

Smart Subsea Solutions

- intelligent vehicles
- reliable communication
- accurate positioning
- modern sensor networks
- diver navigation systems

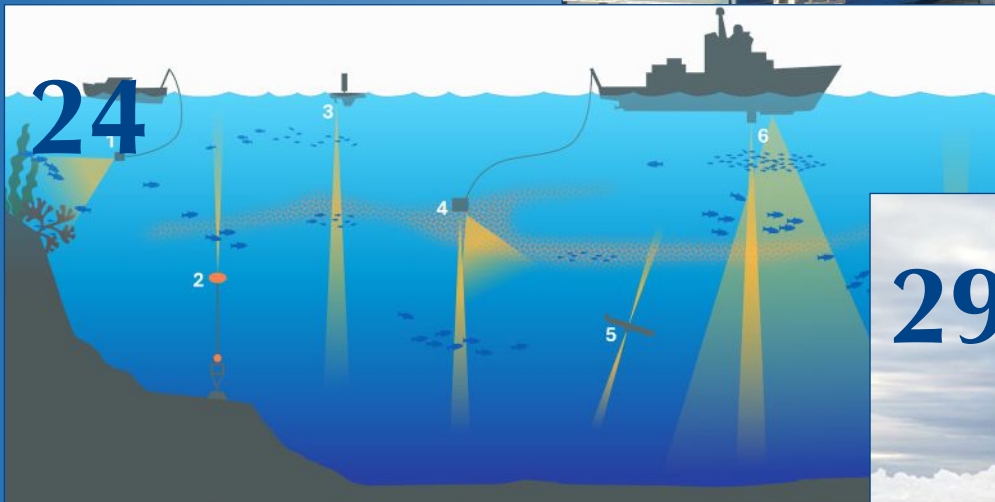
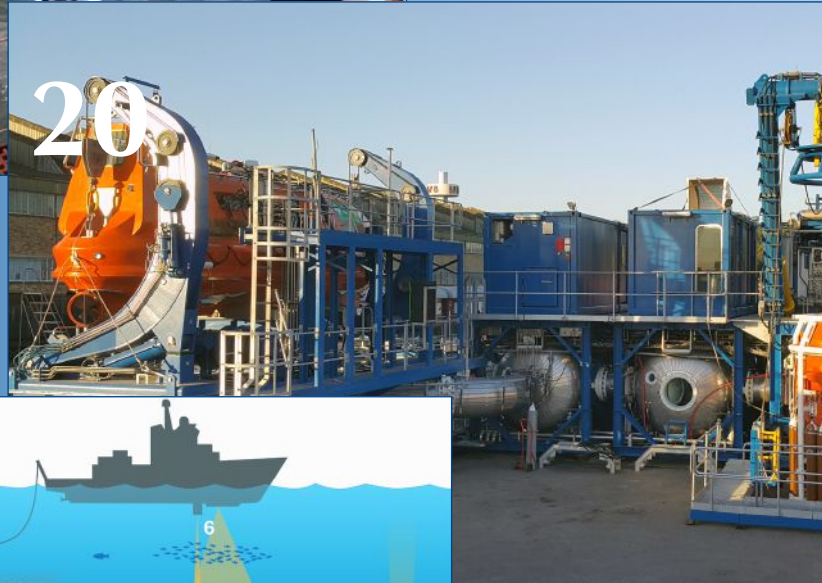
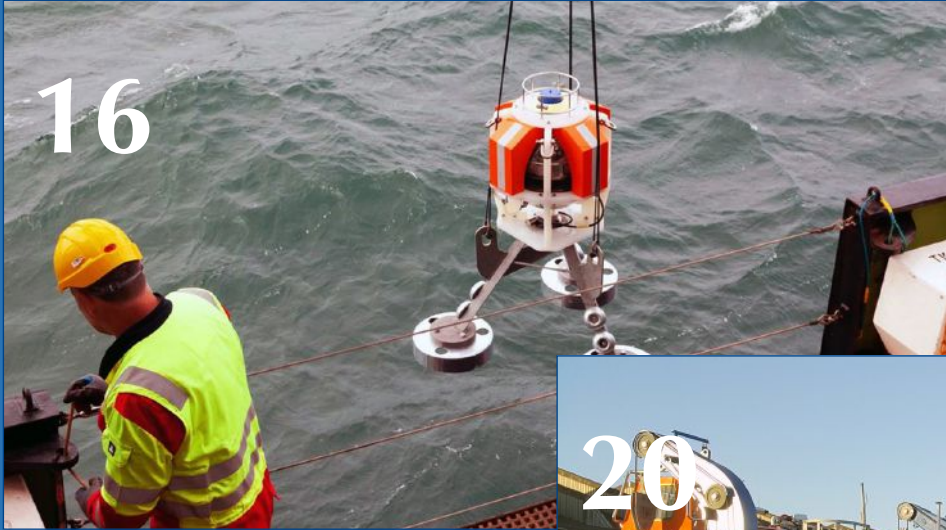
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FEATURES

10

REDEFINING SENSOR DESIGN

Rachel McAlpine (*General Oceans*), Asim Azad (*Tritech*) and Lila Johnson (*Nortek*) discuss the creation of sensors to operate on smaller underwater vehicles.

16

EVOLVING USV ROLES

Mike Poole (*AutoNaut*) explains how small USVs offer decarbonization and monitoring benefits.

20

ENGINEERING INTEGRATED SOLUTIONS

Chris Blake (*Unique Group*) shows how in-house R&D enables wide-ranging and sustainable maritime tech.

24

ACTIVE ACOUSTICS

Dr. Haley Viehman (*Echoview Software*) describes how echosounders can be used for underwater research and monitoring applications.

29

DELIVERING LEO CONNECTIVITY

Timo Biemüller (*Speedcast*) introduces new satellite resources that offer reliable communications for polar expeditions.

DEPARTMENTS

6

Soundings

7

Editorial

32

International

34

Ocean Research

36

Product Development

38

Marine Renewables

39

Marine Electronics

40

Marine Resources

41

People

42

Contracts/Meetings

43

Soapbox

44

Professional Services Directory

45

Advertiser Index

COVER IMAGE

Nortek's Nucleus 1000 navigation sensor combines DVL technology with a pre-synchronized AHRS or INS, equipping small AUVs and ROVs with all the necessary information for navigation and positioning within a single compact package. Image shows a Nucleus 1000 on a Blue Robotics BlueROV in Trondheim, Norway. (Credit: Nortek)

NEXT MONTH

Vessel water, waste management ... Accurate positioning for Panamex vessels ... AI for ship management ... ROVs for port security ... Methanol-to-hydrogen conversion tech for ports.

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)) Apia Ocean Declaration. The Commonwealth Heads of Government Meeting, hosted by Samoa, has resulted in adoption of the Apia Ocean Declaration, which delineates shared priorities for ocean protection and sustainable management. This includes the need to agree on an ambitious, legally binding instrument to end plastic pollution, under negotiation via the UN. Ocean issues such as marine pollution and biodiversity loss are prominent within the Commonwealth, which covers 36 percent of national marine waters globally and accounts for two-thirds of the world's small island developing states. Key aspects of the Apia Ocean Declaration include: recognition of national maritime boundaries in the face of sea level rise protection of at least 30 percent of the ocean and restoring at least 30 percent of degraded marine ecosystems by 2030; urgent finalization of the Global Plastics Treaty; ratification of the Agreement on Marine Biodiversity in Areas Beyond National Jurisdiction (BBNJ Agreement); development and implementation of coastal climate adaptation plans and strategies, including vulnerability assessments and nature-based solutions, such as blue carbon; stepped up support for a sustainable blue economy with sustainable ocean plans, recognizing the need for 100 percent management of national waters (*Sea Technology*, January 2025); reduction of emissions from global maritime shipping; and enhanced marine renewable energy targets to triple global renewable energy capacity, agreed as part of the UNFCCC Global Stocktake in Dubai in 2023.

)) Apply: Career Support for Fishermen. Subject to the availability of funding, the U.S. National Sea Grant Office anticipates approximately \$1,000,000 in fiscal year 2025 federal funds will be available to eligible applicants to support two to three projects that will develop and execute local, regional, and national programs, workshops, and services to enable fishermen to enter career paths and make a living supplying seafood from U.S. oceans, coasts and Great Lakes. Successful projects will create and implement trainings that include the following types of programs, workshops, and services: seamanship, navigation, electronics, and safety; vessel and engine care, maintenance, and repair; sustainable fishing practices; and other training needs as identified by the community. To be eligible to receive a grant under this program, a recipient shall be a collaborative state, tribal, local, or regionally based network or partnership of public or private entities, which may include: a Sea Grant institution; a federal or state agency or a tribal organization; a community-based nongovernmental organization; fishermen's cooperatives or associations; an institution of higher education (including an institution awarding an associate's degree), or a foundation maintained by an institution of higher education; or any other appropriate entity. Applications must be submitted to Grants.gov by April 23, 2025.

)) UNESCO Uses eDNA Method. UNESCO's environmental DNA (eDNA) program has mapped nearly 4,500 marine species across 21 World Heritage sites, providing new key data and a revolutionary method for stronger ocean protection in an era of rapid climate disruption, specifically for the 18,000 marine protected areas around the world. UNESCO makes this technology freely accessible and calls on its member states to support the scientific community for its large-scale use. Over three years, marine experts and local scientists took 500 samples from 21 sites. Nearly half of the identified species were fish, and the others include 86 shark and ray, 28 mammal, and three turtle species. Among the findings were 120 species listed as vulnerable, endangered or critically endangered on the IUCN Red List. The study also determined that, based on the warmest future climate scenario, up to 100 percent of fish species in the tropical and subtropical sites studied would exceed their current thermal limits and be potentially endangered, while 10 to 50 percent of fish species in temperate oceans would exceed their current thermal limits. UNESCO's eDNA program marks the first standardized application of eDNA sampling to monitor the status of marine species among global biodiversity hotspots. With a single 1.5-liter water sample, eDNA techniques can reveal genetic traces of approximately 100 marine species on average, reducing data collection times from years to months. UNESCO's eDNA program is a step toward the Kunming-Montreal Global Biodiversity Framework's "30x30" goal of protecting 30 percent of the world's terrestrial, inland water, and coastal and marine areas by 2030.

)) RFI to Define Sustainable Maritime Fuel. To support and advance future maritime fuel technology and investment, the U.S. Department of Energy (DOE) has released a request for information (RFI) to establish a consistent and reliable definition for sustainable maritime fuel (SMF) that informs and aligns community, industry, governments, and other maritime stakeholders. The Action Plan for Maritime Energy and Emissions Innovation, a summary of which was released in December 2024, builds on the 2023 U.S. National Blueprint for Transportation Decarbonization to define actions that aim to achieve a clean, safe, accessible and affordable U.S. maritime transportation system. The action plan calls for the federal government to define "sustainable maritime fuel," which is critical to evaluating and determining future SMF production volume goals in the action plan and alternative fuels that align with the U.S. 2050 net-emission goals. The RFI also seeks feedback on minimum carbon intensity reductions, sustainability factors, criteria air pollutant inclusion, acceptable feedstocks, global requirements, and emission reduction technologies. RFI submissions must be sent electronically as a Microsoft Word (.docx) attachment to: DefiningSMF@ee.doe.gov by 5 p.m. EST on February 28, 2025. **ST**

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How to Encourage Equity And Inclusion in STEM

I began my STEM career as a recruiter, eventually serving as the director of maritime engineering at an agency. Through the years, I became increasingly aware of the persistent lack of progress in diversity and inclusion within STEM industries. I was particularly concerned by the overwhelming challenges faced by individuals looking to return to STEM roles after a career break. Determined to address this issue, I launched a small pilot "returners" program with BAE Systems, which proved to be a resounding success.

Building on this achievement, I expanded the initiative into what is now STEM Returners, an organization that has helped more than 500 individuals restart their STEM careers. Since 2017, STEM Returners has been at the forefront of promoting equity, inclusivity and diversity in the STEM sector. Our mission is to provide these professionals with a supported pathway back to work, ensuring their valuable expertise is not lost.

Through our flagship STEM Returners Programme, partnering organizations offer paid, short-term placements that help professionals confidently reintegrate into the workforce. These placements are designed to provide returners with the support they need to transition back into their careers while helping employers access an untapped talent pool.

