUVs with integrated MAC-equipped VPMs could bring many dozens of missiles to the fight, offsetting threats to surface platforms, as well as the retirement of the Ohio SSGNs.

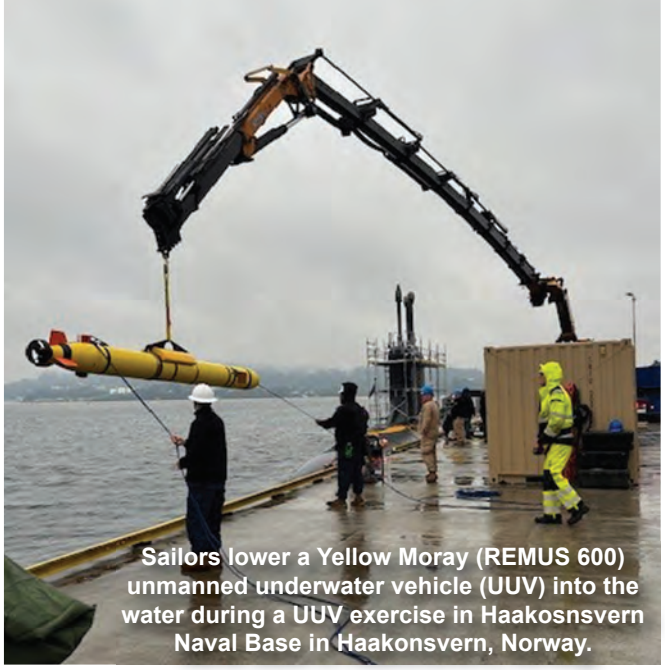
But with an integrated VPM, a UL-AUV would more closely resemble a crewed submarine in size and displacement than a scaled-up UUV (The VPM is 84 feet in length—nearly as long as a payload bay-equipped Orca XL-UUV). Before such an un-

Former Chief of Naval Operations (CNO) Adm. Lisa Franchetti toured Boeing's Orca Extra Large Unmanned Undersea Vehicle (XLUUV) manufacturing facility, met with Boeing contractors and Sailors assigned to Unmanned Undersea Vehicles Squadron (UUVRON) 3, and gave remarks.

Credit: U.S. Navy photo by Chief Mass Communication Specialist William Spears

crewed behemoth could put to sea, the technical challenges currently afflicting the Orca XL-UUV would need to be overcome. Still, the concept is entirely plausible—and such an ambitious leap could draw inspiration from the Navy's large USV (LUSV), which is also set to bring added VLS muscle to the fight.

ONR's call for UL-AUV designs suggests the U.S. Navy is envisioning a fleet of undersea platforms that could act as drone motherships, clandestine forward deployed logistics nodes, or autonomous missile barges to counter China's narrowing of the "VLS Gap." With the ability to carry dozens of missiles, UUVs, or strike drones, a VPM-equipped UL-AUV would be a potent tool of power projection on par with an SSGN. Just as the presence of a U.S. carrier or SSGN can influence adversary thinking, the credible threat of a heavily-armed UL-AUV could similarly shape strategic outcomes, making it an instrument of coercion or escalation management. Its development would likely be fraught with technical, operational, and manpower challenges, especially in light of current delays in submarine construction and an overstretched shipbuilding workforce. But if successful, it would mark a significant expansion of uncrewed undersea assets from tactical/operational sensor and effector platforms, to formidable strategic assets capable of posing significant dilemmas for U.S. adversaries.



Sailors lower a Yellow Moray (REMUS 600) unmanned underwater vehicle (UUV) into the water during a UUV exercise in Haakosnsvern Naval Base in Haakonsvern, Norway.

Credit: US Navy/Oliver Cole

About the Author

David R. Strachan is a defense analyst and founder of Strikepod Systems, a research and strategic advisory focusing on autonomous undersea systems.


Figure 1

Case Study:

CHILEAN OCEAN LANDER DATA ACQUISITION AND CONTROL SYSTEM

By Víctor Villagrán, *Centro de Instrumentación Oceanográfica (CIO) & Universidad de Concepción,* ***Dr. Osvaldo Ulloa,*** *Instituto Milenio de Oceanografía (IMO) & Universidad de Concepción,* ***Kevin Hardy,*** *MTR Columnist, President, Global Ocean Design LLC*

Figure 1 (above)

A hadal-class ocean lander, designed and built by the **Universidad de Concepción (UdeC), Centro de Instrumentación Oceanográfica,** is seen during buoyancy testing on the RV Kay-Kay in Dichato Bay, 38 kilometers north of the city of Concepción, in central Chile. The proximity and challenge of the Atacama Trench relentlessly draw UdeC engineers and scientists. Their ocean lander can downcast as a CTD-O in descent, remain in situ for extended periods on the trench floor, then upcast as a CTD-O/Rosette on return to the surface. The free-fall vehicle design is based on the **Global Ocean Design** (San Diego, CA, USA) "Audacia" lander described in *MTR*, April 2018. The vehicle frame is made of HDPE polymer and pultrusion fiberglass, using two 17" Vitrovex glass spheres (**Nautilus Marine Service**, Buxtehude, DE) for instrumentation and six 10" Vitrovex glass spheres for supplemental flotation. Oceanographic instrumentation and equipment: SBE49 CTD, (**Seabird**, Bellevue, WA), Optode Hadal 5331 (**Aanderaa**, Bergen, Norway), Optim SeaCam and LED SeaLite (**DeepSea Power & Light**, San Diego, CA, USA), two 30 L Niskin Bottles (**General Oceanics**, Miami, FL, USA), circular BART acoustic release system (**Edgetech**, West Wareham, MA), and satellite beacon XMI-X-11 K and flasher light XMF-11 K (**Xeos**, Dartmouth, NS, CA). *(Photo by Matías Pizarro, UdeC).*

There are enormous technological challenges in accessing and sampling hadal depths, but the recent surge in the development of deep-ocean technologies ranging from ocean landers, remotely operated vehicles (ROVs), and human-occupied vehicles (HOVs) has allowed the oceanography of trenches to be addressed.

Ocean landers are a cost-effective class of autonomous unmanned underwater vehicle that possess a unique capacity for exceptionally quiet, extended stays on the seafloor, studying benthic communities and environments by in-situ sensing and sampling. Multiple landers can be used to survey large areas from a modest vessel using different search strategies.

Recent developments with ocean landers at the **Universidad de Concepción** in Chile have shown they are capable of collecting water samples at chosen depths, as well as downcast and upcast conductivity-temperature-depth plus dissolved-oxygen (CTD-O) profiles to hadal depths.

Ocean landers currently see limitations related to their data acquisition and control (DAC) systems. Most are controlled using acoustic systems operated from a surface vessel or pre-set countdown timers. In many applications, commercial sensors are often unnecessarily operated at their maximum sampling rates throughout the entire mission, depleting critical battery power.

Chilean marine researchers have derived a hybrid design for an autonomous DAC system that combines the capability to produce high resolution hydrographic profiles with a stationary bottom platform (moored mode), for observing diversity in benthic zones to hadal depths. The system integrates standard oceanographic instruments with energy-conserving strategies to obtain optimal performance within mission constraints. To achieve these objectives, the Chilean research team leveraged open-source hardware components, such as Arduino microcontrollers, expansion boards, and open software tools, significantly accelerating the development process.

Data Acquisition and Control (DAC) system

The design of the DAC system is based on the Atmega 2560, a microcontroller board with 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), and a 16 MHz crystal oscillator. A compact version of the classic Arduino Mega, Mega2560-Core, provides a board that can run on 3.3V, drawing approximately 18 mA. The Mega2560-Core, along with commercial breakout boards and individual components, provide a robust and flexible platform for data acquisition and control. The Mega2560-Core can enter sleep mode with a current consumption of less than 0.18mA. A key strategy to conserving power is using the Mega2560-Core to switch the power-hungry CTD on and off, and adjust its sampling rate. The Mega2560-Core consumes only 1.7% of the power used

by the CTD in the active mode. The battery pack consists of 12 D-cell alkaline batteries, (nominal 270 WH). An Adafruit DS3231, a precision real-time time clock (RTC), is used for timekeeping, allowing for the synchronization of low frequency sampling and building a log file for the system. This RTC is temperature compensated, offering high accuracy, with a typical drift of 1 min per year. The I2C interface module includes a coin cell, allowing the RTC to maintain data and time for at least two years without any external power. The RTC consumes less than 0.1 mA powered by the 3.3V power unit available in the system. Data is stored in a SanDisk Secure Digital Micro SD Card Industrial grade 16 GB microSD. As tested in this project, the SD Card requires less than 10 mA during writing and up to 100 mA in short periods when it is initialized.

A significant advantage of Mega2560-Core are the numerous serial hardware interfaces available. Each port is supported by an individual universal asynchronous receiver/transmitter (UART) circuitry, providing reliable communication with serial peripherals. As with most microcontrollers, the serial ports utilize TTL levels, 0–3.3V/5V. A SparkFun max3232 breakout board allows the conversion from TTL levels to the standard RS232, which is available on the interfaces of the CTD and the Oxygen sensor. The third serial port is intended to support communication with the host computer using either a Bluetooth modem or an external TTL/USB adapter. Thus, the user can configure the system from a Serial Terminal or a Graphical User Interface (GUI) that can be built in the future. Serial port 0 is reserved for accessing the IDE when updating the firmware.

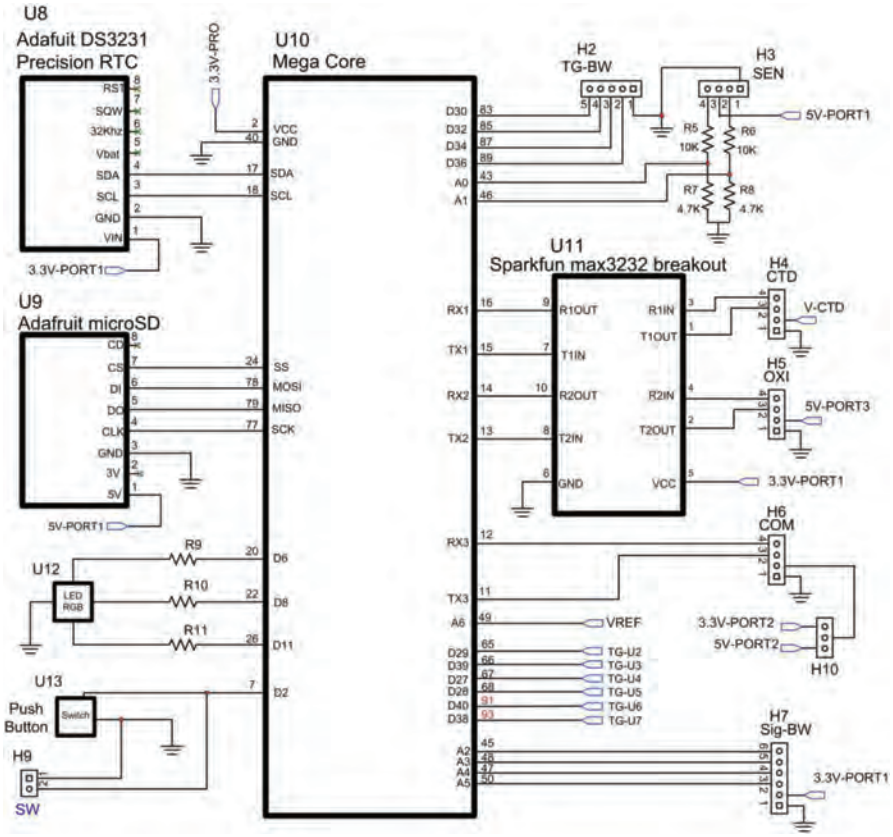


Figure 2

Wiring diagram of the main processor based on Atmega Mega2560-Core, and expansion boards. The system components have been selected for efficient energy consumption, from the microcontroller with an active mode consumption of 59 and 0.6 mW in sleep mode. *(Image by Victor Villagrán, UdeC)*

Firmware Development

The firmware for this system provides a comprehensive solution for the high sampling rate required when the lander profiles the water column down and back, and the low sampling rate required when it reaches the seabed. As shown in the flowchart in Fig. 4, the user can enable a premonitoring cycle to verify the correct sampling of the sensors. To activate this function, the user toggles a reed switch using an external magnet. Premonitoring can be run for hours without power concerns because it performs low-frequency sampling and enters sleeping modes in between. When removing the magnet, the system took samples on FastCat to determine the beginning of the downcast, which occurred when the conductivity is greater than a user-defined threshold parameter. Similarly, the CTD has an internal conductivity threshold parameter that ensures that the pump is turned on only in saltwater.

Bench Testing

Extensive lab tests were used to evaluate the system design and conduct simulations under controlled conditions. The tests were performed in the laboratory to verify general functioning and to determine whether the data was properly stored in the microSD card.

At Sea Deployment

The first Integrated Deep-Ocean Observation System (IDOOS II) cruise was conducted from 27 September to 9 October 2023 in the Antofagasta region onboard the RV Abate Molina. The main goal of this expedition was to deploy the first deep-ocean observation system to study the physical, geological, and biological structures of the area. In addition, the new lander was launched to confirm improvements in electronic systems and structural design, gather data on the physical variability of the water column, and obtain biological samples from the Atacama Trench floor.