STEM Returners serves a dual purpose. We offer life-changing opportunities for individuals facing barriers to re-entering the workforce while also reshaping the broader STEM industry by championing diversity and inclusion.

The need for our work is critical, as the STEM sector continues to struggle with a lack of diversity. Only 10.9 percent of professional engineering roles are held by women (www.wisecampaign.org.uk/statistics-round-up-2024), and just 9 percent of STEM professionals come from minority ethnic groups (www.afbe.org.uk/Home/About). In contrast, our STEM returners are 46 percent women and 34 percent from minority ethnic backgrounds, proving that, with the right support, a more diverse workforce is achievable.

Our initiatives go beyond compliance, aiming to foster a culture of equity and respect. By addressing unconscious bias in traditional recruitment processes and highlighting the unique value returners bring, we have made strides in reshaping the industry and promoting a more inclusive community.

In 2024, we celebrated a major milestone: helping our 500th returner re-enter the STEM workforce. This achievement underscores the ongoing demand for returner programs. We also launched an initiative in partnership with the Global Underwater Hub and the Engineering Construction Industry Training Board in the U.K. to address skills gaps and promote diversity and inclusion in the underwater sectors, offering proof of concept for others in the industry to follow. Our STEM Returners Index 2024 continues to provide critical insights into the barriers faced by returners (www.stemreturners.com/the-stem-returners-index-2024). The data from this annual index can help shape industry practices and influence government policies to catalyze systemic change in STEM.

As we look ahead, our focus remains on expanding our impact and reach. We continue to refine our programs, ensuring they meet the evolving needs of returners and the industry. Key to our strategy is working closely with organizations to combat unconscious bias, improve recruitment practices and promote equitable opportunities.

STEM Returners is about more than filling job roles—it's about driving meaningful, enduring change in the industry. We are excited to continue to break down workforce barriers. Learn more at: www.stemreturners.com. **ST**

SEA TECHNOLOGY® 2025

JANUARY

Annual Review & Forecast

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

***Undersea Defense Technology (UDT), March 25-27, Oslo, Norway*

MARCH

Electronic Charting/Vessel Management/
Ports & Harbors/Dredging/Homeland Security

***Ocean Business, April 8-10, Southampton, U.K.*

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

***MAST AUKUS (USA), May (dates TBD), Waikiki, Hawaii*

MAY

Communications, Telemetry, Data Processing

***OCEANS 2025 Brest, June 16-19, Brest, France*

JUNE

Seafloor Mapping/Sonar Systems/Vessels

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BONUS INFORMATION

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Editorial Calendar

ADVERTISING CLOSES ON THE 15TH OF THE MONTH PRECEDING ISSUE DATE

JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

****IMAGE 2025**, August 24-29, Houston, Texas

AUGUST

Ocean Resources Development & Coastal Zone Management

****MAST AUKUS (UK)**, September (dates TBD), Glasgow, U.K.

****OCEANS 2025 Great Lakes**, September 29-October 2,
Navy Pier, Chicago, Illinois

SEPTEMBER

Geophysical Exploration/Seafloor Engineering

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

****CLEAN GULF**, November 18-20, New Orleans, Louisiana

****Offshore Energy**, November 25-26, Amsterdam, The Netherlands

NOVEMBER

Undersea Defense/Antisubmarine Warfare

****International WorkBoat Show**, December 3-5, New Orleans, Louisiana

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of Serving the Global Ocean Community

Redefining Sensor Design

Creating Sensors to Operate on Smaller Underwater Vehicles

By Rachel McAlpine • Lila Johnson • Asim Azad

Established in 2021 with a commitment to innovation, collaboration and a pioneering vision, the General Oceans group has rapidly become a driving force in the underwater technology industry. Comprising six operating companies—Nortek, Tritech International Ltd., Klein Marine Systems, Reach Robotics, Strategic Robotic Systems and, most recently, RS Aqua—General Oceans is at the forefront of developing cutting-edge solutions that push the boundaries of subsea exploration and sensing.

In this article, we highlight the latest technologies

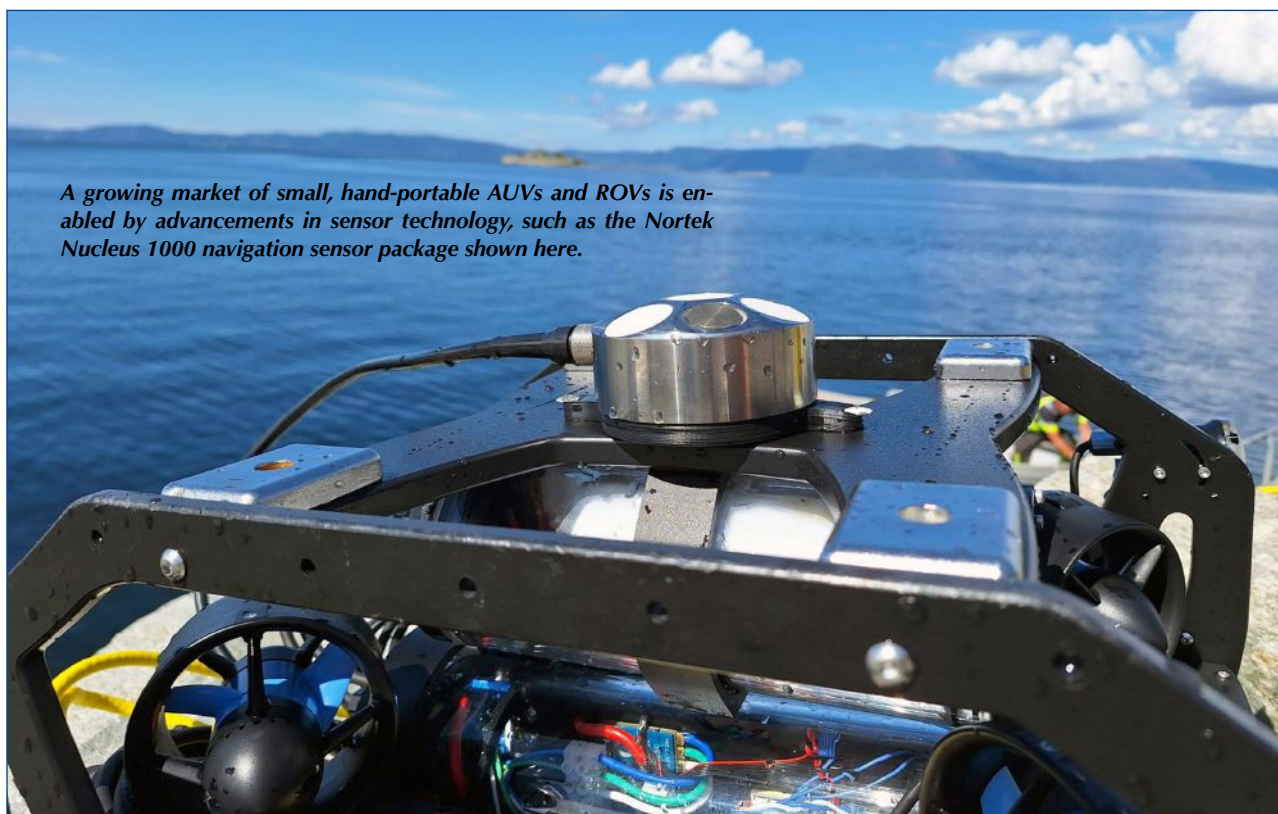
from Nortek and Tritech that are shaping the future of the industry.

Growing Low-Cost Vehicle Market

The world of subsea vehicles has changed rapidly over the last few years. While large work-class ROVs still dominate larger and more specialized subsea operations, a new market of small, easy-to-operate AUVs and ROVs has exploded.

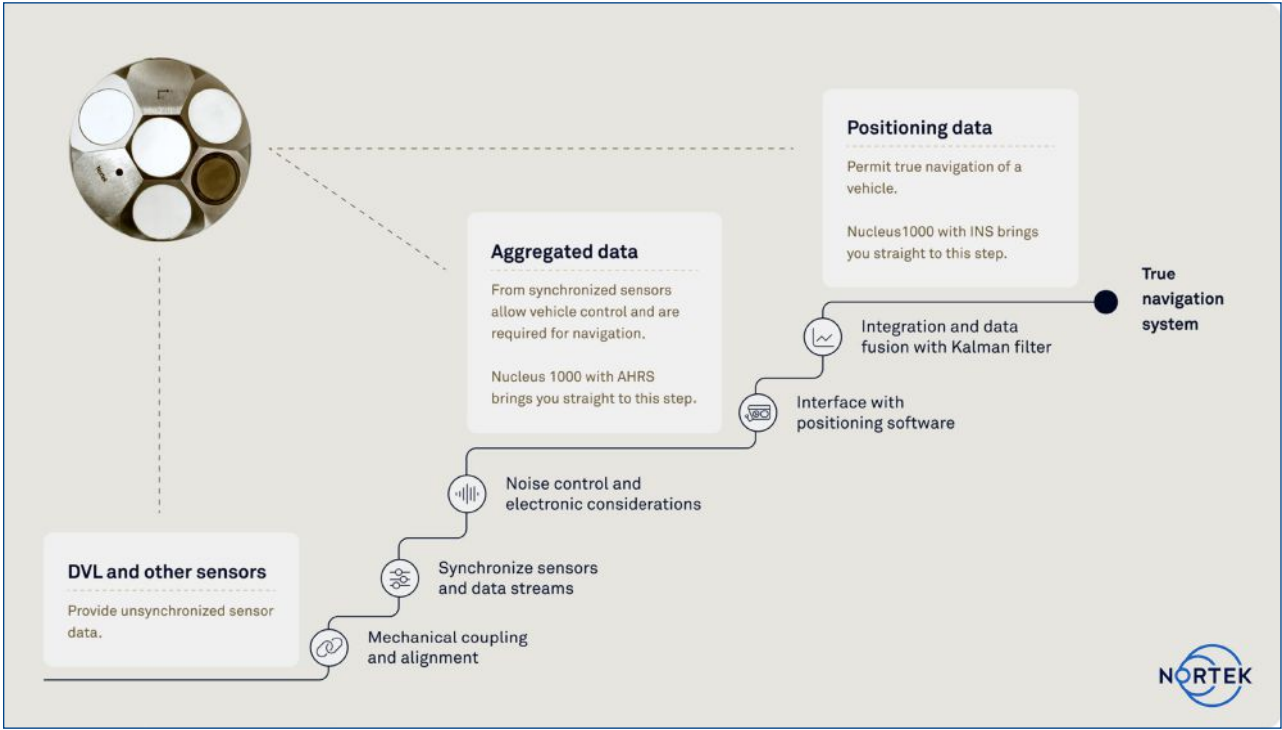
The growth in availability of these smaller and ev-

A growing market of small, hand-portable AUVs and ROVs is enabled by advancements in sensor technology, such as the Nortek Nucleus 1000 navigation sensor package shown here.





(Top) The Nucleus 1000 is about the size of a can of tuna, ideal for very small AUVs or ROVs. (Bottom) This diagram shows some of the key steps associated with creating a subsea navigation system. The Nucleus sensor package brings together multiple data streams, removing some of the integration work typically required.



er-more-capable vehicles would not be possible without advancements in sensor technology. One of the key sensor elements that has previously limited these small vehicles from performing at a high level was the lack of a compact and affordable navigation system option. Now, advanced navigation sensor technology makes it possible for even small vehicles to be equipped with a single sensor that collects all the necessary data to navigate underwater.