Throughout this first research cruise, only one lander launch was executed, as the majority of tasks focused on deploying two deepwater moorings in and

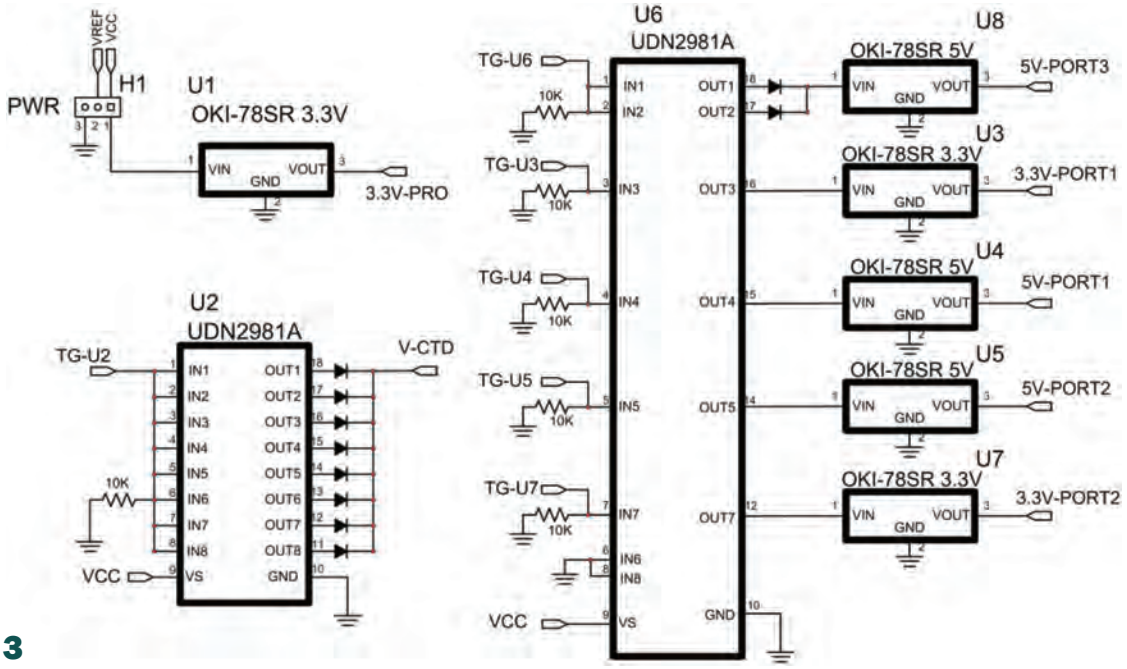


Figure 3

Simplified flowchart of the firmware for integrated operation of the lander. During the moored mode, the DAC increases the sampling period of the oceanographic instruments to 10 min. During this period, the system remains in sleep mode, only waking up every 1 min to measure the depth, without turning on the CTD pump. “C_min” is a threshold conductivity to start the downcast, “Th” is a bottom detection algorithm, “P_N” is Pmax +Pnoise control parameter, “P_Sh” is depth to finish upcast. *(Image by Victor Villagrán, UdeC)*

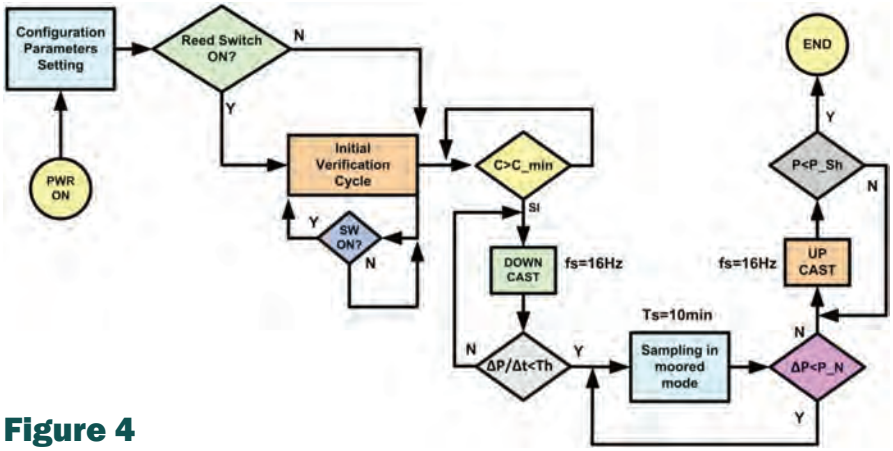


Figure 4

Simplified flowchart of the firmware for integrated operation of the lander. During the moored mode, the DAC increases the sampling period of the oceanographic instruments to 10 min. During this period, the system remains in sleep mode, only waking up every 1 min to measure the depth, without turning on the CTD pump. "C_min" is a threshold conductivity to start the downcast, "Th" is a bottom detection algorithm, "P_N" is Pmax +Pnoise control parameter, "P_Sh" is depth to finish upcast. *(Image by Victor Villagrán, UdeC)*

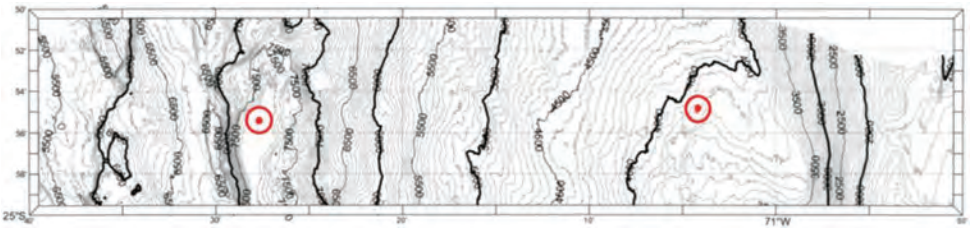


Figure 5

Bathymetry showing the oceanographic mooring sites of IDOOS. The red point on the left marks the deep mooring location at the indicated latitude and longitude, near which lander deployments are regularly conducted.
(Illustration by by Óscar Pizarro, UdeC)

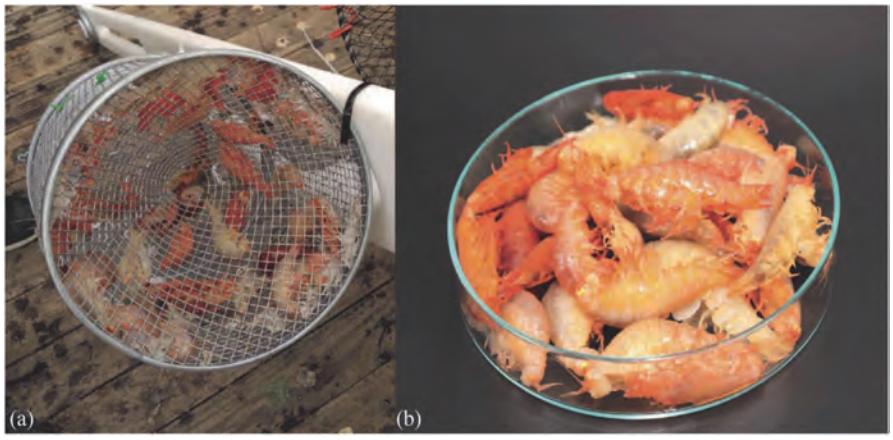


Figure 7

(a) Trap attached to the ocean lander with amphipods collected during the first deployment into the Atacama Trench. (b) Various shades and sizes of Eurythenes atacamensis, *(Photo by Matías Pizarro, UdeC)*

near the trench. Nonetheless, the launch proved successful, concluding in the retrieval of the vehicle along with data and samples for subsequent analysis. The ocean lander was successfully deployed again on two later missions 1) October 2 to October 18, 2024, RV Cabo de Horno (2 lander missions), and 3) January 17 to January 25, 2025, RV Cabo de Horno (4 lander missions).

The primary burnwire ballast release was activated at 18h by the DAC. For redundancy, the burnwire could also have been activated by the EdgeTech BART acoustic system, Burn Wire 1 code. The DAC is used in this configuration as a countdown timer release. Bottle B1 was closed on ascent by the DAC using a burn wire programmed to snap at 7100m as determined by the upcast CTD data. Bottle B2 burnwire was closed on ascent by the EdgeTech acoustic system, Burn Wire 2 code. The drop arm was deployed by a burnwire triggered when the DAC detected arrival on the seabed, indicated by static pressure measured over a defined time interval. After the vehicle

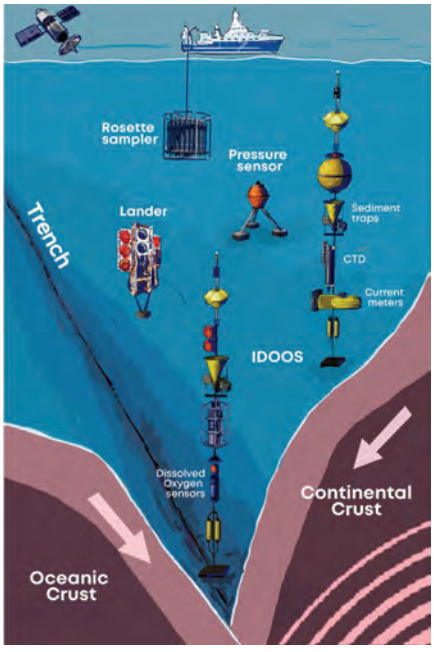


Figure 6

Schematic diagram illustrating the elements of the Integrated Deep-Ocean Observing System, IDOOS *(Illustration by Felipe Gamonal, UdeC).*

is retrieved, it is possible to verify the closure of bottles, deployment of the drop arm, capture of marine organisms, and integrity of the data files.

The profiles obtained by the lander revealed significant hydrographic variability in the water column in both the descending and ascending casts. Among the measured parameters, temperature showed the greatest variability, decreasing from 17°C to 2.3°C down to 2500m depth (where the thermocline was located), stabilizing at approximately 2°C from that depth to 6000m, followed by a slight increase due to the adiabatic effect. Maximum variability of dissolved oxygen was observed at a depth of 500m (oxycline), ranging between 300 and 0µM, with a slight increase to 125µM at 700m, a gradual rise to 160µMat at 4000m, and a slight decrease at greater depths.

Simultaneously, biodiversity studies in the water column have provided key insights into the distribution and structure of metazoans (multicellular animals) at depths greater than 3000m, which are inaccessible using conventional sampling nets. These advances were achieved through environmental DNA (eDNA) analysis of samples collected using Niskin bottles, enabling detailed profiles of species richness and relative abundance. The results suggest that the ultradeep ocean harbors surprising biological richness, often surpassing that observed in the surface layers.

One of the main remaining challenges during lander deployment is preserving viable samples for metabolic analyses, which are essential for studying the chemical and biological processes that enable organisms to adapt to their environment. Genetic material, particularly RNA, is highly susceptible to degradation due to changes in pressure, temperature, and time required to recover the samples. This underscores the urgency of developing in-situ preservation techniques that minimize the alteration of genetic material.

Despite these limitations, valuable results have been obtained through adapted protocols for analyzing degraded material. Although these methodologies provide limited coverage of metabolic pathways, they highlight the need for innovation in more robust technologies. Such advancements will be fundamental for exploring the adaptations that sustain life in hadal ecosystems, offering new perspectives on the evolutionary processes in these extreme environments.

Conclusions and Future Opportunities

This article presents an integrated observation system that enables the physical and biogeochemical study of the deep ocean. The lander's successful mission in the Atacama Trench demonstrates the broad potential of this platform to contribute to the characterization of unexplored regions of the sea. The data acquisition system allows oceanographic instruments to be adaptively configured in real time, making them more efficient in their use by introducing profiling and moored modes. The system controls tasks involving mechanical actuation and offers different activation methods based on either the vehicle's depth or time interval relative to its arrival at the seafloor. The achievements obtained with the lander in the Atacama Trench have been extraordinary, excelling both in the discovery of new species and the analysis of biodiversity and metabolism in this environment. These findings not only expand our understanding of biological diversity in the Atacama Trench but also shed light on the adaptation mechanisms of organisms in the hadal zone. The versatility of the DAC design allows for the development of new capabilities, such as the introduction of artificial vision techniques and electromechanical traps. Considering the limited availability of oceanographic instruments capable of operating in hadal conditions, the utilization of Aanderaa sensors for dissolved oxygen measurements stands out as a remarkable accomplishment. More work is needed on event triggers, including accelerometers, motion sensors, and pressure sensors. The EdgeTech BART acoustic release is capable of outputting 4 additional commands on JP3 AUX header that could enable expanded functions of the UdeC DAC board, including delaying the release sequence until commanded, enabling long-term deployments. The integration of the two appears straightforward, and would give topside researchers direct command and control of their seafloor scout in-situ. More sensor manufacturers should make external control of their devices possible. More work is needed on hadal depth actuators, including solenoids, flash wire releases, motors, and others. Further development of pressure-compensated LiPo batteries can provide more power safely for less offsetting buoyancy. Greater integration of recovery beacons inside the upper glass sphere will result in cost, complexity and weight savings, such as the Global Ocean Design Beacon Board that triggers on burnwire activation. Exploring hadal zones presents a vast field for technological advancement today, owing to both technical challenges and limited commercial incentives.

Acknowledgements

This MTR story is an adaptation of the IEEE-OES paper "Versatile Data Acquisition and Control System for Free-Fall Underwater Vehicles: Exploring Hadal Waters". The full IEEE text may be found at <https://ieeexplore.ieee.org/document/11015447**>.*

MTR acknowledges the full suite of authors of the IEEE-OES paper: Víctor Villagrán, José I. Cifuentes, Óscar Pizarro, Nadin Ramírez, Pablo Oliva, Kevin Hardy, Carolina E. González, and Osvaldo Ulloa.