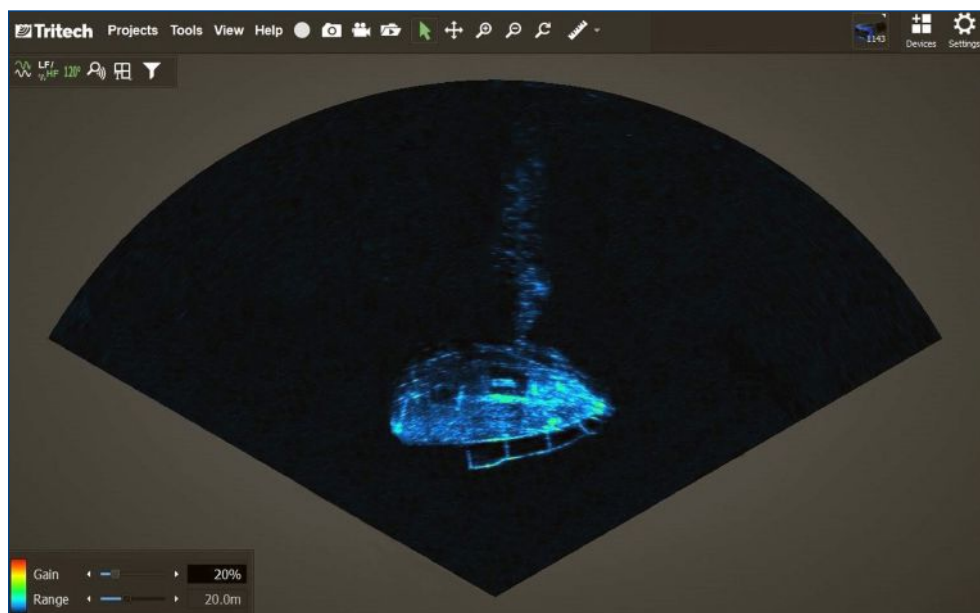
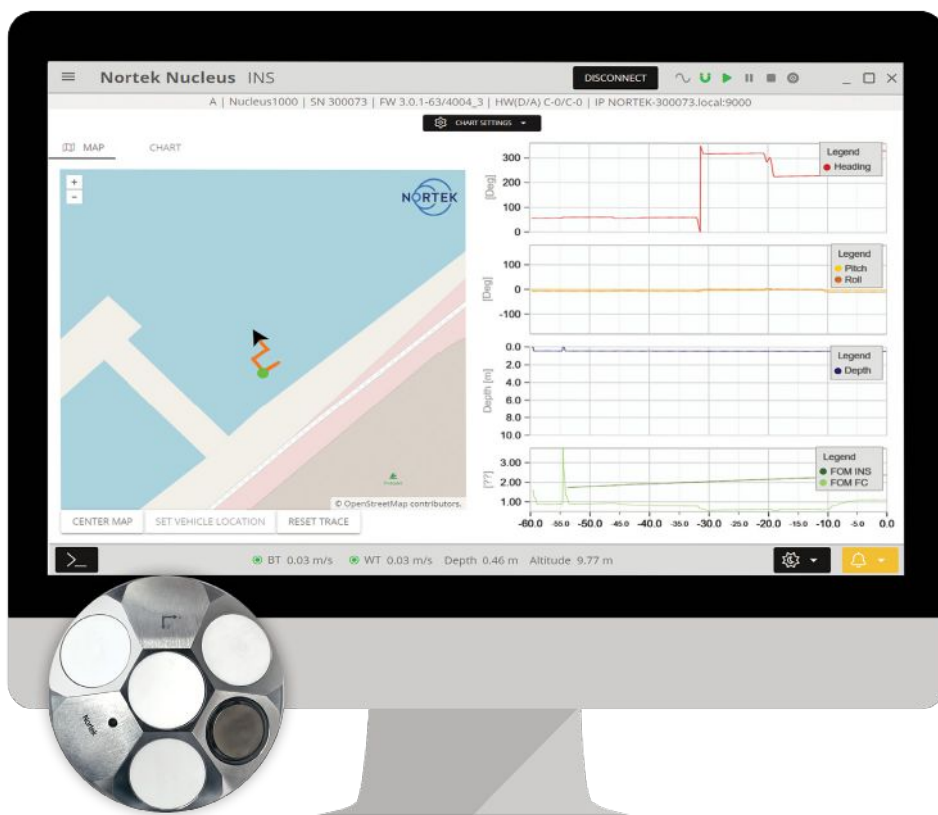
Subsea Navigation Systems

In many cases, a subsea navigation system comprises a Doppler velocity log (DVL) for speed over ground and an inertial navigation system (INS) for directional

information, or a similar combination. However, these sensors have historically been prohibitively expensive and too big to be considered for smaller vehicles, not to mention the complex integration requirements associated with this type of navigation system.

These limitations meant that navigation systems on small AUVs or ROVs were either foregone or limited. This in turn meant that small vehicles were limited in the types of jobs they could do; without a reliable navigation system, certain tasks were out of the question, especially autonomous tasks without input from an operator. Even station-keeping is a challenge without a reliable positioning sensor.

The advent of newer and, importantly, smaller DVL



(Top) The Nucleus 1000 shows a vehicle's location on a map in real time, requiring only an initial GPS input. (Bottom) Tritech Gemini 1200id (see page 14): Air bubbles from divers escaping from a hatch on a wreck.

technology has now opened doors for these types of vehicles to perform missions that they could not do previously. These vehicles typically don't require the same level of survey-grade accuracy required by work-class

ROVs but still greatly benefit from navigational sensors. Nortek's Nucleus 1000 is one example of a sensor suite that provides navigational capabilities to these small AUVs and ROVs. The Nucleus offers the additional benefit of being a combined sensor suite that offers DVL and INS (or attitude and heading reference system, AHRS) information in one small package.

Benefits of a Combined DVL/INS Sensor Suite

While, on its own, DVL technology getting smaller creates possibilities for small vehicles, a DVL alone does not enable these vehicles to navigate. The Nortek Nucle-

The Tritech Gemini 1200id multibeam sonar is ideal for work-class ROVs. It has an operating depth down to 4,000 m (see page 14).



us 1000 is unique in that it offers both DVL functionality and a pre-synchronized AHRS or INS. This alleviates the need for multiple sensors and reduces the amount of integration required to achieve navigation underwater.

In addition to providing a dedicated INS data stream, the Nucleus software shows a vehicle's location in real time on a map using inputs from the sensors and navigation algorithms.

Users can now add a source of basic positioning to their vehicle without substantial time, cost and payload demands. The Nucleus only needs to be provided with a GPS position to begin navigating using absolute positioning.

Providing Earth-referenced position to a vehicle control system means that users who need to know where they are, where they've been and where they're going now have a pre-configured, pre-synchronized navigation package.

Additional Sensor Capabilities

Payload demands are one of the biggest limiting factors on adding sensors to small ROVs and AUVs, so combined sensor suites such as the Nucleus aim to provide as much information as possible without requiring additional space or power from the vehicle.

The ability to collect current profiles, for example, is beneficial for several applications. If the environment the vehicle is being deployed has currents whose strength exceed the capacity of the vehicle, then an operator can deploy the vehicle at the surface to take a current profile. Scientific applications often require current profile information, which can be collected from the same sensor that the vehicle uses to navigate. Collecting current profiles is also beneficial as a safety check before sending divers into the water.

The Nucleus also has a dedicated altimeter beam, which can take a direct measurement of the distance to the seafloor, and has dedicated temperature and pressure data streams as well.

Reliable Sensors for Autonomy

As the subsea vehicle industry continues to grow, many vehicle manufacturers and users are pushing the limits of what vehicles can do without intervention from a pilot or other operator. This increase in autonomous operations means that onboard sensors must become increasingly reliable.

While small sensors such as the Nucleus may not have the same long-term accuracy required by larger work-class vehicles, having a compact, reliable and multifunctional navigation sensor suite on board small vehicles makes a world of difference in the ability to perform autonomous functions.

Even if vehicle autonomy is not the end-goal of a user, having reliable and easy-to-use equipment enables crew members of any experience level to launch and operate small vehicles for inspections or other applications. Station-keeping, operating at a constant depth, or navigating to waypoints in unfamiliar terrain all require data from sensors such as the Nucleus.

Case Study

When the French AUV company RTsys required a sensor for its NemoSens micro-AUV that would not only contribute to vehicle navigation but also collect current profiles for a dredging application, Nortek's compact Nucleus 1000 sensor fit the small footprint required for the application.

RTsys worked together with Nortek's support team on the integration of the sensor. The Nucleus on board the

NemoSens was used to navigate the AUV and collect current profiles in an area near the dredging operations, with the goal of characterizing the movement of the sediment plume.

Gemini 1200id Sonar

The Gemini 1200id is the latest addition to Trittech's multibeam sonar portfolio, targeted specifically at work-class ROVs and other applications where reliability is of the utmost importance. Based on the industry standard Gemini 720is platform, the Gemini 1200id employs a mechanical design that is tried and tested in the harshest of subsea environments and offers a degree of redundancy by design not afforded by any other platform. The sonar has been developed largely in response to requests from existing customers who regularly operate the Gemini 720is to depths as low as 4,000 m.

In addition to the 720-kHz acoustic frequency offered by the Gemini 720is, the Gemini 1200id introduces dual-frequency operation with the addition of a new 1.2-MHz acoustic operating frequency, which improves angular resolution from 1 to 0.6° and range resolution from 4 to 2.4 mm, resulting in a significant improvement in imaging resolution.

Gemini 1200id Design

The introduction of the 1.2-MHz acoustic operating frequency to the Gemini 1200id necessitated a redesign of the analog front-end electronics to handle the higher sampling rate requirements of the new higher-frequency mode of operation. Rather than taking the easier and cheaper route of transitioning over to single-ended analog front-end integrated circuits developed for ultrasound applications as typically used by the majority of other multibeam sonars, the Gemini 1200id continues to employ an in-house developed analog front-end solution that incorporates fully differential receiver channels consisting of discrete low-noise amplifiers, discrete variable gain amplifiers, second-order bandpass filters, and discrete high-speed, high-resolution serial ADCs (analog-to-digital converters).

This custom analog front-end solution enables the receiver to be optimized for longer-range sonar applications, rather than shorter-range medical ultrasound applications that primarily drive the development of ultrasound analog front-end integrated circuits, due to the relatively larger volumes involved. As a result of its superior analog front-end tailored for sonar applications, the Gemini 1200id has a dynamic range twice as wide as its nearest competitor.

The electronic circuits within the Gemini 1200id have also been optimized. Additional filtering is exclusively employed to minimize self-generated noise around the two acoustic operating frequencies, resulting in significant reductions in unwanted artifacts that can appear in the sonar image. The Gemini 1200id also actively attenuates external waterborne noise from other subsea equipment in the vicinity of the sonar, including from the likes of ROV thrusters, which have a tendency to generate relatively large levels of electromagnetic interference.

By pushing self-generated electrical noise away from the acoustic operating frequencies, and by actively attenuating external waterborne electromagnetic interference, the Gemini 1200id offers welcomed improvements in signal-to-noise ratio (SNR).

The wide dynamic range and enhanced SNR of the Gemini 1200id enable it to produce sonar images displaying sharp and bright acoustic returns on a noise-reduced dark background, resulting in crisp sonar images of excellent clarity.

A flight-time sensor operating at 1 MHz and integrated into the side of the Gemini 1200id measures the speed of sound in the water immediately around the sonar at the time of acoustic reception to ensure that observed targets are displayed accurately for position and size.

All auxiliary port features supported on the Gemini 720is are also supported by the Gemini 1200id, and the depth rating of 4,000 m is maintained, ensuring that the Gemini 1200id offers a direct upgrade path for customers who until now have been reluctant to consider anything beyond their trusted Gemini 720is sonars for mission-critical operations.

The Gemini 1200id can be controlled using either Genesis or software development kits that support integration into third-party applications. Genesis is Trittech's latest all-in-one software package for controlling, displaying and recording data from its portfolio of sensors. It boasts a modern, dynamic and easy-to-use interface with a comprehensive suite of integrated features.

To allow the Gemini 1200id to share bandwidth with other equipment and sensors that may be present on an existing or shared network connection, the data bandwidth consumed by the sonar can be limited by capping the ping rate, reducing resolution, or enabling data compression.

Every Gemini 1200id sonar that rolls off the production line is subjected to a strict factory acceptance testing regime to guarantee quality and performance. As part of this testing, every function of the sonar is verified and additional tests at pressure limits conducted to confirm operation under extreme conditions. The design of the sonar is qualified to ensure reliability against shock and vibration, corrosion, and for compliance against relevant electromagnetic compatibility (EMC) regulations.

The Role of Small Sensors

The subsea industry is growing quickly. Vehicle manufacturers rely on sensor innovation to bring their vehicles into harsh environments, perform complex tasks and reduce the need for divers in dangerous situations. Sensors such as the Nucleus and Gemini 1200id sonar are just one piece of a much larger puzzle that enables these innovations, and sensor technology will continue to evolve as the needs of the subsea operations market change. **ST**

Rachel McAlpine is the group marketing manager at General Oceans.

Lila Johnson is a marketing specialist at Nortek.

Asim Azad is the hardware engineering manager at Trittech International.