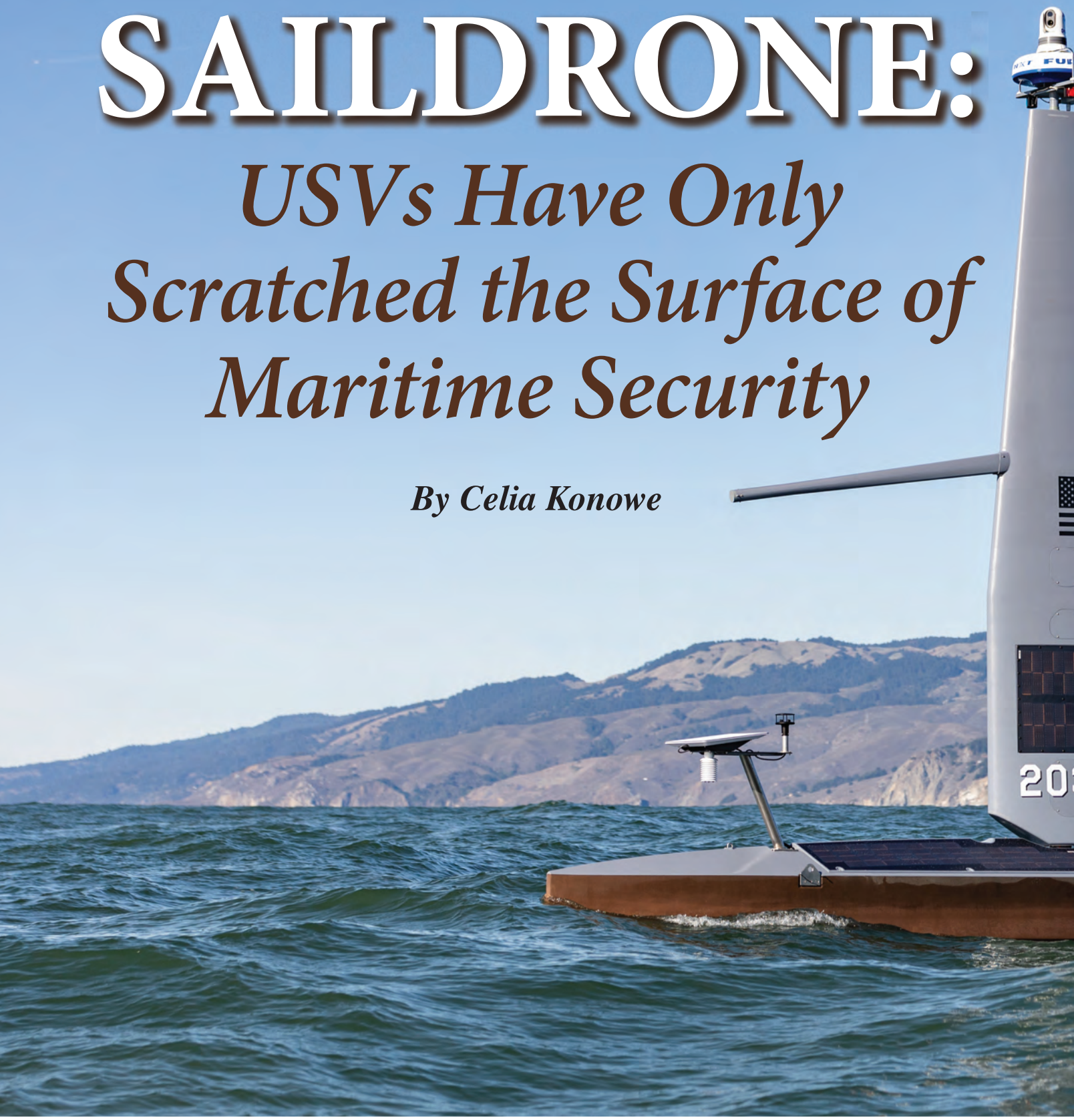
"Lander Lab" is a hands-on column of Ocean Lander technologies, a unique class of unmanned undersea vehicles, and the people who make them. It is meant to serve the global ocean lander community in the manner of Make Magazine and other DIY communities.

Comments on this article, or suggestions for stories of interest to other Landereans are welcome. Other ocean lander teams are encouraged to write in about their work. MTR invites you to contact Kevin Hardy <***khardy@marinelink.com***>.

SAILDRONE:

USVs Have Only Scratched the Surface of Maritime Security

By Celia Konowe



*** All images courtesy Saildrone***

Increasing global instability and emerging threats are reinforcing the mission criticality of maritime security and ocean intelligence. To meet that challenge, Saildrone, a company that builds and operates one of the world's largest fleets of unscrewed surface vehicles (USVs), is redefining how oceans are explored, monitored and protected.

At the helm is **Brian Connon**, vice president of ocean mapping and a former U.S. Navy oceanographer. After leaving the Navy, Connon joined a hydrographic research center at the University of Southern Mississippi, which lead to his role at Saildrone. Now, four and a half years in, Connon has helped establish and scale up the company's ocean mapping capabilities.

SAILDONE SETS THE STANDARD

In just over a decade, Saildrone has logged more than two million nautical miles and 50,000 days at sea, from the Arctic and to the Southern Ocean. "We circumnavigated Antarctica and we've served customers from NOAA and NASA to the U.S. Navy and U.S. Coast Guard, and in similar foreign civil and defense organizations around the world," noted Connon.

The company has delivered 100 Explorer-class, 45 Voyager-class, and 6 Surveyor-class vehicles — all manufactured in-house — designed to support a range of missions from research to reconnaissance.

Today, nearly 50 Saildrone vehicles are actively deployed, with almost full utilization focused on the high-capability Voyager and Surveyor platforms. "Our newer platforms have a lot more capability for the missions we're asked to do today," he said. And those missions are growing.

THREE CLASSES OF VEHICLE

The Explorer, a 7-meter USV, is solely reliant on solar power and wind propulsion and provides ocean research data. "That was our starting point for Saildrone to get into the ocean-data market and work out the physical platform and the physics of sailing," explained Connon. "And then, we quickly realized that the potential at Saildrone exceeded the capabilities of the Explorer due to power or speed or size constraints. or all three."

Next came Voyager, a 10-meter diesel-hybrid USV that serves as the primary platform for maritime security and shallow water mapping. It features a high-powered radar, automatic identification system (AIS) and a pan-tilt-zoom flare camera. It can also be equipped with shallow-water multibeam sonar and a sub-bottom profiler. "That's what really gives us that large area coverage; we can conduct geophysical surveys, safety of navigation, offshore energy projects, and subsea infrastructure construction and monitoring," he said.

Last is the 20-meter Surveyor. In addition to the abilities of Voyager, it has deep-water survey capabilities equivalent to

MARINE TECHNOLOGY TV

Watch **Marine Technology TV**'s full video interview with Brian Connon here:

modern survey ships—covering missions like Exclusive Economic Zone (EEZ) mapping, subsea cable routes and offshore energy exploration.

Surveyor's recent mission with Meta to map deep-water portions of undersea cable routes has proven it can fill that role, despite being uncrewed. "What we showed was we can follow the route. We can collect the data to the standards that they need to determine if the route is safe to lay a cable. We showed that we can quickly alter that route if we do come across a sea melt or a canyon or some reason why we can't continue on the planned route," said Connon. Using USVs not only lowers costs but avoids 97% of the carbon of a standard survey ship. "This is a cost-effective and environmentally safe way to do an important job because the subsea cable market is really taking off."

AI ADVANCES THE MISSION

All of Saildrone's command and control software is developed in-house, with a focus on vertical integration that allows tight coupling of hardware, autonomy and mission management.

"Our platform has real-time fleet monitoring. We can do dynamic mission updates. We're doing secure data handling and built to allow us to scale globally. And since we own that full stack, we can rapidly adapt to new customer requirements," he said. "We can integrate emerging tech like machine learning and AI, while maintaining a tight control over cybersecurity. So, it's not about just building the drones, it's about managing oceans of data efficiently and securely."

In fact, AI is at the forefront of Saildrone's technology. "We've developed the largest image dataset of the ocean, and we used it to build a proprietary machine learning algorithm

Our platform has real-time fleet monitoring. We can do dynamic mission updates. We're doing **secure** *data handling and built to allow us to scale globally. And since we own that full stack, we can rapidly adapt to new customer requirements. We can integrate emerging tech like machine learning and AI, while maintaining a tight control over cybersecurity.* **So, it's not about just building the drones, it's about managing oceans of data efficiently and securely."**

– Brian Connon, VP Ocean Mapping, Saildrone

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to detect and classify activity at sea. So, we're fusing multiple sensor streams into actual insights in near real-time," he explained. An object on the sea can be classified by the algorithm as a boat, or an iceberg, or a whale spout—to name a few. A recent partnership with Palantir Technologies is further driving optimism optimistic towards the role of AI.

DIVERSE MARKETS, GROWING DEMAND

Ocean surveying serves as one of Saildrone's two leading markets. The race to understand the subsea world is intensifying as deadlines like Seabed 2030 loom. "We've only mapped 26% of the oceans to modern standards, but there's a general lack of capacity from traditional survey ships to accomplish this in a reasonable timeframe," Connon explained. More specifically, he noted, more small island states are trying to develop their blue economy. Whether they need to understand what's under the water within their EEZ, or they want to run undersea cables or establish offshore energy, the demand for ocean survey isn't waning.

However, maritime intelligence, surveillance and reconnaissance (ISR) may be experiencing an even bigger pull as customers realize the need for domain awareness. "We feel the maritime security sector will probably end up being the biggest portion of our business in the next three to five years," he predicted.

"We're seeing around the world more need to provide maritime surveillance to counter drug trafficking, illegal fishing and anything nefarious on the water where you need to have eyes," said Connon. Maritime security forces can't cover the entirety of the sea effectively. "So, what we do with Saildrone is we provide those additional eyes on the ocean more economically than having to procure or build new ships and then having to operate and maintain them."

Additionally, Connon sees a trend towards specific types of USVs, as militaries are looking for vessels that can carry out niche missions. "Saildrone's a leader in that space. What we're hearing from the military is that a persistent presence and the ability to use radar, AIS, cameras and passive acoustics to look above and below the ocean is really what they're driving towards."

He looks forward to the industry's future, adding that cost is another factor driving USV needs. "Shipbuilding is very expensive and is, in some ways, kind of broken in the sense that ships are over budget and way behind schedule. And so, they're going to be looking a lot more at autonomous solutions—not just the USVs, but AUVs and UASs as well, to help fill those gaps."

SAILING INTO THE FUTURE

As Connon and his colleagues look ahead, geographic expansion is on the horizon. This spring, the company announced Saildrone Denmark, a European entity based in Copenhagen. "This expansion reflects our commitment to supporting European allies and enhancing their maritime situational awareness through advanced autonomous technologies," he said.

As maritime challenges multiply—from climate to conflict—Saildrone is emerging as a trusted, tech-forward partner to governments, researchers and commercial operators. By building multifaceted platforms, investing in AI, and expanding its global footprint, the company is delivering on a vision of smarter, safer and more sustainable ocean operations.

And with the Explorer, Voyager and Surveyor fleets sailing further and faster than ever, it's clear: the future of subsea intelligence isn't just under the sea—it's on the surface.

Source Exail

LARS

NOT JUST A SIMPLE HANDLING TOOL

Even if launching is just "fire and forget," the recovery of vehicles takes considerably more effort.

By Wendy Laursen

Launch and recovery are often the riskiest parts of a subsea operation, and as **iDrop** COO David Galbraith points out, with a payload of new data, subsea vehicles are more valuable on recovery than they were on launch.

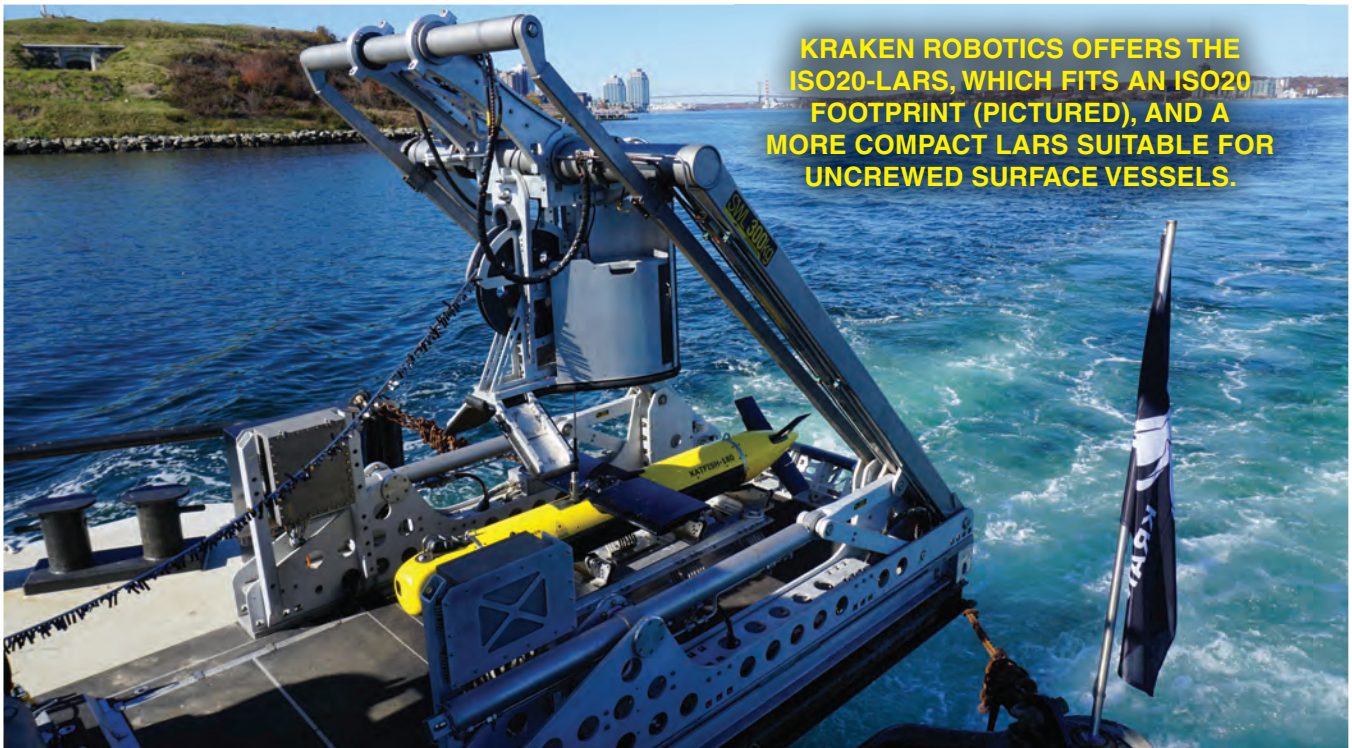
For iDrop, the challenge is how to launch and recover large numbers of its autonomous ocean bottom nodes (OBNs). The current method for laying OBNs, which catch reflected waves during seismic surveys, involves specialist vessels and crews. Instead, iDrop's Oceanid drones are designed to self-steer to the seafloor without the need for ROV help or DP-capable mother vessels. They can then resurface back into simplified collection lines for easy recovery.

All launch and recovery systems (LARS) aim for efficiency, but with swarms, the challenges are amplified. "We have all these bespoke launch and recovery solutions recovering our multi-million-dollar AUVs, but those solutions just don't scale economically when you're talking about a variety of different vehicles, or swarms," says Seth McCammon, a scientist at **Woods Hole Oceanographic Institution**. "A LARS system for a swarm needs to be flexible and repeatable, since it will have to pick up many, and likely many different AUVs"

The solution, he says, is to have two types of vehicles: larger, more capable autonomous platforms that can recover smaller, less capable ones. The smaller swarm members need to be able to navigate underwater but not necessarily localize globally underwater. They could just localize to where they last surfaced or descended.

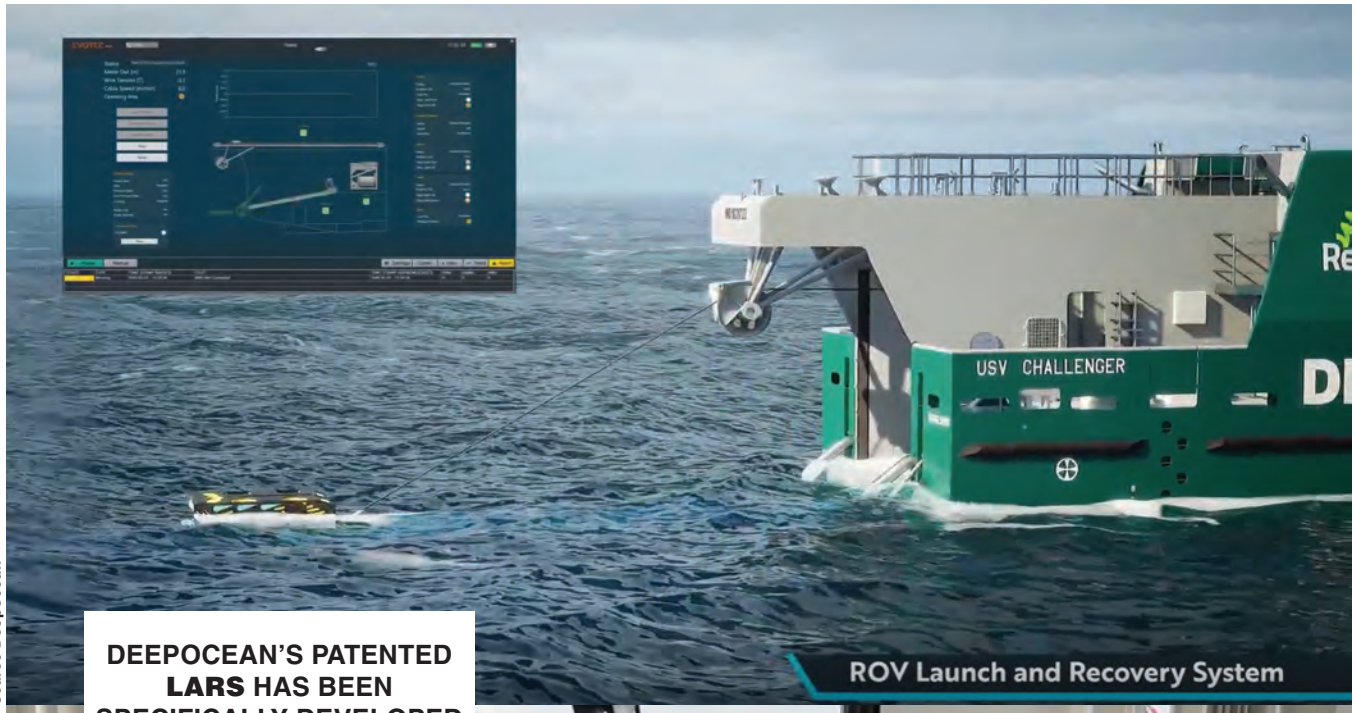
The recovering autonomous surface vessel needs to be a much more capable platform, perhaps with machine vision as well as GPS and the ability to detect acoustic signals. "You're investing more in the autonomous systems on that vehicle, but you need significantly fewer of them," he says. This lets the inexpensive AUVs benefit from the extra capability of the surface vessel, while still keeping each AUV low-cost.

McCammon is currently developing a net system for an au-



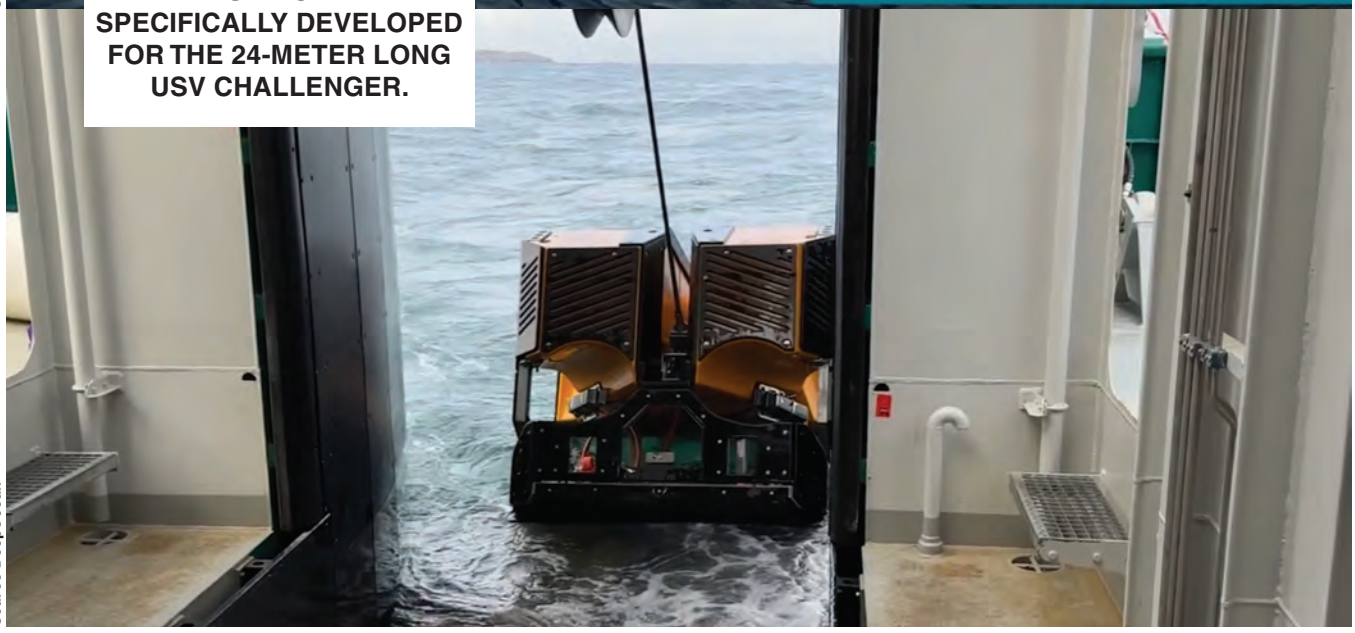
KRAKEN ROBOTICS OFFERS THE ISO20-LARS, WHICH FITS AN ISO20 FOOTPRINT (PICTURED), AND A MORE COMPACT LARS SUITABLE FOR UNCREWED SURFACE VESSELS.

Source Kraken Robotics



Source DeepOcean

DEEPOCEAN'S PATENTED LARS HAS BEEN SPECIFICALLY DEVELOPED FOR THE 24-METER LONG USV CHALLENGER.

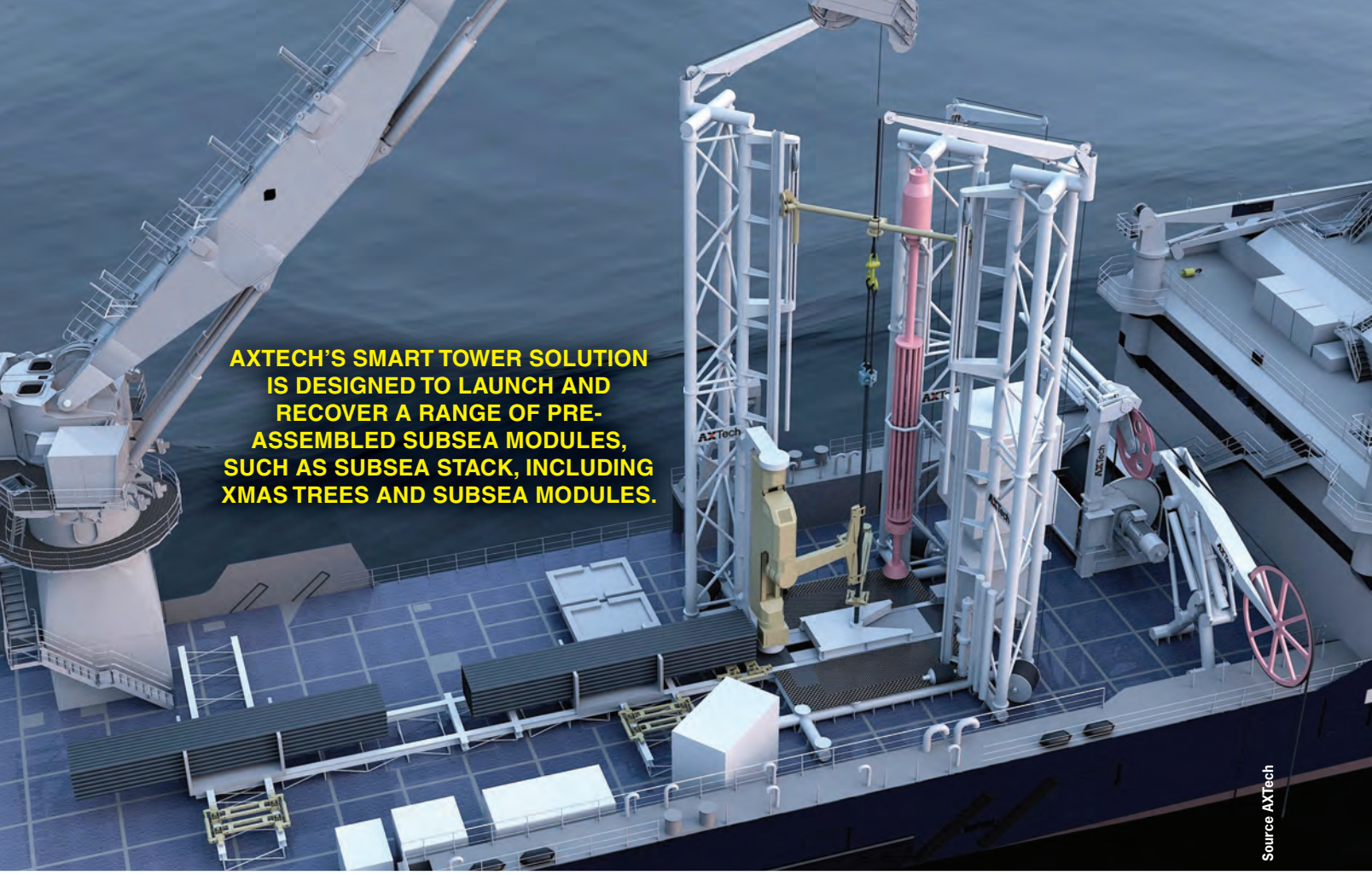


Source DeepOcean

tonomous surface vessel to enable it to recover swarm AUVs. The system is scalable because the recovery onus is on the larger, more capable platform. When the swarming agents are done with their mission, the ASV uses use computer vision and acoustic tracking technology to locate and scoop them up.

Exail has developed a modular LARS that can handle both AUVs and towed underwater vessels from an unmanned surface vessel. This reduces the number of LARS that are needed to be purchased, operated and maintained. The LARS can operate in heavy seas, because at the end of the mission, it puts a cable into water and unwinds it until its tip is well below the influence of waves. The AUV detects the cable using front-looking sonar and seizes it using specially designed clips. The LARS can then rewind the cable, bringing the vehicle onboard. Smart interactions between vehicle and surface vessel determine the best heading for launch or recovery. The surface vessel adopts the plan and so does the LARS.

"We have many autonomous functions integrated into our systems," says Peter Crocker, **Kraken Robotics'** KATFISH and LARS Product Owner. Kraken Robotics offers the ISO20-LARS, which fits an ISO20 footprint, and a more compact LARS suitable for uncrewed surface vessels. While the ISO20-LARS integrates human-in-the-loop autonomy features, the USV-LARS is designed to allow for fully autono-



mous launch and recovery.

Both systems include an intelligent, all electric winch that is software controlled and able to be remotely operated in a safe manner. The software continuously monitors cable tension, and in the event of a cable snag on the seabed, the winch will automatically pay out, keeping the system below the safe working load of the tow cable and system. Additionally, auto-tensioning of the winch ensures the KATFISH is securely held in the LARS docking head for safe recovery. It also ensures optimum spooling of the tow cable on the winch.

"Video data and other sensor data can be monitored remotely by an operator," says Crocker. "During towing operations, the winch is programmed with a safe-depth mode: when commanded in an emergency, the winch and KATFISH autopilot will bring the KATFISH up to a safe depth below the vessel. These autonomous safety features built into our LARS allow for safe remote operation of the systems

RESEARCHERS AT KTH ARE USING AUTONOMOUS AERIAL DRONES TO CARRY AND RELEASE UNDERWATER VEHICLES PRECISELY TO MISSION LOCATIONS.

Source KTH

over low bandwidth data links."

DeepOcean's patented LARS has been specifically developed for the 24-meter long USV Challenger. Unlike conventional moonpool or A-frame systems used on larger vessels, it launches and recovers a ROV over the stern while the vessel remains in motion. The LARS consists of an electrical winch, a sheave wheel trolley, kicker and rear hatch. When launching, the ROV is simply pushed in. When recovering, the ROV is pulled in like a trawl. The USV is also equipped with a gyro stabilizer that reduces vessel movements during launch and recovery operations.

Recently delivered from the shipyard, the USV Challenger began commissioning and testing for uncrewed operations in June with promising results. The USV was built around the LARS to optimize the integration between the vessel, its remote systems and the ROV. This intentional, coordinated design improves the reliability and safety of launch and recovery operations.

There's value in having a modular and flexible system. **AXTech's** Smart Tower Solution is designed to launch and recover a range of pre-assembled subsea modules, such as subsea stack, including xmas trees and subsea modules. The solution provides multiple options, ranging from light well intervention operation and coil tubing operation to pulling tubulars out of the well. Despite these varied operational duties, it can be installed on any offshore construction vessel equipped with appropriate cranes and a moonpool. It typically operates through the moonpool, avoiding the need for hull modifications.