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Evolving USV Roles

Small USVs Offer Decarbonization, Monitoring Benefits

By Mike Poole

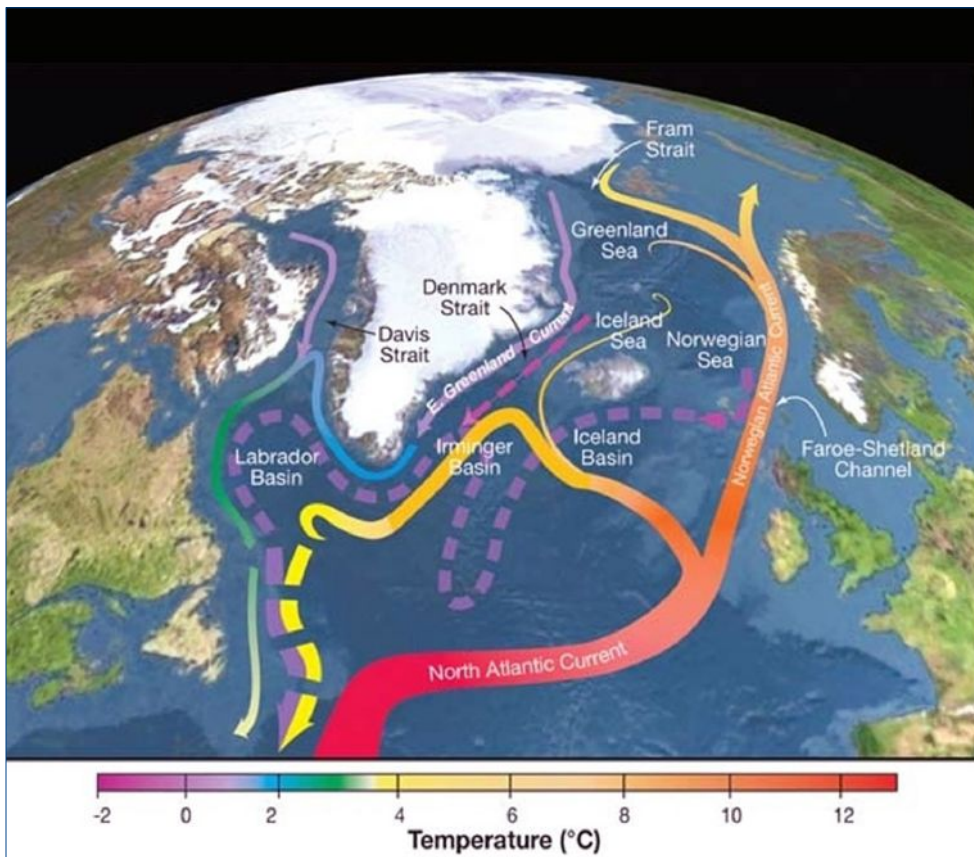
The autonomous vessel kaleidoscope is incorporating a changing focus as regulators step in. There's more to come, which makes this a good time to illustrate tech advancements and their relationship to the regulatory landscape, with two recent examples of small USVs.

In this article, we report on the wave-propelled AutoNaut's recent zero-carbon demo mission to collect a year's worth of data from a sensor moored 1,800-m deep

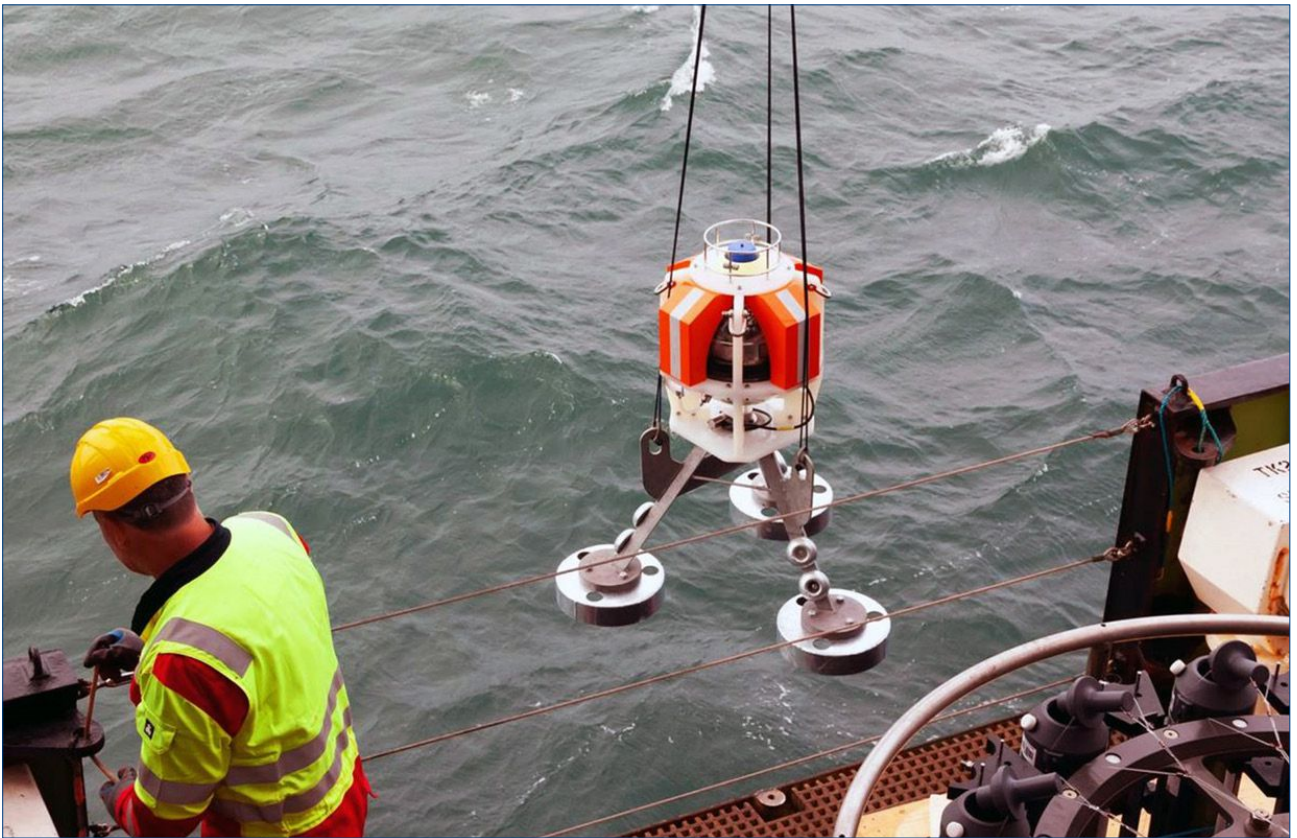
in the Rockall Trough and whiz it ashore via satellite in real time—then go back and allow scientists ashore to remotely recalibrate the moored sensor. A first, and all without needing a mothership.

We also report on a fleet of small AutoNaut USVs being used to improve hurricane forecasting, potentially saving thousands of lives.

It is important such benefits of new technology are



The speed and strength of the Atlantic circulatory currents (Atlantic Meridional Overturning Circulation, or AMOC) affect the Earth's climate. Small USVs such as AutoNaut can help gather data to monitor climate over time.

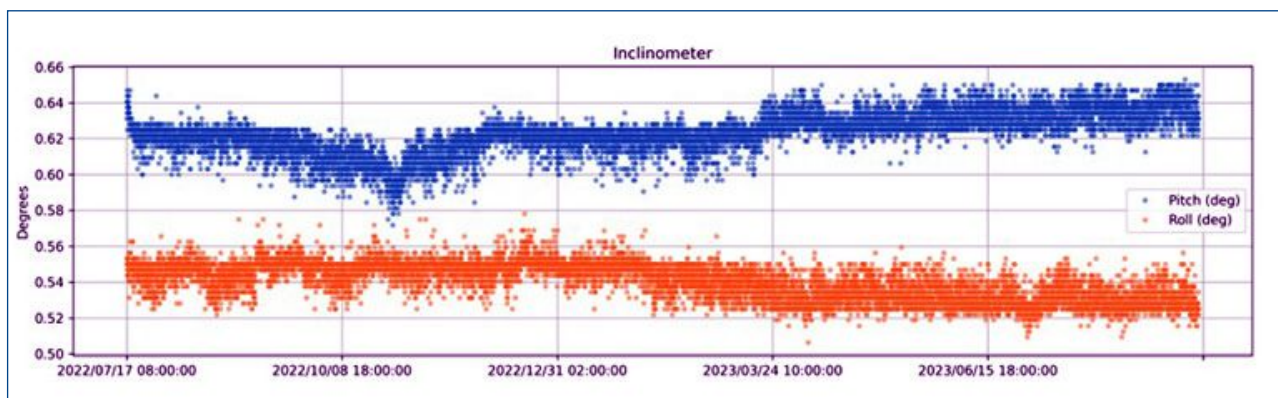
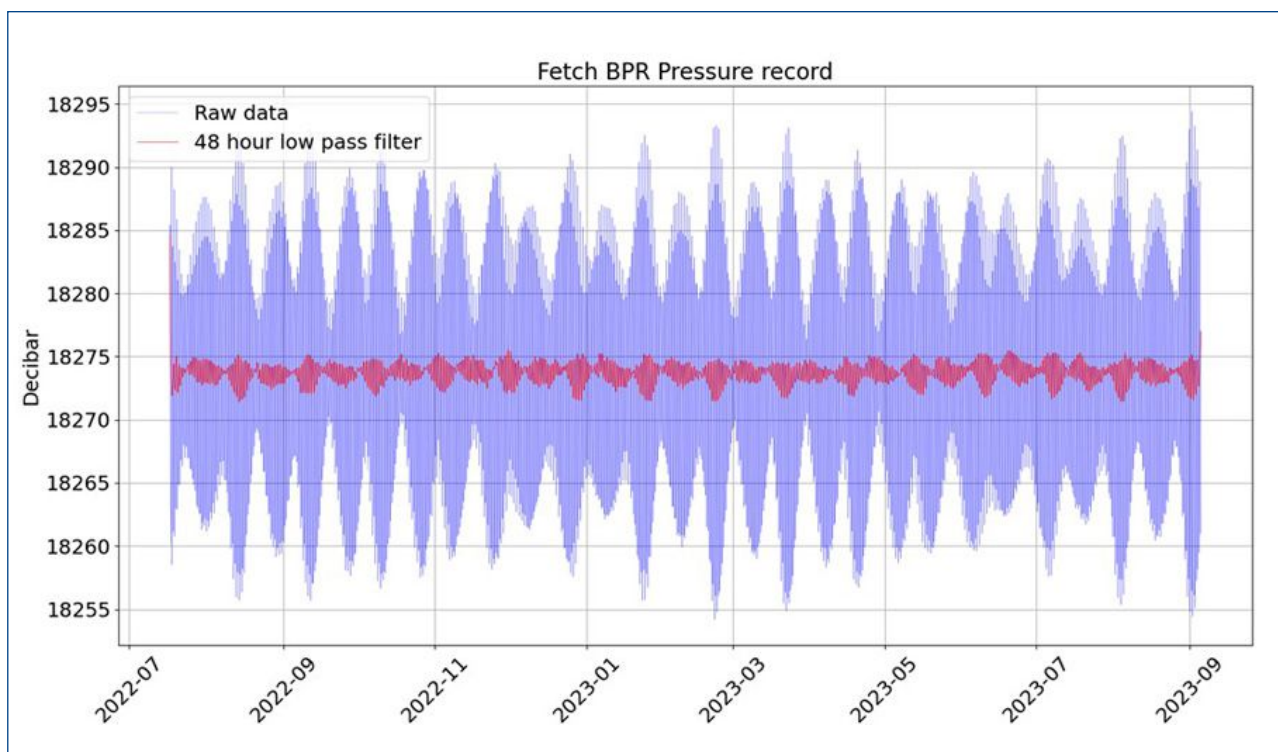


(Top) A Sonardyne Fetch BPR was moored at 1,800-m depth in the Rockall Trough. (Credit: Ben Moat, U.K. National Oceanography Centre) (Bottom) AutoNaut being prepared for launch. A Sonardyne HPT 3000 acoustic transceiver for through-water communication is mounted centrally, below the hull. The Thales VesseLINK 700/Iridium Certus satellite enabled scientists ashore to control the transceiver remotely. (Credit: Scottish Association for Marine Science, SAMS)

factored into the thinking about new regulation because the world is also evolving in response to climate change. The U.K. Maritime and Coastguard Agency (MCA) aims to become “world leading” in developing regulation for autonomous vessels. The International Maritime Organization (IMO) is wrestling with the same regulation issue,

but on a global scale, with a mandatory code expected in 2032.