Researchers at **KTH** are aiming to take platform flexibility in a new direction, up, and they've gained the attention of companies looking to launch both large and small vehicles. The aerial LARS project, underway in partnership with Saab, involves using autonomous aerial drones to carry and release underwater vehicles precisely to mission locations. A winch system will also allow the aerial drones to retrieve the vehicles from the water without requiring human intervention. The system leverages machine learning algorithms for object detection and dynamic stability during deployment and retrieval.

The aim is to achieve faster and more flexible vehicle deployment and recovery, to reduce risk to human operators by eliminating manual handling and to enable multi-domain autonomy with real-time AI-powered decision-making. Prototype testing is advancing towards the goal of initiating operations simply with the push of a button.

Argeo Chooses Henriksen's SOLUS Launch and Recovery System For Argus USV

Argeo of Norway has become the first commercial customer for the new Henriksen SOLUS launch and recovery system for unmanned surface vehicles (USV).

Argeo employs a range of unmanned and autonomous vehicles, providing advanced offshore survey and inspection services. The new SOLUS system now makes it possible for an uncrewed USV to be recovered by the mothership even in unfavorable sea conditions.

The Henriksen SOLUS system achieves this by enabling the 9-meter Argeo Argus USV to be brought alongside and reconnected to the mothership's lifting wire by means of its telescopic mast. During launch and remotely controlled work operations, the USV's mast is kept retracted within its structure. At the end of its mission, it is brought alongside the mother ship, and its mast is raised remotely by the USV's controller, revealing its recovery lines.

Regardless of conditions, the mast is able to present the recovery lines to the mothership's crew. The personnel can then secure either of the lines with a threading boat hook. Once the connection has been made between the USV and the mothership, it becomes possible to connect the crane's fall wire to the lifting point on the USV, bringing it aboard the mothership

SOLUS is the latest addition to Henriksen's product range, which also includes launch and recovery systems for AUVs and advanced mine sweeping systems.

SOLUS ENABLES CONVENTIONAL LAUNCHING OF ARGEO ARGUS BY CRANE.

Source Henriksen

ARGEO ARGUS WITH SOLUS MAST EXTENDED TO SHOW ORANGE CAPTURE LINES.

Source Henriksen


Source Marley Parker

SHIPWRECK WINDFALL

ROV Expedition Captures Maritime History

By Celia Konowe

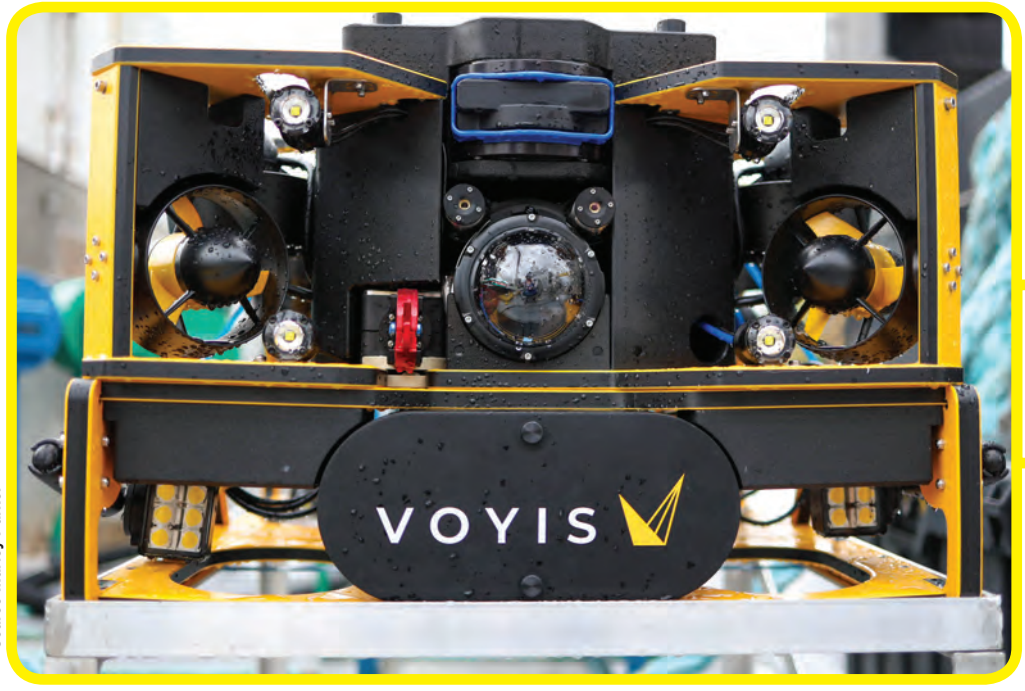
The chill, freshwater depths of Lake Ontario may not first come to mind when thinking about shipwrecks, but an expedition by the Ocean Exploration Cooperative Institute (OECI) at the University of Rhode Island (URI) is challenging that perception. Its star explorer? A compact but mighty Remotely Operated Vehicle (ROV) named Rhody. What began as a mission to support NOAA's interest in high-resolution shipwreck documentation within the Lake Ontario National Marine Sanctuary has evolved into a dynamic academic research experience merging innovation, partnership and the expanding role of robotics in nearshore and inland underwater operations.

Preserved Beneath the Surface

Lake Ontario, one of North America's Great Lakes, features a trove of submerged history. Beneath its waves lie hundreds — potentially thousands — of shipwrecks, many dating back to the era of westward expansion. These include wooden sailing schooners and early steam barges, vessels that once carried goods and dreams across the inland seas.

"We documented 17 shipwrecks during the expedition," said Holly Pettus, project manager at OECI. "But within the lake in its entirety, there are hundreds or potentially thousands down there."

You're not alone if these numbers surprise you. Your correspondent, who for five years lived on the lake's southern



Source Marley Parker

THE DISCOVERY STEREO CAMERA FROM VOYIS.

shore in Rochester, New York, had no idea about shipwrecks just below the waves.

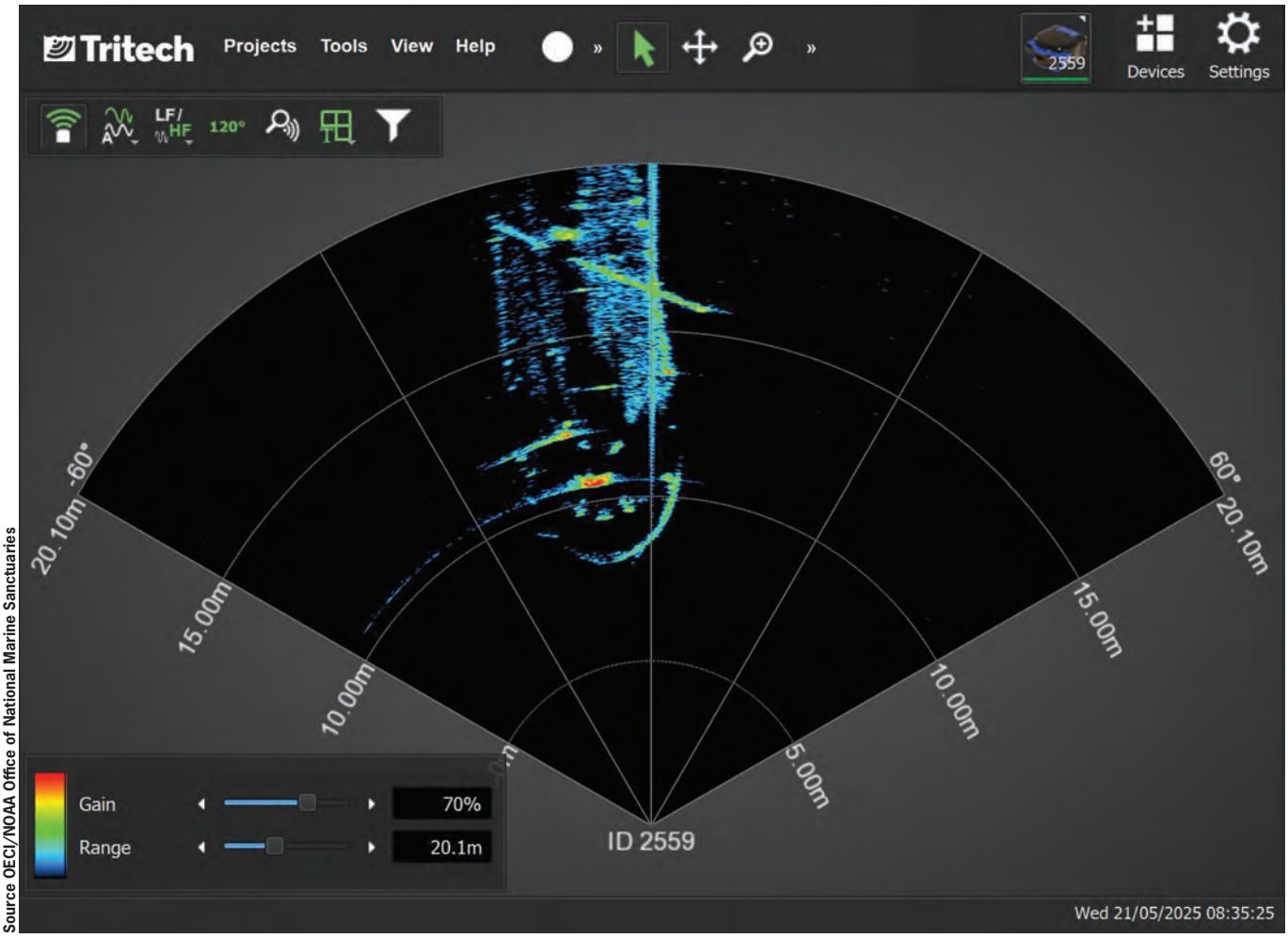
"When you get offshore in Lake Ontario, it can have conditions very similar to the ocean. It's not tidily affected, but there it's big enough that the fetch allows the wind to generate storms and waves on the lake that are sufficient to sink a vessel like these," explained Jason Fahy, associate director at OECI. "A majority of the wrecks that we were looking at happened in this November and early December timeframe when shipping companies are trying to get the last delivery in before the lake freezes up. A big storm will come through and sure enough, it'll sink vessels."

The shipwrecks served as a founding reason for the Lake Ontario National Marine Sanctuary, designated by the National Oceanic and Atmospheric Administration (NOAA) in 2024. The organization's website states, "As the gateway between the Great Lakes and the ocean, the maritime landscape of this area represents connections between cultures, between a nascent nation and the frontier, and of commerce, opportunity and ingenuity."

With historically rich treasures on the lake floor, yet limited documentation, NOAA contacted OECI to conduct a baseline survey. "We brainstormed the technologies and the way we could tell that story. And that snowballed into what became this project we just completed in May," said Fahy.

Meet Rhody

Central to the success of this expedition was Rhody, a customized HD3-class ROV built in collaboration with **JM Robotics**. "I reached out to multiple vendors trying to select the right fit for our project," said Fahy. "JM was really willing to work together on the customization of the vehicle for our purpose. And that's what really sold us."



Source OECI/NOAA Office of National Marine Sanctuaries

SONAR OF THE FARMERS DAUGHTER SHIPWRECK

"What drew us to the vehicle was it has a unique ability to fly with six degrees of freedom. So, its maneuverability was the first thing that caught my attention," he added.

"What NOAA wanted from us were these high-resolution 3D models of the shipwrecks," said Pettus. "And the body and the skid that we were able to integrate onto the HD3 robot allowed us to have all of those sensors to create those 3D models." Adding the **Discovery Stereo Camera from Voyis** sealed the deal, allowing for a 4K video stream and still images that were ready for machine vision and 3D reconstruction.

The vehicle is rated for 300 meters, ideal for shallow-to-mid-depth lake and coastal missions. It's also compact—transportable in Pelican cases and deployable from small boats—making it perfect for scientific expeditions and rapid-response applications.

Deep Discoveries and Student-Led Science

The Lake Ontario mission was Rhody's maiden voyage and it proved the ROV's capability in real-world conditions. Each day varied slightly depending on the type of shipwreck. "Some of these wrecks had standing masts which would add a lot of survey time because for the photogrammetry you need pictures of every angle of what you're surveying," explained Pettus. Most days, the team completed two surveys, although smaller wrecks allowed for up to four surveys in one day. And while ROV dives were limited to the daytime, mapping operations using a multi-beam sonar were conducted at night, filling in unmapped parts of the lake.

The mission also doubled as an educational platform. Students from URI joined the expedition, contributing directly to operations—from piloting Rhody to processing multi-beam sonar data. One undergraduate even discovered a previously undocumented wreck during a night mapping shift.

The project's deliverables were as impressive as its methods: 750,000 images, dozens of hours of subsea video, and eventually, 17 photorealistic, scaled 3D shipwreck models to be delivered to NOAA. These digital artifacts will support both preservation efforts and public engagement, al-

lowing viewers to explore submerged history in an accessible manner.

"The initial results are compelling. The Voyis camera is exceptional; this is exactly what it's designed to do and it performed extremely well. I can't wait to share that with the public," said Fahy.

The team was also struck by the quality of preservation of some of the shipwrecks. "We knew these shipwrecks were going to be extremely well preserved because of conditions in the lake," explained Pettus. "But when we would approach a shipwreck with Rhody, it looked like it was just delicately set down on the lakebed."

"If you're familiar with sailing schooners at all, on the front of the vessel on the bow, there's something called a dolphin striker. It protrudes from the bow, and there's a lot of rigging that's necessary to hold that in place," she said. "And we saw one of those that was completely intact. All the rigging was still there. Our chief scientist was like a kid in a candy store when he got to see that."