It is not easy. Clearly, regulation is essential for a future that promises 40,000-ton freighters doing 18 kt. with no sailors on board. Technology hares ahead, while regulation goes carefully, carrying a shell comprising 250



An example of readings from AutoNaut sensors for pressure and inclinometer. Data were recorded at 1-hr. intervals.

years or more of maritime regulation that stretches back to square riggers.

It is not just new technology that needs splicing into this long-established framework. We need to look forward at our changing world by encouraging the benefits that uncrewed and autonomous vessels can bring to solving today and tomorrow's problems and helping regulators work out how to de-risk autonomy. Climate change means we need to factor in sustainability, including phasing out fossil fuel-powered research ships.

Zero-Carbon Operation

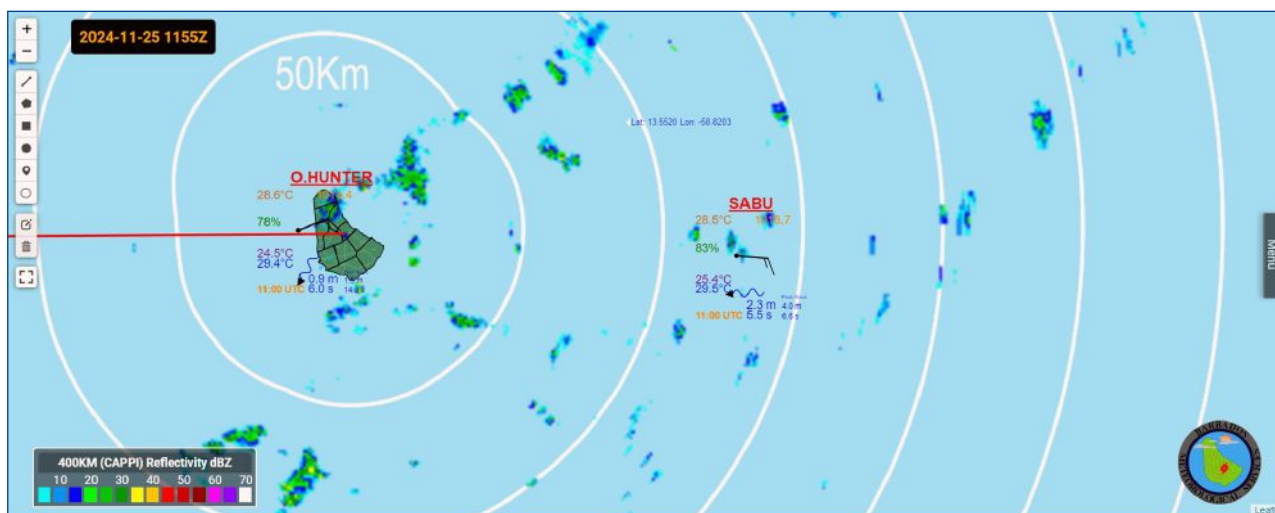
Propelled by waves, AutoNauts are zero carbon in operation. Working with the Scottish Association for Ma-

rine Science (SAMS), and funded by the U.K. Natural Environment Research Council (NERC) through the Future Marine Research Infrastructure program, a 5-m AutoNaut was sent from the Isle of Mull on the west coast of Scotland out into the Atlantic to the Rockall Trough. There, it gathered data from a sensor moored 1,800-m deep, a Sonardyne Fetch bottom pressure recorder (BPR). The sensor mooring is designed to last 10 years, and the data are needed frequently, with a role to play by USVs.

There are hundreds of ocean floor sensors that could be tapped with this method, along the Mid-Atlantic Ridge and in other oceans. If we are to begin to deal with the results of anthropogenic climate change, it is vital we monitor changes to ocean currents that determine the weather patterns of Europe and the rest of the world. Ideally, we will do so sustainably, looking beyond the usual preoccupation with lowest cost.

Monitoring Extreme Weather

Replacing manned, diesel-guzzling ships with USVs for the jobs that are dangerous, dirty and difficult is prov-



An example from BMS radar that depicts two AutoNauts at sea, Ocean Hunter and Sabu, and the data they transmit in real time (www.barbadosweather.org/Radars/LeafScripts/BMSRadarProducts.php).

ing valuable. As recent weather events around the world demonstrate, tropical storms are becoming more extreme. The effects of climate change are causing increasing worry, due to the snail's pace of change in reducing CO2 emissions and our politicians acting too slowly (or not acting at all).

Barbados Meteorological Services (BMS) operates a fleet of four AutoNaut USVs that provide data to improve forecasting of the direction, speed and strength of incoming hurricanes. Two more USVs are in build.

The benefits of using USVs in a "hurricane watch" role should be factored into the new world of autonomous vessel regulation. A primary benefit is saving lives. Economic savings also flow from better early warning to agriculture and other industries and for protection of infrastructure. Crews are not put at risk when using USVs to monitor a hurricane, and USVs can capture accurate data on storm intensity (e.g., surface pressure, subsurface water temperatures, wind speed, humidity, dew point and wave data). Budgets tend to be limited, and small USVs that are easy to launch and operate can provide affordable data. USVs such as AutoNauts offer very long endurance, which allows for improved data sets and, thus, better forecasting.

Aligning Tech Development with Regulations

While all these benefits might make using small USVs a no-brainer, there are several key issues that currently prevent small USVs from fulfilling their market potential because of a mismatch with existing regulations, such as COLREGs.

One is stability: For radar and cameras to be useful,

you need "height of eye," which necessitates one or more masts, with kit on them, all of which are vulnerable in a storm. Windage is another; speed is not important for the "hurricane watch" role, but survival is. An AutoNaut sized at 5 m, and other small USVs, will inevitably pitch-pole and capsize when breaking wave crests are higher than the boat is long. Self-righting must be part of the design, and all the kit aloft will need to be balanced by ballast.

Power is another consideration for regulatory compliance. Long-term power is needed for the sensors, satellite communication, command and control, bilge pumps, AIS, etc. For very long endurance vessels, energy must be harvested on the fly, by photovoltaic panels or other means. Even new alternative fuel solutions provide limited endurance relative to the size of the fuel tank. Other factors to consider are areas of operation and traffic density, degrees of autonomy, and scaling risk against potential benefits, such as lives saved.

In the coming years, regulators will work their way toward solutions, with the help of the embryonic industry, just as regulations evolved for the aerial drone industry as it moved into consumer markets. Another test in the coming years will be to find ways to allow new autonomous technologies to be tested at sea without regulation stifling progress. **ST**

Mike Poole is the founding director of AutoNaut Ltd.



Engineering Integrated Solutions

In-House R&D Enables Wide-Ranging, Sustainable Maritime Tech

By Chris Blake

In 1993, Unique Group started its operations by providing survey equipment for the Middle East oil and gas market. Over time, the company has become a one-stop-shop solution provider for the wider energy, subsea and offshore markets. What started in a small garage in the United Arab Emirates has developed into a global powerhouse, employing more than 650 professionals spread across 18 locations worldwide. Unique Group supports clients wherever their projects take them, ensuring seam-

less delivery of products and services around the world.

Unique Group has six core divisions: USVs, survey equipment, buoyancy and water weights (for load testing), diving and life support, lifting and mooring, and bespoke engineering. The company offers a comprehensive range of solutions by partnering with leading industry manufacturers, such as Kongsberg, Sonardyne, Saab, Nortek, R2Sonic and many more, to provide state-of-the-art survey products. Additionally, Unique Group has



Unique Group has a diving and life support division, which manufactured and delivered this DNV-classed, 12-person, 300-msw-rated, customized saturation diving system.

Unique Group's fleet of USVs, from left to right: Uni-Max, Uni-Pact and Uni-Mini.



ventured into manufacturing its own flagship products to deliver custom, high-quality solutions tailored to clients' needs.

Pioneering Tech

Unique Group's survey technologies are designed to enhance accuracy, efficiency, and ease of use for oceanographers, hydrographers, and surveyors. Unique Group's R&D team, comprising more than 200 engineering specialists, has pioneered transformative products, such as Aquila Subsea, the industry's first AI-powered chat solution, developed to reduce downtime due to delays in technical troubleshooting and to enhance operational efficiency in marine surveys.

The Uni-Counter system is another example. It provides reliable and accurate cable measurements for oceanographers, hydrographers, and surveyors working with side scan tow fish, magnetometers, ROVs, and other equipment.

The Uni-Mesh telemetry system, a complementary product to autonomous survey vessels and other subsea operations, supports long-range mesh radio operations, offering a radio range of up to 12 km. This solution enables seamless data exchange in fluid, self-forming, self-healing mesh networks, simplifying frequency management and increasing data reliability.

The electric Uni-Winch CEW500 boasts a compact design that saves deck space, making it ideal for smaller survey vessels. It is capable of handling a wide range of oceanographic equipment, including towed side scan and magnetometer systems, sub-bottom profilers, and water samplers. Its precision

variable-frequency drive system ensures smooth and controlled cable handling, and its rugged construction ensures reliability in extreme offshore conditions.

The Uni-PPS/NMEA Distribution Box ensures seamless time synchronization across multiple systems, including acoustic and logging devices, significantly improving data accuracy in hydrographic surveys. This versatility supports a range of applications, making it an indispensable tool in the marine surveying toolkit.

The Uni-FlowX Controlled Mass Flow Excavation system significantly enhances seabed excavation. By eliminating physical contact with the seabed, Uni-FlowX reduces risk, improves efficiency, and delivers unparalleled performance. This system recently played a crucial role in completing two complex cable trenching projects in Malaysia, overcoming challenging weather and seabed conditions.

USV Fleet

The in-house innovation at Unique Group is clearly showcased in the Uni-USV fleet. These unmanned surface vessels were designed to meet the growing demand for efficient, cost-effective, shallow-water survey and monitoring solutions. Combining flexibility, performance and cutting-edge design, the Uni-USV fleet offers a range of vessels tailored for different operational needs.

The fleet offers three distinct models: the Uni-Mini, Uni-Pact and Uni-Max. The Uni-Mini, weighing just 65 kg and constructed from durable carbon fiber, is lightweight, portable, and fully electric, making it an ideal solution for confined and shallow-water environments. The Uni-Pact, which is compact, versatile, and fast, offers exceptional stability and maneuverability for missions requiring rapid deployment. The Uni-Max is a hybrid vessel designed for more demanding missions, built for endurance with two powerful Torqeedo Cruise engines, providing extended range and payload capacity for large-scale operations.

Each model offers customizable payload options that can accommodate various sensors and equipment. These features enable clients to tailor each vessel to specific project requirements, ensuring the fleet remains adaptable for a wide range of marine and subsea applications,





Unique Group's Uni-Mesh telemetry system in use for a project in the United Arab Emirates. It supports long-range mesh radio operations, offering a range of up to 12 km.

such as seabed mapping, environmental monitoring, and coastal surveys.

Coastal Survey with Uni-Pact USV

In a recent project, a client required high-resolution topographic and bathymetric data to assess coastal erosion and guide the construction of breakwaters in Singapore. This challenging mission had to balance precision with minimal environmental disruption, while navigating complex tidal conditions and maritime restrictions.

Unique Group deployed the Uni-Pact USV, outfitted with LiDAR sensors and multibeam echosounders. The vessel's autonomous navigation capabilities allowed for efficient data collection across the survey grid, while real-time telemetry enabled immediate adjustments. Despite logistical constraints, the Uni-Pact completed the survey within the client's strict timeline. The resulting data were processed into 3D models, providing actionable insights into erosion patterns and aiding in strategic decision making.

The project demonstrated the efficiency and precision of the Uni-Pact. Its electric engines minimized noise and environmental disruption, aligning with the client's sustainability goals.

Uni-Pact USV Bathymetry Survey

Another recent project by Unique Group was a recent bathymetry survey using the Uni-Pact USV to provide MMA Offshore with precise depth data around Fremantle Sailing Club's wharfs, berths, and jetties, as well as for the entry to Fremantle Fishing Boat Harbour in Australia.

Despite challenges such as strong winds and heavy maritime traffic, the project was efficiently completed through meticulous planning and advanced technology. Equipped with NORBIT iWBMS sonar and Valeport SWiFT SVP (sound velocity profiler) systems, the Uni-Pact collected accurate data while being remotely operated from multiple locations.

The environmentally friendly, electric-powered USV demonstrated its versatility, autonomy, and ease of deployment, supported by expert technical guidance and a hot-swap battery system that minimized downtime. The client praised the efficient delivery and high-quality data, which will inform safe navigation and operational planning.

Environmental Monitoring

In Oman, Unique Group has provided a solar-powered oil spill detection radar system for a coastal client. This system, which includes advanced sensors, solar panels, and online alerting capabilities, was designed to detect oil spills early, minimizing environmental damage and associated costs.

Similarly, in Saudi Arabia, Unique Group deployed a buoy-based oceanographic and meteorological system to monitor water quality, currents, and wave parameters, contributing to the country's marine conservation efforts.

Looking Ahead

As the marine and subsea industries continue to evolve, Unique Group remains committed to advancing its technological capabilities with the needs of clients in mind. Future developments will focus on incorporating AI into data analysis and operational workflows, enhancing the precision and efficiency of its product offerings. The Uni-USV fleet is also set to undergo significant upgrades, including increased payload capacities, extended mission durations, and enhanced autonomy, enabling these vessels to tackle even more complex and large-scale operations. By integrating AI, enhancing vessel autonomy, and focusing on sustainable solutions, Unique Group is poised to continue as an industry leader. **ST**

Chris Blake is the vice president of survey at Unique Group. He has more than 30 years of experience in the offshore industry throughout Europe, the Middle East, Africa, and the Americas, with organizations such as Fugro and N-Sea. His strong track record in global survey products and services, as well as business leadership, reinforces Unique Group's operational excellence in global survey operations.



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Active Acoustics

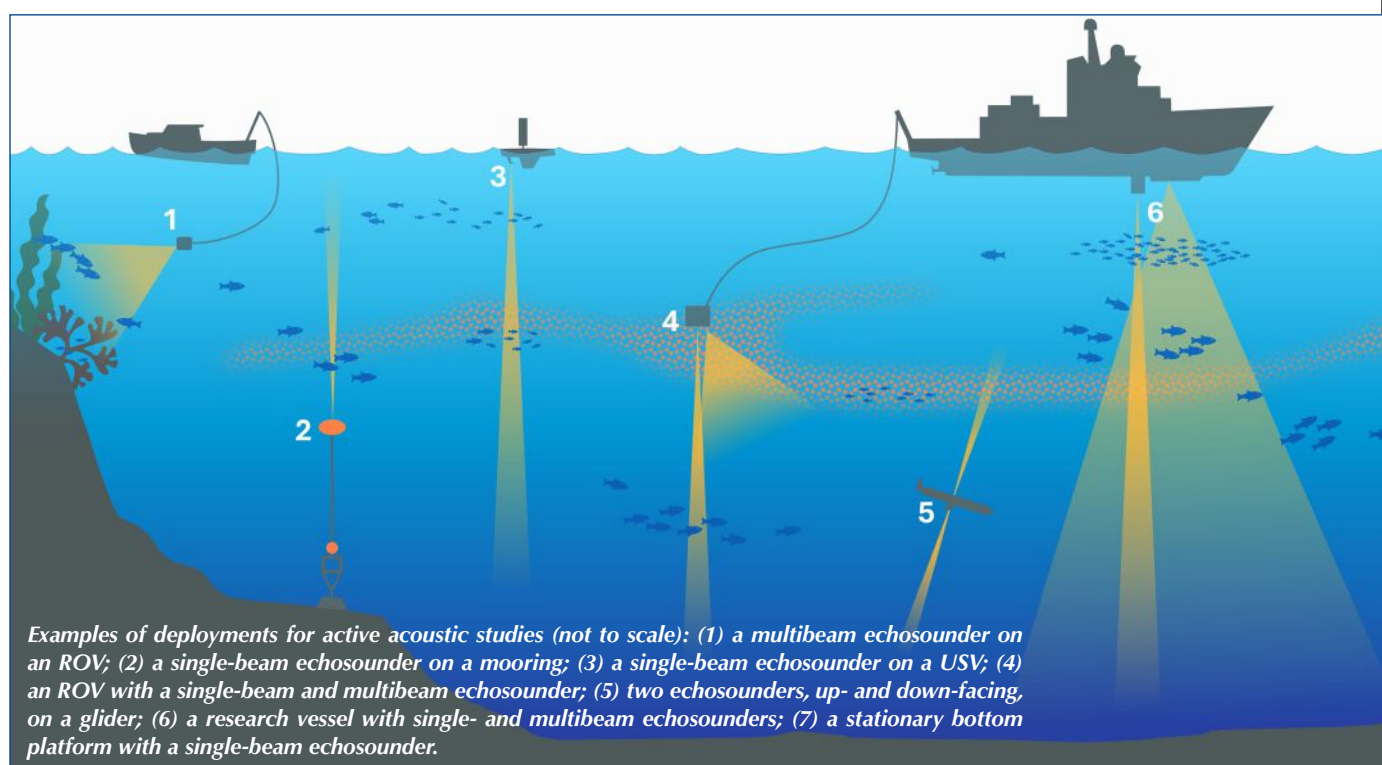
Echosounders for Underwater Research and Monitoring

By Dr. Haley Viehman

Aquatic research and monitoring questions often revolve around what's happening in the water column, such as fish quantity and movements, zooplankton distribution, or vegetation canopy height. Active acoustic instruments, a.k.a. echosounders, are well-suited to addressing these questions. Active acoustics has a long history in fisheries stock assessment, and more recently its applications have expanded into other sectors, including aquaculture, ocean renewable energy, hydropower and more.

Echosounders emit pulses of sound of a specific

frequency band into the water, and then listen for the sound to return as it gets scattered by objects in the water ("backscatter"). This is similar to echolocation by dolphins and whales. One iteration of sending out a sound pulse and listening for its return is called a "ping." How long it takes for the transmitted sound to return indicates how far away an object is, and the properties of the returned sound (such as pulse amplitude and shape) can reveal properties of the object itself. This sending and receiving of sound differentiates active acoustics from passive acoustics, which involves only receiving sound



by use of a hydrophone. Sound travels rapidly in water (1,450 to 1,500 m/s), so echosounders can sample a large volume of water at once with high spatiotemporal resolution, and they can be deployed for long periods of time. Compared to cameras, echosounders require no light, are relatively unaffected by turbidity, and can sample much larger volumes of water. More invasive physical sampling methods, such as trawls, hook and line, or baited traps, cannot compare to the spatiotemporal coverage and resolution of active acoustic systems.

These versatile instruments can be deployed on virtually any platform, moving or stationary. Echosounders have traditionally been deployed in the hulls of vessels, but are now used on USVs, AUVs, gliders, moorings, pilings, dams, and sometimes even airborne drones to fit any survey design and monitoring or research question.

Common applications of active acoustics include fisheries stock assessment, for example, in large-scale surveys to enumerate freshwater, estuarine, or marine fish stocks; on stationary platforms in rivers to quantify migrations of diadromous species (e.g., salmon); and on commercial fishing vessels to improve species detection and reduce bycatch. In aquaculture, active acoustics is used in and around fish pens and macroalgae farms to gather information on organism

size, health, and responses to environmental factors; detect harmful jellyfish; inspect nets for damage and biofouling; and monitor the effects of aquaculture on the surrounding environment. In ocean renewable energy, active acoustics help to monitor fish and other aquatic organisms at offshore wind, wave, and tidal power sites, where traditional survey methods (e.g., trawls) may not be safely deployed or provide the necessary resolution and coverage. For hydropower applications, echosounders monitor fish abundance and distribution in rivers in relation to dams, e.g., pre- and post-dam modification or removal, and to assess the effectiveness of fishways under light and dark conditions. Power plant intakes can benefit from active acoustics to detect approaching jellyfish swarms. At marine protected areas, echosounders are used to map and monitor fish densities in and around the sites and assess their effects. In habitat mapping, active acoustics can detect underwater vegetation, map canopy height above the bottom, and detect anthropogenic effects. Underwater gas seeps can also be located and mapped via active acoustics.

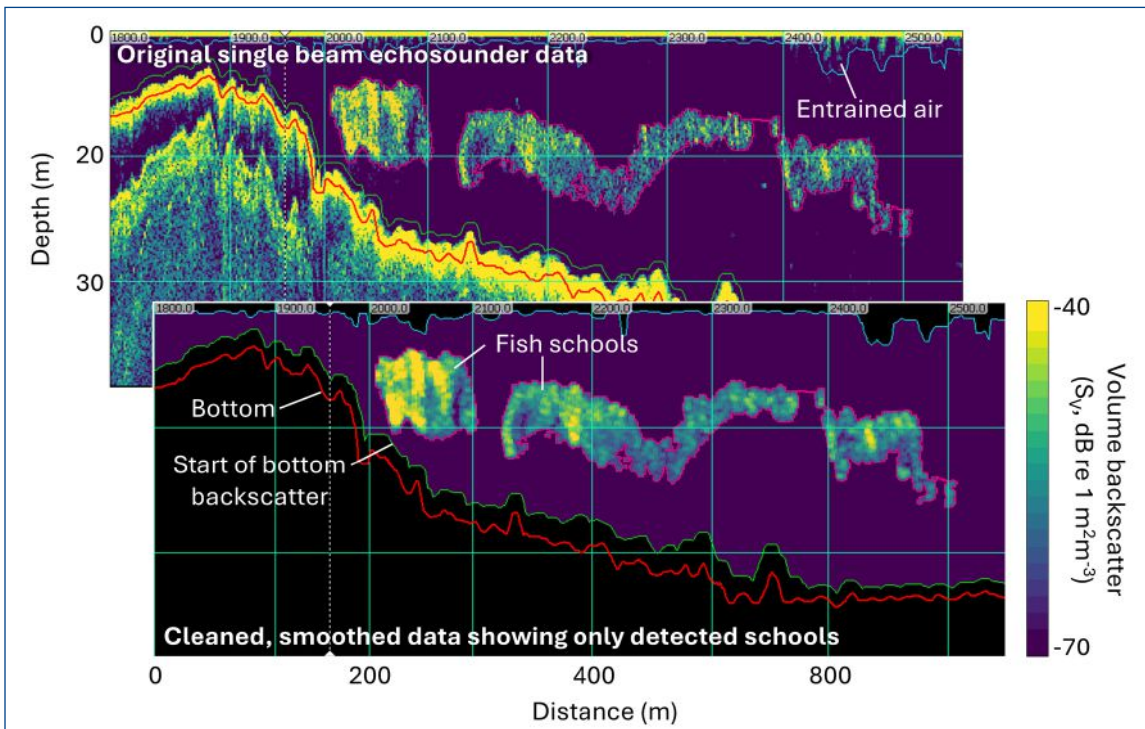
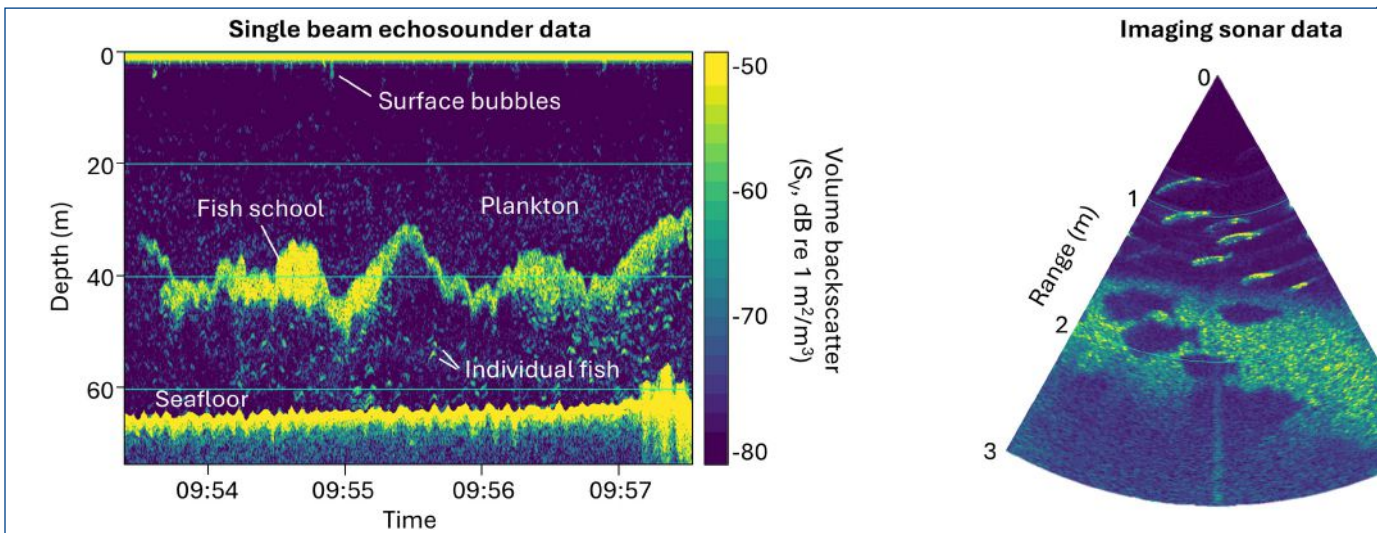


Stationary seafloor platforms can be deployed with upward-facing echosounders and other instruments for long periods of time, such as this one for the Fundy Ocean Research Center for Energy. (Credit: FORCE)

Types of Echosounders

Echosounders come in many different forms, each with different strengths and applications. All include a transducer and transceiver, which can be separate units or combined. To generate a ping, the transceiver sends an electrical signal to the transducer, which translates that voltage to an acoustic pulse emitted into the water. The transducer receives any backscattered acoustic energy from the emitted pulse and converts it back to voltage, which is digitized by the transceiver. A computer controls the echosounder in real time or pre-configures its deployment plan (if autonomous), records data files, and processes the data. Echosounders can be grouped into two broad categories: single-beam and multibeam. Choosing the correct hardware depends on the questions being asked and the capabilities of each system.