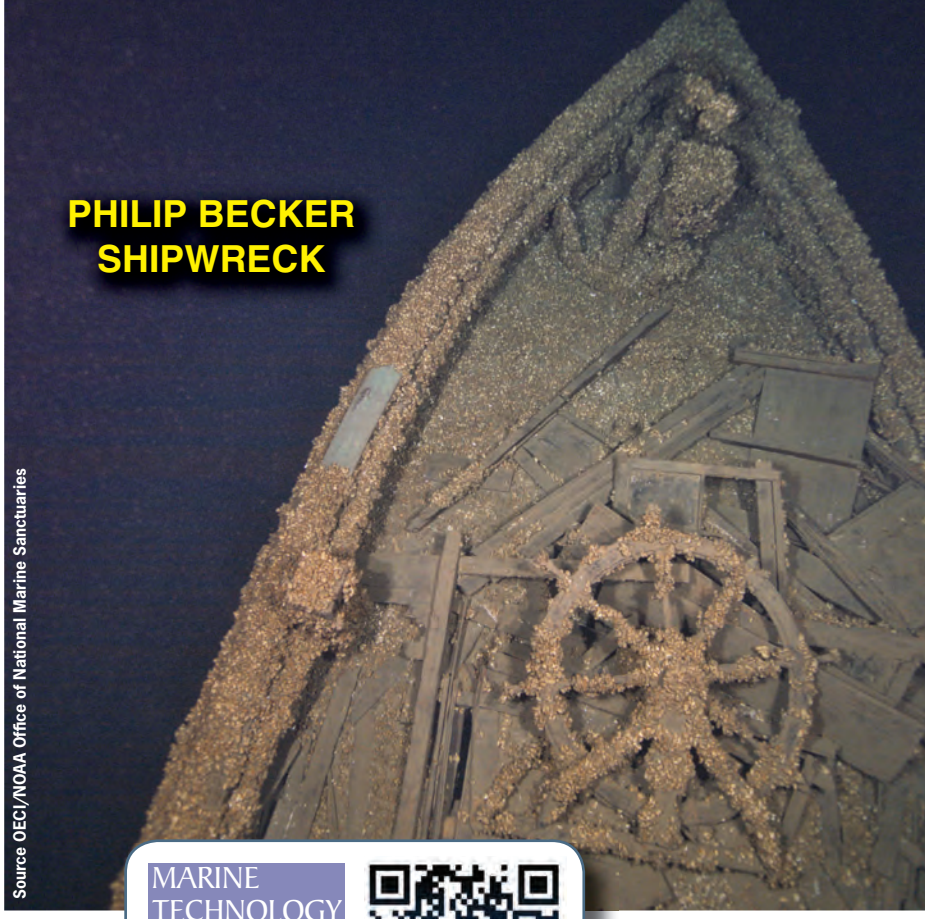
The Rhod(y) Ahead

"We've got huge plans for little Rhody," laughed Fahy. Upcoming projects include cold-water coral studies in the Gulf of Maine and participation in the documentation of the intentional sinking of the S.S. United States off the Florida coast to create an artificial reef. "This is a really cool opportunity because you can do a pre-sinking inspection to know what the current conditions are. After the vessel is sunk and the community starts to interact with it as a dive site, how it changes is an important scientific question to answer."

Rhody may also see some modifications, including the addition of manipulator arms. "We're expanding its capability. Then we can do not only the survey work, but we can collect samples and actually interact with the seafloor or the lakebed as well," explained Pettus.

The Lake Ontario expedition marked a milestone not only for the OECI and NOAA, but also for the wider underwater technology and marine heritage communities. In Rhody, the OECI team has developed more than just a robot—they've created a model for how adaptive technology, academic partnership and a spirit of exploration can unlock the mysteries of inland waters and beyond.

In a world increasingly reliant on remote and autonomous systems, Rhody proves that even small vehicles can make big discoveries.



Source OECI/NOAA Office of National Marine Sanctuaries

MARINE TECHNOLOGY TV

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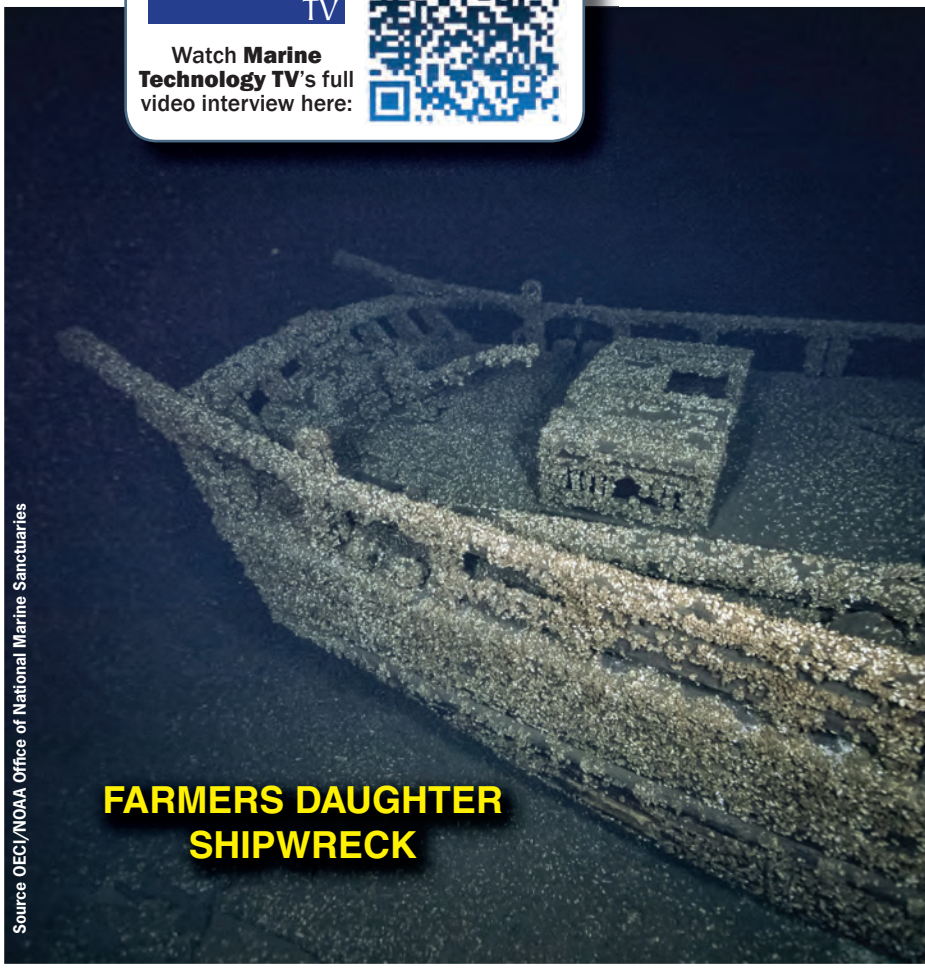

Source OECI/NOAA Office of National Marine Sanctuaries

■ **IFREMER**

■ **Vard**

■ IFREMER Fleet Welcomes New Research Vessel

A new research vessel built for the French oceanographic fleet and operated for the National Science Community by the French national Institute of Ocean Sciences (IFREMER), Anita Conti, has been launched at the Freire Shipyard in Vigo, Spain.

Designed to replace the vessel Thalia, the Anita Conti will fully integrate the French Oceanographic Fleet in 2026. It will have an overall length of 45 meters and a beam of 11.5 meters.

It has been designed to carry out research missions in coastal areas in mainland French waters (Bay of Biscay, Channel) but may also be deployed in certain years on the coast of Africa and in the Antilles and French West Indies-Guyana zone. It will house a crew of 12 people and 10 scientists.

The Anita Conti has a wide range of energy-saving technologies and low-consumption solutions implemented.

The diesel-electric propulsion system will be composed of three variable-speed, biodiesel-compatible generator sets feeding two shaft lines driven by electric motors and a direct current (DC) electrical distribution system.

This set, together with a battery pack, will enable good energy efficiency, optimization of consumption, operational redundancy and compliance with acoustic requirements according to BV COMF 2 class notation and DNV SILENT-F standard.

Anita Conti will be equipped with a gondola under the hull housing all the acoustic transducers that will enable it to explore and map the seabed and water column. It also has laboratories and a scientific PC.

The vessel will feature an oceanographic marine telescopic main crane at the stern for marine use for launching and retrieval of scientific equipment and general maneuvering at the stern of the vessel. In addition, it will have an A-type stern gantry, a T-type side gantry. For scientific fishing operations, this vessel will also have two trawling winches and a removable net drum.

■ Vard, Inkfish Sign Shipbuilding Research Vessel Contract

Vard has signed a new contract with the US research organization Inkfish for the design and construction of an advanced research vessel. The deal is valued at over $233 million.

The custom-built research vessel, designated Project RV6000, is specifically designed for scientific exploration. It will join Inkfish's expanding fleet, alongside the RV Hydra and RV Dagon, to support global marine research. In close collaboration with host countries, the data collected will contribute to open-source repositories.

The vessel is designed for seabed mapping, submersible support, and ROV operations. It will be 100 meters long and 20.7 meters wide, with a maximum speed of 15 knots and an operational autonomy of up to 30 days.

The RV6000 is equipped with an ROV capable of operating at depths of up to 6,000 meters. It will be capable of supporting two manned submersibles and will feature an A-Frame system aft and a large hangar for maintenance and storage. An offshore crane equipped with an AHC system will be installed on the starboard side for operations at depths of up to 2,500 meters. The vessel will be equipped with a hydroacoustic survey system capable of high-resolution seabed mapping, with a resolution of 0.5 x 1 degree, and analyzing the water column at all depths.

The technical configuration includes hybrid power generation and propulsion. The hull is designed to ensure advanced seabed mapping performance and excellent seakeeping qualities, thanks to anti-roll technologies that reduce movement and acceleration, ensuring excellent hovering performance. The ship will also be equipped with laboratories, offices, and workshops, as well as accommodations and recreational areas designed for maximum comfort. These spaces will accommodate up to 70 crew members and researchers and will meet the stringent requirements of the DNV COMF (Comfort Class) notation, ensuring low noise and vibration levels.

Inkfish RV Main Particulars

Length:	100m
Beam:	20.7m
Max speed:	15 knots
Autonomy:	30-day ops sequence
Ultra deep winch:	6000 m
Capacity [Crew and scientist]:	70

Amenities

- DP capability
- ROV Hangar
- SUB Hangar
- Stern A-Frame for Submarine handling and routing for Scientific winch
- Helicopter Deck
- Offshore Crane
- Science work facilities

■ Australian Antarctic Program

■ RSV Nuyina Completes Voyage for the Australian Antarctic Program

The RSV Nuyina, operated by Serco, has returned safely to Hobart after a 9-week dedicated marine science voyage to the Denman Glacier, carrying 85 Australian Antarctic Program expeditioners and 45 crew.

In achieving its third 2024/25 season voyage, the Nuyina successfully facilitated research and navigated through harsh environmental conditions, including winds at times reaching 63 knots (116 km/hour), thick ice and frequent periods of very low visibility.

The Australian Antarctic Program had previously been unable to access Antarctica's Denman Glacier—which is of prime scientific interest as one of the largest, least-studied glaciers, with the potential to raise sea levels by 1.5m if it melts entirely—because of the Glacier's extreme geographical remoteness and logistical challenges. The purpose of this voyage was to leverage the Nuyina's unique combined capabilities as an icebreaker and research vessel to allow Australian scientists to venture further than ever before, enabling critical studies.

Prioritizing crew and expeditioner safety, the team adapted to 12-hour shifts, organizing 24/7 availability of all technical skillsets. This included highly trained staff such as experienced ice navigators and dynamic positioning operators.

Where new operations were being undertaken to support ambitious research goals, the crew showcased their creativity and ingenuity to provide scientists with maximum access to desired locations and marine life. This involved everything from developing new strategies on the go, including running rehearsals of tender launches to holding Man Overboard (MOB) practices to ensure thorough preparation.

Having successfully completed its dedicated marine science voyage for the Australian Antarctic Program, the RSV Nuyina departed on Monday May 12, 2025 for its fourth voyage of the season, with the purpose of conducting resupply to Macquarie Island.

Serco has operated the RSV Nuyina for the Australian Antarctic Program since 2021, from its initial build through to engineering, maintenance, operations, crewing, catering and upkeep. Offering diverse capabilities, the vessel is uniquely suited for use in resupply missions, scientific research and medical evacuations.

■ **Ulstein Group**

■ **Incat Crowther**

■ **Bernhard Schulte Offshore**

■ Megamas Contracts for Cable-Laying Vessel Design

Megamas Resources announced a ship design contract with Norway-based Ulstein Design & Solutions AS to start the engineering phase on a fiber-optic cable-laying vessel (CLV) planned to be built at the Lloyd Werft Bremerhaven GmbH.

The ULSTEIN SX228 has a deadweight of 8,200 tons and a cable capacity of 5,500 tons. Measuring 121.7 meters in length with a 23-meter beam, the vessel has been specifically optimized for fiber-optic cable laying and is also prepared for future power cable operations. This includes an underdeck carousel integrated into the cable tanks.

Equipped with two firing lines and all necessary cable handling equipment within an enclosed working area, the vessel ensures safe and efficient operations in challenging offshore environments. Additional features include an ROV hangar for the cable trencher, a 50-ton A-frame, and a bollard pull capacity of up to 120 ton for subsea ploughing.

■ Zamil Offshore's New 60m Fast Support Intervention Vessel

Zamil 80, the first of three new 60-meter Fast Support Intervention Vessels (FSIVs) designed by Incat Crowther for offshore marine services provider Zamil Offshore, has passed sea trials and will soon enter service.

The new vessel exceeded expectations, achieving a service speed of 28 knots with a 200-tonne payload, above the contracted required service speed of 25 knots, Incat Crowther said.

The three new ABS-Classed, low-draft monohull FSIVs are being constructed by Singaporean shipbuilder Lita Ocean and will assist Zamil Offshore with the safe transport of cargo, heavy maintenance equipment and personnel for Saudi Aramco's operations in the Arabian Sea.

Construction on the remaining two contracted vessels is expected to be completed in 2025.

The new vessels are powered by four MTU 16V4000 diesel engines coupled to ZF gearboxes driving Hamilton HT810 waterjets.

Maneuverability of the DP2-certified vessels is enhanced by three Hydromaster tunnel bow thrusters, allowing safe docking and superior station-keeping for transfer of cargo and personnel.

Two of the main engines are coupled to FFS firefighting pumps with paired 1200 m3 /hour water monitors and shipboard water spray protection offering FiFi-1 capability.