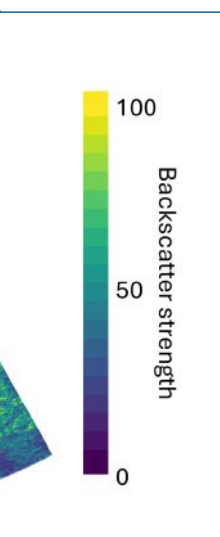
Single-Beam Echosounders. These emit sound in one “beam” extending outward from the transducer face. Recreational fish finders are in this category, though the



(Top) Data from two types of echosounders. Left: an echogram from a single-beam echosounder, showing various scatters from the surface to the seafloor over time. Right: one ping from an imaging sonar, showing a school of fish and their “shadows” near the seafloor. (Bottom) Single-beam echosounder data processing can include detecting and omitting unwanted backscatter (e.g., from the bottom and air entrained at the surface), smoothing the data, detecting fish schools, and removing all non-school backscatter so only the schooling species can be quantified. The images here are examples of these steps carried out in Echoview.

echosounders commonly used for monitoring or research (often called “scientific echosounders”) are usually highly engineered systems that, when calibrated, produce measurements that can be compared across surveys and sites. The sound spreads as it travels, resulting in a roughly conical acoustic beam that can extend for hundreds of meters depending on the environment and acoustic frequency. Data from single-beam echosounders are visualized in an “echogram,” which displays backscatter in two dimensions (depth or range from transducer versus time), with backscatter strength mapped to a color scale.

Single-beam echosounders provide information on the distance (range) to objects in the water column, and when calibrated, backscatter values can be transformed into biomass estimates. Some single-beam echosounders, known as “split-beam” echosounders, comprise multiple sectors forming the beam. Split-beam echosounders can



locate individual objects within the beam in 3D, which allows more accurate size estimates, as well as tracking of individual objects as they pass through the beam.

Like all sampling tools, single-beam echosounders have limitations. One is species identification. Although the characteristics of backscattered sound can help differentiate object types, identifying an organism in an echogram to species level typically requires additional supporting information. This may come from direct or indirect species and size observations obtained from physical samples, visual techniques (e.g., stereo cameras), or genetic methods (e.g., environmental DNA). Single-beam echosounders are additionally not well suited for sampling water directly

adjacent to boundaries, such as the water's surface, the seafloor or man-made structures, because biological backscatter may be masked by the strong signal from these objects. Though suitable for sampling pelagic organisms, other tools may be needed for observing demersal species, such as imaging sonars. Recent advances in wide-band data collection and processing can improve resolution of single-beam echosounders near boundaries and may provide more insights for species identification.

Multibeam Echosounders. These send and receive sound in multiple beams angled outward from the echosounder to sample a fan-shaped “swath” of water. These include echosounders typically used for bathymetric surveys, which sample a huge volume of water and, hence, can also be useful for assessing water column features (e.g., biological aggregations, seaweeds or bubble

plumes from gas seeps). Omnidirectional sonars sample a long-ranging, 360° swath of water by sending and receiving sound in a “donut” around themselves.

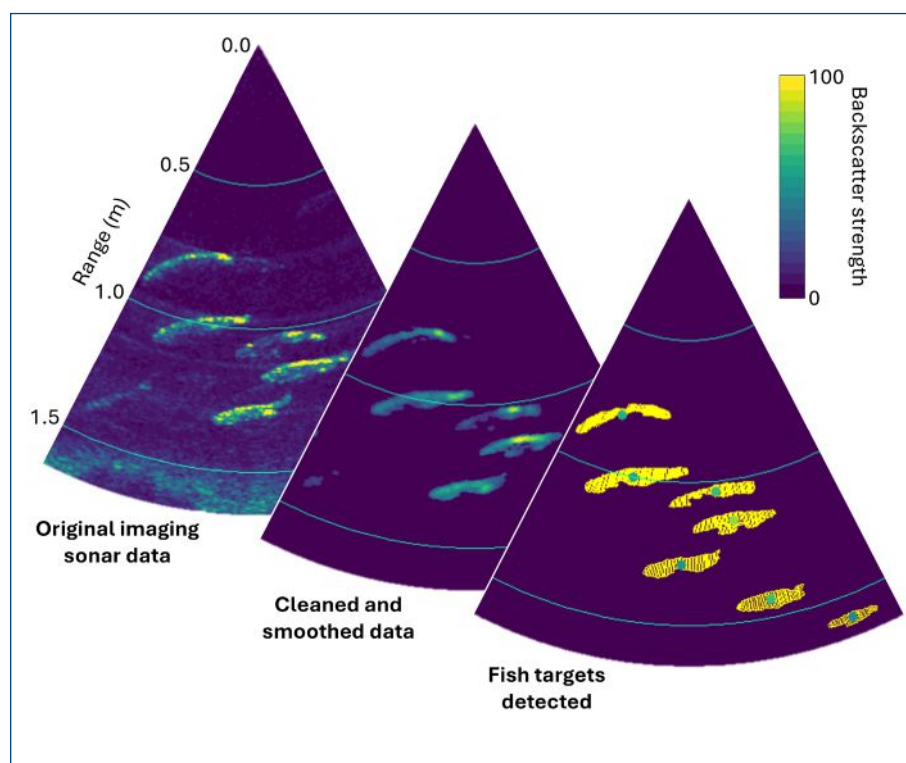
In contrast, imaging sonars, or “acoustic cameras,” are multibeam systems that use very high-frequency sound (usually in megahertz) and a fast ping rate to produce video-like data of a shorter-range swath, similar to medical ultrasounds. These systems produce highly intuitive data with fine detail, making them excellent tools for observing individual organism size and behavior, inspecting habitat or structures, and identifying species.

Active Acoustic Data Analysis

Choosing the right hardware and deployment for a given research or monitoring task is essential, but it is equally important to consider how the resulting data will be converted into usable information. Active acoustic data sets are incredibly variable, but processing can be broken down into six general steps.

The first is data exploration. This includes loading the data; organizing the various data streams (such as data from multiple acoustic frequencies, collected concurrently); and visualizing and inspecting the data for potential issues or interesting features.

The second is data calibration, which ensures the active acoustic measurements are quantitatively accurate and mapped correctly in space and time. This includes applying correct environmental parameters (for example, sound speed) and calculating any necessary offsets to the backscatter values. Calibration offsets are typically derived by analyzing backscatter data from a known target (usually a tungsten-carbide or copper sphere of specific dimensions), and the calibration data are ideally collected in situ before and after survey data collection.



Imaging sonar data processing often includes removing the background, smoothing the data, and detecting fish, as shown here. Echoview was used to detect and track fish over time, providing fish size and movement metrics for analysis.

“Data processing requirements should be considered and procured alongside hardware, including storage, computing power, and analysis software.”

The third step is data cleaning, including removing unwanted components of the data set, such as backscatter from non-targeted objects (e.g., the seafloor or entrained air near the surface). Other unwanted components include acoustic or electrical noise; for example, due to other acoustic instruments operating in the vicinity or to an unclear power source. Once identified, unwanted or contaminated data points can be removed entirely or replaced with representative values (e.g., a local average). The presence of noise degrades a data set and any subsequent results, regardless of the cleaning methods used. Sources of electrical and acoustic noise should therefore be identified and rectified before collecting survey data.

The fourth step is target detection and tracking: identifying and delineating the scatterers of interest in the data set. This may include detecting backscatter likely to come from individual fish (when fish are separated enough) and tracking those fish across pings, or delineating schools of fish when they are packed closely together.

The fifth step is target classification: the identification of scatterers that have been detected in the data. This is one of the more challenging aspects of active acoustics. Classification might include categorizing backscatter according to taxonomic group, body size, bottom type, etc. Approaches to target classification will vary with survey goals and instrumentation. For example, if data are collected concurrently at multiple frequencies, groups of scatterers may be classified by comparing backscatter from one frequency to the next. The size, shape, behavior, and/or location of detected schools or individual targets may additionally be useful for classifying certain species of fish or other organisms.

The sixth step is target characterization: calculating metrics for the targets of interest in calibrated, cleaned and classified data. This can be, for example, average backscatter (converted to biomass) from each grid cell of the echogram, or swimming behavior metrics from individually detected and tracked fish (e.g., swimming speed, direction and tortuosity).

Processing Software

Data processing requirements should be considered and procured alongside hardware, including storage, computing power, and analysis software. Active acoustic data sets can be quite large, and more data or more complex processing steps require a more powerful computer. Most echosounders are supplied with software for data replay that may also provide basic processing capabilities, and this can be sufficient for some applications. However, specialized software is often required when processing goals require more comprehensive features, or flexibility to cover a broader range of technologies, deployment types, and data quality.

Echoview

Echoview is a global industry standard for water column echosounder data processing, enabling easy visualization and interaction with more than 75 different active acoustic file formats from 18 different echosounder manufacturers. The software includes a large selection of built-in data processing and automation tools to produce quantitative results from echosounder data.

Echoview has been employed across the full spectrum of active acoustic applications. For example, Echoview was used to automate the processing of several years of active acoustic data collected at the Fundy Ocean Research Centre for Energy (FORCE) in Nova Scotia, Canada, for multiple research objectives. At such sites, fast currents pull air bubbles deep into the water column, requiring their backscatter to be identified and removed to study the backscatter from fish accurately and understand their interactions with tidal energy devices. Echoview's power and flexibility was invaluable for handling data collected in this challenging environment.

Learning Active Acoustics

Effectively using active acoustics for research or monitoring requires an understanding of the physics of underwater sound, the biology of the organisms of interest, and instrument operation. For example, the best echosounder type and frequencies to use will depend on the sound scattering properties of the sampled organisms and the environment they inhabit. Data collection settings, such as transducer orientation, pulse duration and ping rate, must be chosen carefully because they affect what can be learned from the resulting data set.

Once data are collected, software solutions such as Echoview can make working with the files relatively easy, but the steps needed for data cleaning, identifying scatterers of interest, and interpreting their backscatter must be guided by prior knowledge on how sound interacts with the species present. Active acoustics can present a steep learning curve as introductory literature in this space is generally sparse (though improving).

At Echoview Software, we deliver training courses in active acoustics theory and data processing, provide consulting and client services, and offer advice on any questions you might have about active acoustics and its applications. You can learn more by reaching out to us at: info@echoview.com. **ST**

Dr. Haley Viehman is a hydroacoustics specialist at Echoview Software in Tasmania, Australia. She has more than 14 years of experience with active acoustics, which started with researching potential impacts of tidal energy development on fish in the U.S. and Canada during her Ph.D. and postdoctoral work. Viehman is passionate about science informing sustainable development, particularly in the blue economy. She has been with Echoview Software since 2018.