Three Scania 300kW diesel generators provide ship service power. The vessels' main deck offers an expansive 250 m2 aft cargo deck rated at 2.5 t/ m2 and a climate-controlled forward cabin featuring business-class seating for 60 service personnel, as well as three bathrooms, an office, snack bar and a well-equipped medical bay.

Each vessel's 18 crew are housed on the hull deck which features a large pantry, mess, three bathrooms and laundry.

The health of the crew is also prioritized with an isolation room located behind a sealed door. The vessels comply with the latest MCVSR requirements from Saudi Aramco, including ABS SMART and IDM-A notations.

60m Main Particulars

Length, oa.	196.1 ft.
Length, wl.	184 ft.
Beam oa.	29.5 ft.
Draft	7 ft.
Depth	14.5 ft.
Construction	Marine grade aluminium
Tonnage	498 GT ITC
Fuel Oil	44,909 gallons
Fresh Water	8,453 gallons
Grey Water	475 gallons
Black Water	475 gallons
Lube Oil	528 gallons
Waste Oil	528 gallons
Bilge Oil	528 gallons
Industrial personnel	60
Crew	18
Speed (Service)	28 knots
Speed (Max)	36 knots
Main Engines	4 x MTU 16V4000M63L
Power	4 x 2240kW @ 1800rpm
Propulsion	4 x Hamilton HT810 waterjets
Bow Thrusters	3 x Hydromaster 150 kw thrusters
Generators	3 x Scania DI09 (300 kW each)
Flag	Panama
Class / Survey	A1, Circle E, HSC Crewboat, AMS, DPS-2, FF Capable, SMART (INF, SHM, MHM), IDM-A, ENVIRO

■ Equinor/ECO

■ HydroSurv

■ CSOV Pair Christened for Bernhard Schulte Offshore

Bernhard Schulte Offshore announced the delivery of its latest Commissioning Service Operation Vessel (CSOV) from Ulstein Verft in Norway.

The newbuild, which was christened 'Windea Curie' on June 26, is now being deployed for the charterer TenneT, an offshore transmission system operator in the European Union, to support its offshore grid connection facilities in the North Sea.

'Windea Curie,' which utilizes Ulstein's TWIN X-STERN design, features two sterns and azimuth propellers located at both fore and aft, making her an ideal choice for Dynamic Positioning (DP) operations and reducing the fuel consumption. Regardless of whether the vessel is facing towards or away from the weather, it maintains excellent operability and flexibility. With the TWIN X-STERN solution, the ship can achieve improved fuel efficiency while also minimizing motion.

The new offshore vessel has a large, height-adjustable, centrally positioned walk-to-work motion compensated gangway and elevator tower for personnel and cargo transfers. Furthermore, a 3D compensated crane capable of 5-ton offshore cargo lifts is installed, enhancing operational efficiency and versatility. The optimized on-board logistics include large storage capacities and stepless approach to the offshore installations.

'Windea Curie' has a length of 89.6 m and a beam of 19.2 m. The vessel offers up to 90 cabins with windows for charterers' offshore personnel. In total, there are 111 cabins providing comfortable living conditions for up to 132 individuals. The ship is equipped with hybrid battery propulsion and prepared for methanol fuel to enable low-carbon operations.

The sister ship of the 'Windea Curie' is currently under construction at Ulstein Verft in Norway with delivery planned in August 2025. It will expand the BSO fleet to five offshore service vessels, all highly flexible in operation to support the offshore wind energy market as well as the oil and gas segment.

■ SOV ECO Liberty Launched

Equinor, the developer of Empire Wind, launched the Service Operations Vessel ECO Liberty on June 28 for deployment in its New York offshore wind project, marking the culmination of a major investment in the U.S. shipbuilding industry.

The American-made ECO Liberty was built by Edison Chouest Offshore, built with American steel and including components from companies in several Gulf Coast states.

The 262-ft. hybrid-powered ECO Liberty will be homeported at New York's South Brooklyn Marine Terminal, where more than 2,000 workers have been put to work constructing a next-generation staging facility, O&M base, and control center for Empire Wind.

■ GOSL Nigeria Orders HydroSurv REAV- 47

HydroSurv announced the sale of a REAV-47 uncrewed surface vessel to Geodetic Offshore Services Limited (GOSL) for hydrographic and geophysical survey operations. The sale marks the company's first delivery to Nigeria where GOSL is a leading provider of offshore survey services.

The battery-hybrid REAV-47 will be integrated with an advanced payload consisting of a Ping DSP 3DSS-IDX interferometric sonar alongside Innomar's Compact Parametric Sub-Bottom Profiler. This payload configuration will enable concurrent wide-swath bathymetric mapping and high-resolution sub-bottom imaging for comprehensive landfall survey capability on offshore infrastructure projects.

GOSL will operate the multipurpose REAV-47 USV as a standalone survey system, and as a mothership force-multiplier. As a new product introduced into HydroSurv's portfolio in 2024, the design is an evolution on the company's existing seagoing USV platform. The vessel can sustain survey operations for up to 72-hours with a battery-hybrid system consisting of a 12kW Mastervolt battery system and a 4kW Fischer Panda generator.

The REAV-47 uses HydroSurv's advanced Virtual Watchkeeper Vessel Control System, alongside autopilot technology from Dynautics and a navigation and situational awareness spread from Furuno and TimeZero. The vessel's 5.0kW rim driven electric propulsion from RDT minimzses entanglement risk whilst delivering exceptional performance.

CUSTOM SEARCH AND RECOVERY GRIPPER FOR UNDERWATER BODY RECOVERY

Search and Recovery operations for victims of underwater fatalities are high-pressure, time-sensitive, and extremely technical. Investigating officers and grieving families are wholly dependent on recovery teams achieving mission success, an ever-present reality for Sergeant Jay White who heads up the National Underwater Recovery Training Center (NURTC).

In addition to managing recovery operations, he trains specialized officers deployed to work in the Royal Canadian Mounted Police's (RCMP) six Underwater Recovery Teams stationed in British Columbia, Saskatchewan, Manitoba, New Brunswick, Prince Edward Island, and Newfoundland. His expertise and field experience led him to initiate the development of a new custom search and recovery (SAR) gripper for his Chinook ROV, collaborating with SEAMOR Marine.

Not a Task for the Faint-Hearted

The standard challenges of working in a marine environment are ever present, including high pressure at depth, strong or variable currents, and submerged physical obstructions. Every case presents multi-faceted complications for operators, such as a victim's body being trapped inside a vehicle, a seatbelt still intact, or the natural processes of decomposition actively taking place within the bodies. The general challenge for the recovery teams is two-fold: find a reliable gripping point to maneuver the body free and then stabilize the ascent back to the surface.

A Custom-Fit Recovery Solution

Sergeant White found that the robotic manipulators commercially available to him proved insufficient for this challenge. In response, he initiated a collaboration with the SEAMOR team to develop a custom-made gripper specifically for the task of recovering submerged victims. Since its creation in 2023, the SAR gripper has been employed in eight successful recovery missions. Now this design has been replicated and deployed to multiple Underwater Recovery Teams across the country for use on their ROVs.

Expanded Grasp

Initial strategies using SEAMOR Marine's dual-function gripper relied on using clothing as the primary gripping point. However, given the circumstances of many marine fatalities, it proved to be the case that often little or no clothing was accessible for these purposes. A widened grasp allowed operators to find more secure points to grip, primarily wrists and ankles. In addition, the field of view was increased by extending the neck of the manipulator so that the camera 'eye' of the ROV could capture a clearer picture of the environment. Extending the SAR gripper allowed ROV pilots to stay away from the silty bottom which, when touched, creates low visibility environments and threatens the preservation of the crime scene.

Early implementations of the prototype design encountered a challenge related to the biochemistry of decomposition: as bodies are raised toward the surface, the changing pressures can cause internal gases to expand in unpredictable ways. For example, a body might weigh just fourteen pounds due to buoyancy three hundred feet underwater. However, as it is recovered, the expanding gases from decomposition can cause sudden shifts or changes. Worse than the damage this twisting could inflict on the body, which obstructs investigative efforts, there is a risk of losing grip entirely. Therefore, extra reinforcements beams were added to stabilize the custom SAR gripper arm. This, in addition to the Chinook ROVs six powerful thrusters, was the key to achieving a reliably stable grip.

Spontaneously Adaptable

The integrity of the victim's body is critically important for investigative purposes, regardless of the complexity of the extraction. Any new damage or disruption can severely impact forensic analyses, especially in cases where the fatally is still under investigation. Careful selection of instruments and on-site adaptation are crucial to complete the recovery as smoothly as possible. The design of the custom SAR gripper allows it to be swapped with the original SEAMOR dual-gripper or cutter without needing to re-trim the ROV. This allows teams to overcome additional obstacles such as seatbelts, broken windows, or other obstructions spontaneously. And when the clock is ticking, every minute counts.

The Stakes are High - Your Standards Should Be Too

The stakes of these operations really cannot be understated. "When you find someone then lose them, it's a really bad day," says Sergeant White, who knows first-hand that investigators and families are counting on success every time.

The reliable, portable, and versatile design of SEAMOR Marine's Chinook ROV allows the operators at NURTC to confidently deploy their unit anywhere, from Baffin Island, to the East Coast, the Great Lakes, or the wild coast of Canada's western shore.

Images above: (L): The Chinook ROV with the custom SAR gripper. Courtesy: SEAMOR Marine (R): A view of the custom SAR gripper from the ROV's perspective. Courtesy: National Underwater Recovery Training Center (NURTC)

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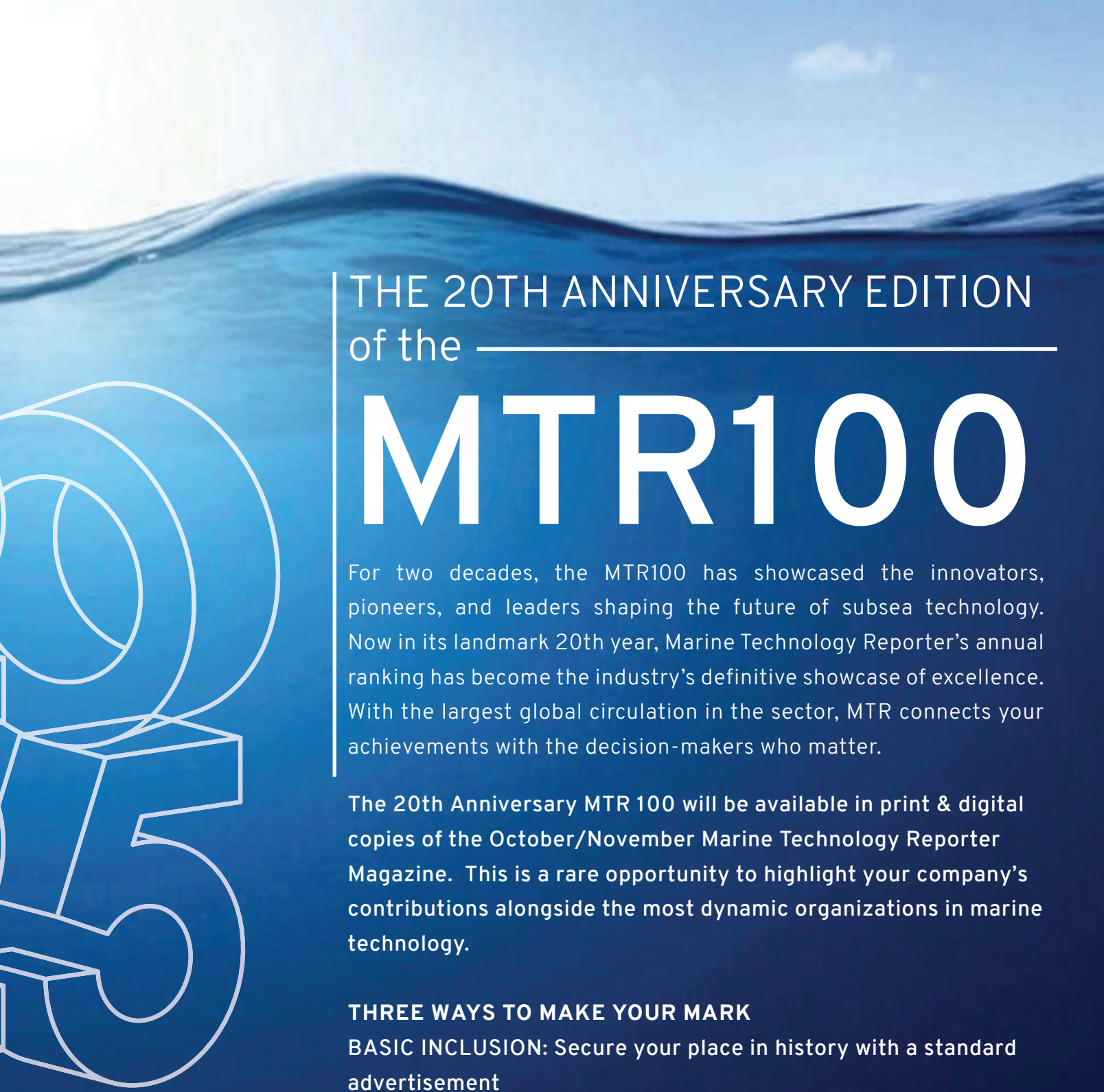

THE 20TH ANNIVERSARY EDITION of the MTR100

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UGUST 31 2025

■ Xsens

■ Xsens Announces New OEM Inertial Measurement Unit

Xsens announced the launch of Xsens Avior, a lightweight, OEM form factor inertial measurement unit (IMU) with a compact 36.8mm x 40mm footprint which offers enhanced performance in a wide variety of industrial and commercial applications.

The Xsens Avior is ideal for products manufactured in high volume thanks to its vertical 10x2-pin socket connector for simple board mounting, and its tolerance of any mounting orientation in all three axes. The product also eases design integration by including UART, CAN, SPI and I2C interfaces on-board, and supports RS232 and RS422 via the product's development kit or an external transceiver.

Xsens has integrated a new generation of sensing components in the Avior, as well as advanced analog filtering for higher stability and noise reduction, resulting in substantially better performance compared to the previous generation product. Heading accuracy is 1° RMS and roll and pitch accuracy is 0.2° RMS. Stability is also enhanced in the Xsens Avior: in-run bias stability in the gyroscope is 8°/hr, and accelerometer in-run bias stability is 15µg.

Weighing 35.2g, the Xsens Avior is enclosed in a robust aluminum housing and has a rating of IP51 and an operating temperature range of -40°C to 85°C. The sensor's small size, light weight, high performance and robust construction provide outstanding value in applications such as:

- Camera/payload stabilization, including SOTM (SATCOM-on-the-Move) devices
- Marine equipment – remotely-operated vehicles (ROVs), autonomous underwater vehicles (AUVs), sensor buoys
- Mobile robots and autonomous mobile robots (AMRs)
- Drones and 3D mapping and surveying tools
- Humanoid robots

The new sensor is available in three versions:

- IMU providing calibrated inertial sensor data
- Vertical Reference Unit (VRU) providing accurate, calibrated values for roll and pitch, and unreferenced yaw data
- Attitude and Heading Reference System (AHRS), providing accurate, calibrated roll and pitch values, and heading data referenced to true North

The Xsens Avior is available in a ready-to-use hardware development kit, and is supplied with free software development kits supporting the C#/C++, Python, ROS 1 and ROS 2 and Matlab environments, as well as full documentation and step-by-step guides to design integration.

Key product specifications:

- Typical power consumption: <0.5W
- Maximum output data rate: 400Hz
- Gyroscope full range: ±300°/s
- Accelerometer full range: ±8 g
- Magnetometer full range: ±8 G
- Fully supported in the MT Software Suite development environment
- Certifications: CE, FCC, RoHS, ITAR free

■ Kongsberg Discovery

■ Advanced Navigation

■ Silicon Sensing, Kongsberg Discovery Join Forces to Develop Gyro Technology

Silicon Sensing Systems Ltd. and Kongsberg Discovery AS have signed a cooperation agreement to develop next generation MEMS-based gyro technology that will disrupt existing solutions.

Gyro sensors measure changes in rotation angle over time, enabling detection of direction, angle, and vibration. They are used in smartphones, game consoles, car navigation systems, industrial equipment, and devices requiring vibration detection, camera shake correction, and attitude control.

This agreement will merge the engineering skills of both companies to speed up the evolution of products within each company. Kongsberg will use developments to enhance their next generation of high-performance systems—including Attitude and Heading Reference Systems (AHRS) and Inertial Navigation Systems (INS). Silicon Sensing will use these outcomes to benefit its precision Micro Electro-Mechanical Systems (MEMS) inertial measurement units (IMUs), gyros and accelerometers.

The ambition for Silicon Sensing and Kongsberg Discovery is to achieve 'navigation-grade' performance from a MEMS-based gyro. Navigation-grade refers to a highly accurate and stable gyroscope used in inertial navigation systems (INS) to precisely measure angular velocity and rotational motion. By combining their extensive capabilities the companies will significantly accelerate the development of such a gyro.

■ Boreas A70 IMU Bolsters Blackwater ROV Navigation

The Advanced Navigation Boreas A70 is a strategic-grade inertial measurement unit (IMU) that delivers acceleration and orientation with superior accuracy, stability and reliability under all conditions with no reliance on GNSS. It also features automatic gyrocompassing with industry-leading reductions in size, weight, power and cost (SWaP-C) compared to competing systems on the market.

The Boreas A70 is well-suited for surveying, mapping and navigation across subsea, marine, land and air applications.

Tamboritha, an offshore services contractor, chose the Boreas A70 for a subsea drilling operation off the coast of Northern Territory, Australia. At a depth of 1,200 meters in black water conditions, Tamboritha's task was to precisely place a 30-inch well conductor into a seabed drill slot.

The Boreas A70 stood out for its performance in challenging environments, delivering stable and precise orientation. Additionally, it provided:

- Rapid and precise north-seeking
- Heading stability
- Customer-focused support
- Ease of integration with ROV

The integration process also involved configuring Ethernet connectivity for real-time data streaming and ensuring compatibility between the Boreas A70 and the ROV's multibeam sonar system.

■ NOVACAVI

■ Verlume

■ Sonardyne

■ NOVACAVI Hybrid Umbilical Powers AI Robot

NOVACAVI has been chosen to design and manufacture a hybrid buoyant umbilical that will drive an AI-guided demolition robot during the rehabilitation of Dock 7 at the Port of Trieste.

The arm-equipped robot will remove deteriorated concrete using high-pressure hydro-demolition while protecting the underlying steel structure. Reliable power, control and real-time data transmission will be delivered through NOVACAVI's hybrid buoyant cable. Wrapped in a hydrolysis- and UV-resistant matt polyurethane (PUR) sheath, the cable combines lightness, buoyancy and rugged durability—ideal for demanding marine infrastructure projects.

■ Verlume Appoints Valor Ocean Technology

Verlume, a leader in subsea batteries and power management systems, has appointed Valor Ocean Technologies as its first business development agent in Canada. The partnership follows the successful offshore deployment of three Verlume Charge systems in Canadian waters and signals a strategic expansion to meet growing market demand.

Through this collaboration, Valor Ocean Technologies will promote Verlume's technology suite:

- Charge – A rechargeable subsea battery and power management system delivering reliable, on-demand power for both short- and long-term applications.
- Halo – A modular subsea power system that integrates with marine renewables to provide stable, continuous power.
- Axonn – An intelligent energy management system that autonomously monitors and controls power delivery subsea, ensuring system stability. Axonn is the only system of its kind available in the market.

This announcement coincides with Verlume's participation in the Innovate UK Global Business Innovation Program, an initiative designed to connect UK innovators with Canadian partners in the marine sector. Over a ten-month period working with COVE (Centre for Ocean Ventures and Entrepreneurship, Canada's hub for marine sector innovation), Verlume has built valuable connections with market leaders, potential clients, and partners, gaining deep insights into the Canadian operating landscape.

■ Sonardyne Wins Contract

Sonardyne has been contracted by the Northern Endurance Partnership (NEP), the developer of the onshore and offshore infrastructure needed to transport carbon dioxide (CO_2) from carbon capture projects across Teesside and the Humber—collectively known as the East Coast Cluster—to secure storage under the North Sea. The infrastructure is crucial to achieving net zero in the UK's most carbon intensive industrial regions.

Sonardyne will provide environmental monitoring, in the form of seabed landers, at key locations above and around the subsurface Endurance site—the saline aquifer located 145km off the coast of Teesside where captured CO_2 will be stored.

Monitoring of the site will begin in the summer of 2026 to provide baseline data for a duration of two years before the transportation and storage of captured CO_2 commences. The seabed landers will be equipped with Sonardyne's Edge data processing application, power management and acoustic through-water communications to enable long-term, remote battery-operated deployment. Each lander will also contain a suite of hardware including Sonardyne's Origin 600 ADCP, Wavefront's passive sonar array and multiple third-party sensors. Together, this technology can detect small changes in water chemistry across a wide area, while the data can be harvested, without retrieving the lander, using wireless subsea acoustic communication techniques.

■ Kongsberg Discovery Starts AUV Production in the US

Kongsberg Discovery has decided to start production of HUGIN, an autonomous underwater vehicle, in the U.S. This decision reflects the commitment to supporting the growing demand for advanced subsea technology in the U.S. market.

Kongsberg Discovery have already delivered HUGIN to the U.S. Navy and other organizations within the government, commercial and academic sectors. HUGIN production is planned to start at the existing facility in Lynnwood, Washington, with a possibility for an additional future production site.

To date, there are 12 navies using HUGIN in real-world missions such as Intelligence Preparation of the Operational Environment, Mine Counter Measure, Subsea and Seabed Warfare, and seafloor mapping operations.

■ Kongsberg Discovery

■ MacArtney to Equip N-Sea's Altera CLV Newbuild

MacArtney Offshore Wind Solutions, in collaboration with Subsea Cable Assets (SCA) and Enersea, has secured the contract to design and deliver a fully integrated cable lay spread, a tailored solution for N-Sea's new cable laying vessel (CLV), Altera.

The project will combine MacArtney's advanced mission equipment and control systems, SCA's fabrication and EPCI expertise, and Enersea's deck layout and integration design.

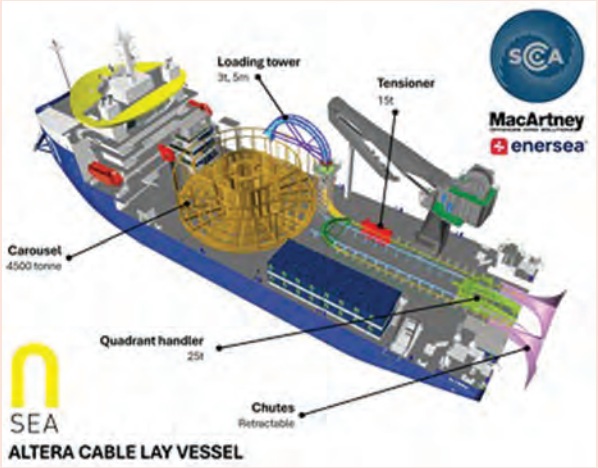
It is expected to result a turnkey system designed to enhance operational efficiency, ensure safety, and enable swift mobilization, customized to meet the demands of offshore wind cable installation and repairs.

The integrated cable lay spread includes a 4,500t carousel, an automated loading tower with integrated tensioner, a 15t tracked deck tensioner, a quadrant and quadrant handling system with sliding banks, cable highways, retractable stern chutes, and a range of winches.

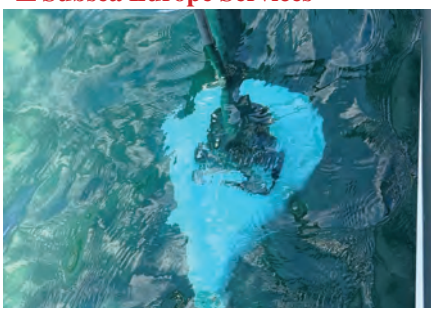
The system is delivered as a complete package, from concept and layout to hardware and execution, backed by a mobilization philosophy designed to avoid disrupting Altera's construction process.

Delivery and mobilization onboard the Altera are planned for Q1 2026.

Altera CLV is being built by Neptune Marine and will transfer to The Netherlands in Q4 2025 for fitting and commissioning in Q2 2026. The DP2 vessel will be dual fuel (methanol) prepared, equipped with a 25t offshore knuckle boom crane, mooring system and can accommodate up to 99 people.



■ Subsea Europe Services



■ ACUA Ocean

■ Deep Ocean Search

■ LR Authorized to Certify Remotely Operated and Unmanned Vessels

Lloyd's Register (LR) has become the first Certifying Authority to receive authorization from the UK Maritime and Coastguard Agency (MCA) to certify remotely operated and unmanned vessels (ROUVs) under the Workboat Code Edition 3 (WBC3) Annex 2.

Under the WBC3 framework, remotely operated and unmanned vessels below 24 meters in length must comply with comprehensive safety and operational requirements and obtain certification through an approved Certifying Authority to operate in UK waters.

Alongside LR's own Unmanned Marine Systems Code, this new authorization enables LR to provide end-to-end certification services for ROUVs, addressing the growing demand for unmanned and autonomous vessel solutions.

■ SES, FLANQ Appointed as Distributor of Voxometer Survey System

Subsea Europe Services, together with its defense division, FLANQ, has been appointed as a mainland Europe distributor for the Voxometer multi-aspect survey system developed by Malta-based R3Vox.

Subsea Europe Services is preparing to take delivery of the most advanced Voxometer-XL system soon, with availability in the company's rental pool anticipated by the end of summer 2025. Its introduction to the European market is expected to improve hydrographic surveying by reducing operational complexities and delivering superior data quality.

The Voxometer is a marine survey system that introduces a new standard for speed, simplicity, and precision in seafloor mapping and data acquisition. As the first smart, agile, and fully automated MA3 Multi Aspect Survey System, it enables faster hydrographic surveys with significantly reduced operational complexity and cost.

Designed for ease of use, the Voxometer delivers near-end quality data directly from the vessel—either crewed or uncrewed. Its ability to capture multiple data types in a single pass, combined with minimal setup and streamlined processing, shortens project timelines and accelerates return on investment.

Under the Voxometer distributor agreement, Subsea Europe Services will promote and represent the system for sales and rental across mainland Europe, focusing on customers in academic research, offshore survey, and geophysical industries. FLANQ will lead engagement with clients in defense, maritime security, and government sectors, ensuring the Voxometer's capabilities are accessible across both civil and strategic applications.

■ ACUA Ocean USV Wins Award

ACUA Ocean is proud to announce that it has been named a winner of Fast Company's 2025 World Changing Ideas Awards. This annual recognition honors bold and transformative efforts that tackle the world's most pressing issues—from sustainability initiatives, robotics and automation and AI developments to pursuits of social equity.

USV PIONEER, developed by ACUA as part of the UK Department for Transport's Clean Maritime Demonstration Competition, delivers enhanced operational capabilities for data collection, logistics and ISR, through the deployment of modular sensor and system payloads. This year's awards showcase 50 winners across 12 categories and 50 additional winners across industries, for a total of 100 projects. A panel of Fast Company editors and reporters selected the winners from a pool of more than 1,500 entries and judged applications based on their impact, sustainability, design, creativity, scalability, and ability to improve society.

■ DEEP SEA VISION – DEEP OCEAN SEARCH Memorandum of Understanding

In conjunction with the launch of its brand-new Mariner XL ROV, Deep Ocean Search (DOS) Ltd entered MoU with the US company Deep Sea Vision (DSV).

DSV is a deep-water survey company using Autonomous Underwater vehicles such as Kongsberg Hugin 6000 able to dive at 6,000msw depth with a track record in the deep ocean space. Through combined efforts to common clients, DSV and DOS can offer AUV+ROV services from the same platform with shared multirole personnel.

With Mariner XL, DOS is offering for hire a 6000msw capable WROV which can be mobilized quickly and easily for rapid deployment anywhere in the world: as a launch & recovery system, an ultra-long range inertial and acoustic positioning system, a pilot station and a store space, all in only 4 x 20' containers. Deployment on board requires no major structural modifications of the support vessel and no calibration. The Argus Mariner XL is a light work-class ROV designed for ultra-deep operations, inspection, sampling, object recovery, imaging and data acquisition.

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