Delivering LEO Connectivity

Polar Expeditions Can Rely on New Satellite Resources

By Timo Biemüller



Speedcast enables remote connectivity for the RV Polarstern in the Arctic.

Today's leading scientists and researchers are in a race against time to minimize the impact of climate change. For those interested in a view of the future, the polar regions are offering a preview of what's to come: According to the World Economic Forum, the Arctic in particular has warmed four times as much as the rest of the world since 1980.

Experts have compiled data that show that permafrost

in the region is thawing at a rapid rate, opening broad sinkholes in the land and swelling the size of lakes. Glaciers that have stood for thousands of years are melting and increasing the speed of their descent into the sea as meltwater cushions them from the ground. At the same time, shoreline erosion is accelerating and, as the ice melts, it is raising the surface level and temperature of the oceans, on which so much of life depends.

“Ultimately, these connectivity developments will accelerate advancements in our understanding of climate change in the Arctic.”

Climate Research in the Arctic

Because of the visible acceleration of environmental changes in the Arctic, the region has become a laboratory for understanding climate change and researching ways to mitigate its effects. Thirty-nine research stations are currently operating in the Arctic, using a vast array of sensors and internet of things (IoT) technologies to study the changing ecosystem. Researchers gather precise measurements of everything from behavior of the ice to atmospheric composition and ozone levels.

Research takes place at sea as well. This is carried out on research vessels such as *Polarstern*, the flagship of Germany's Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI). Managed by Reederei F. Laeisz, the vessel averages 317 days at sea each year, covering approximately 50,000 nautical mi. Its 20,000-horsepower engines enable the ship to break through heavy ice, which has allowed it to deliberately lock itself into ice sheets for more than a year during the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) expedition, providing an opportunity for scientists to conduct fundamental research on the atmosphere, ocean, sea ice and ecosystems.

***Polarstern*: Icon of German Polar Research**

Typically operating in the Arctic in the summer months, the vessel carries a crew of 44 people living and working alongside 55 scientists and technicians. The nine scientific laboratories on board enable users to conduct key biological, geological, and geophysical, as well as glaciological, meteorological, chemical, and oceanographic research right from the heart of the region. In addition to conducting its own research, the *Polarstern* is a designated resupply vessel for AWI's Neumayer Station, which has been investigating the Arctic for more than 40 years.

The immense amount of data collected by the *Polarstern* is too valuable to stay on board. In addition to research and ship operational data being stored in leading-edge onboard systems, where shipboard staff can access them, the data are also transmitted via satellite to AWI to power the research taking place in Germany. The data are also made available to national and international science organizations.

That process sounds simple enough—but the Arctic has long been a challenging environment for satellite.

LEO Connectivity for Remote Missions

For decades, most satellites have circled the Earth in geostationary orbit (GEO) above the equator. Because the surface of the Earth is curved, radio waves from GEO reach the poles from the side, not overhead. Passing

through all that air weakens the signal, leading to interference, and a hill or iceberg in the wrong place blocks the signal completely.

A robust connectivity infrastructure is now imperative for Arctic operations and their real-time connectivity, not just for research but for crew welfare and safety. Low Earth orbit (LEO) connectivity as part of a comprehensive, hybrid service is one such solution.

LEO satellites orbit the Earth at altitudes between 500 to 2,000 km, compared with 36,000 km for traditional GEO satellites. At that altitude above the equator, GEO satellites maintain a geosynchronous orbit, appearing stationary relative to a fixed point on Earth's surface. In contrast, spacecraft in low Earth orbit travel at remarkable speeds of up to 7.8 km per second, rapidly traversing the sky.

To ensure continuous global coverage, LEO satellites operate in extensive constellations, often comprising hundreds or even thousands of satellites, ensuring multiple units are always overhead. Establishing reliable communication services from such rapidly moving satellites to a moving site such as a research vessel, particularly in harsh and remote environments, presents significant technical challenges, requiring sophisticated tracking, signal hand-off, and robust system design to maintain seamless connectivity.

The latest LEO satellites to enter the market offer high data rates at lower cost, often ranging from dozens to hundreds of megabits per second—ideal for vessels that must process masses of data from sensor to server and for internet access by scientists and crew.

In 2023, for example, Speedcast completed the first live deployment of Eutelsat OneWeb's Maritime LEO service on the RV *Polarstern*, which offers 100+ Mbps of capacity with guaranteed enterprise-grade service levels and low latency due to the lower altitude of LEO satellites. Speedcast equipped the vessel with dual parabolic user terminals with advanced blockage mitigation capabilities, which deliver highly efficient, seamless high bandwidth connectivity even in challenging sea conditions. Built to withstand temperatures as low as -40° C, and equipped with an additional heater component, the terminal from hardware manufacturer Intellian is ideally suited to the Arctic's below-freezing climate.

Since OneWeb operates in a polar orbit, its satellites are positioned to provide continuous service even in the far northern latitudes. In an email sent from the North Pole, the captain noted that although his ship had made many voyages to the location, this was the first time they had high-speed internet access, allowing them to enjoy communication in the remote region on this special occasion.

One Part of a Complex Solution

Researching in Arctic waters is not for the faint of heart. Storms and severe weather, equipment breakdowns in the cold, accidents, and medical emergencies pose constant risk to scientists and crew alike. While LEO services bring exciting benefits and options to Arctic connectivity, they operate at very high frequencies that can be impacted by snowfall and other factors. For all these reasons, it is rare that a vessel with critical operations would depend on just one form of connectivity.

This is one reason that the RV *Polarstern* was also outfitted with Starlink connectivity to complement its other communication systems. With a mega constellation of more than 6,000 satellites orbiting the Earth, Starlink is bringing reliable, high-speed internet to people no matter where they are. Speedcast delivered a seamless failover switching solution between the OneWeb and Starlink connectivity paths via its SIGMA network management platform, so the vessel never operated single-threaded. SIGMA also delivered important welfare connectivity services to *Polarstern*, with crew voucher options and access control capabilities to keep remote staff and crew connected during long voyages.

SIGMA offers expanded capabilities for vessels based on operating requirements. It can prioritize data traffic by type—giving highest priority, for example, to research data transmission, compared with email or text messaging. SIGMA is also cloud-native, running on Amazon Web Services (AWS), which can provide users with se-

cure direct access to AWS cloud resources for data storage and processing.

Assisting Vital Research

Speedcast's innovative blend of multiple LEO and L-Band services via SIGMA on the RV *Polarstern* has proven to accelerate onboard connectivity. Through enterprise-grade connectivity, the researchers benefited from traffic prioritization, reduced latency, and enhanced data transmission, enabling them to make more informed decisions and explore new ways of presenting their critical research to a larger audience, for example, through live video streaming to social media channels.

Ultimately, these connectivity developments will accelerate advancements in our understanding of climate change in the Arctic. With new connectivity resources, courtesy of Speedcast, the RV *Polarstern* will embark on many more projects in the future. **ST**

Timo Biemüller joined Speedcast in 2016 and serves as the sales director in Germany, where he supports the maritime business in Europe. Previously, he spent more than six years at DH-INTERCOM GmbH & Co. KG in various commercial and sales leadership positions. Prior to that, he worked in media production for nearly a decade. Biemüller has a degree in media informatics from the Furtwangen University of applied science in Germany and completed studies in media production at San Francisco State University.





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Suriname Seabed Piston Coring Project

TDI-Brooks was contracted by GeoPartners on behalf of Staatsolie Maatschappij Suriname to perform seep data acquisition, processing, interpretation and data management services (multibeam and coring) for the Suriname Seabed Piston Coring Project.

TDI-Brooks has provided multibeam acquisition services using a vessel to acquire approximately 45,000 sq. km of seafloor multibeam data in the survey area, as well as 60 SGE (surface geochemical exploration) cores and seven heat flow samples.

GMDSS Development Center Opens in Busan

Intellian Technologies Inc., a global provider of resilient multi-constellation satellite user terminals and communications solutions, has announced the opening of its new GMDSS Development Center in Busan, South Korea. This center is dedicated to advancing Global Maritime Distress and Safety System (GMDSS) solutions, including the development of GMDSS VHF and MF/HF radio systems and NAVTEX, with the first products expected to launch in 2025.

GMDSS, overseen by the United Nations' International Maritime Organization (IMO) under the Safety Of Life At Sea (SOLAS) Convention, is a critical regulatory framework designed to protect the 1.9 million seafarers worldwide. It mandates essential global maritime safety requirements, including radio and satellite communications, for vessels over 300 gross tons and passenger ships with more than 12 passengers on international voyages.

LR Acquisition

Lloyd's Register Group (LR) has completed the acquisition of Ocean Technologies Group (OTG), a provider of human capital management and operational software dedicated to the global maritime industry, from the European private equity firm Oakley Capital.

This follows the acquisition of OneOcean in 2022 and the purchase of a 50 percent stake, alongside the International Chamber of Shipping, in ISF Watchkeeper in 2023.

BMT Expands in Asia-Pacific

BMT (*Sea Technology*, November 2024) has acquired Australian Maritime Technologies (AMT), a provider of naval and commercial ship design and engineering services. AMT's proven track record in supporting projects such as the Royal Australian Navy's *Anzac*-class frigates adds new depth to BMT's expertise in maritime engineering and design.

Seabed 2030 Scale-Up

The Nippon Foundation-GEBCO Seabed 2030 Project, dedicated to inspiring the complete mapping of the world's ocean by the end of the decade, has been selected as one of 10 global projects for the Paris Peace Forum's Scale-up Program (SCUP) for 2024 to 2025.

Seabed 2030 was chosen for its potential to address global challenges such as biodiversity loss and climate change, which will be a priority theme for next year's forum. Seabed 2030 will receive a year of support from industry and international agencies to scale its impact, strengthen partnerships, and advance its mission to deepen knowledge of the marine environment.

Voyis Distributor in France

CADDEN, a French specialist in positioning, navigation and geolocation solutions, is now the official distributor of Voyis solutions in France. This new partnership will support underwater photogrammetry applications with products such as the Discovery Stereo camera, which captures highly accurate 3D underwater models.

DNV Standard for Hydrogen Production

DNV has released a new standard, Electrolyser Systems DNV-ST-J301, embedded in DNV's certification framework for the equipment and facilities used in producing hydrogen and its derivatives through water electrolysis. This standard integrates seamlessly with ISO 22734 hydrogen generators using water electrolysis, which it complements to offer a framework for safety and compliance.

The standard consolidates all technical safety requirements into a single, clear document, simplifying compliance while providing the hydrogen industry with a definitive benchmark for safe, reliable and scalable operations. Its release aligns with the recently announced EU Innovation Fund hydrogen auction, where certifications are expected to play a crucial role in project success.

Multiparameter Mini-Sensor Development

The U.K. National Oceanography Centre's (NOC) Ocean Technology and Engineering group will develop and test the new SixSense package on AUVs, including Autosub Long Range (ALR) and Slocum Glider platforms.

The new miniature sensor will be capable of measuring six key parameters covering biogeochemical, physical, and environmental measurements related to essential ocean and climate variables. The small package will free up space for other instruments on AUVs and provide greater sensing capability for smaller underwater platforms, such as low-power micro-submersibles and profiling floats. Increasing how much data these platforms can gather, on their own or in swarms, will help scientists to better understand the ocean and how it's changing.

Crowley Scholarship Recipients

California State University Maritime Academy (Cal Maritime) deck cadets Jake Jacobsen and Jan Johnson have been awarded Crowley's Thomas B. Crowley Sr. Memorial Scholarships, which are given to cadets who have shown dedication to a career in the maritime industry.

Jacobsen, entering his final year at Cal Maritime, is studying marine engineering technology. He thrives when working with engines and equipment and aims to start a sailing career.

Johnson is a junior studying mechanical engineering and is set to graduate in 2026 with a merchant mariner credential. Fluent in Czech, he plans to use his bilingual skills to communicate across international borders.

Cadets Anna LaDue and Odegaard Fields from Maine Maritime Academy have also been awarded Crowley scholarships.

LaDue, a junior from Canterbury, New Hampshire, is studying marine transportation operations, with a minor in sail training. LaDue seeks to sail aboard tankers upon graduation.

Fields, a junior from New Marlborough, Massachusetts, is pursuing a degree in marine transportation operations. Fields wants to continue sailing as a deck officer on a tanker or offshore wind supply vessel.

Funding for Ocean Resilience Entrepreneurs

The World Ocean Council is part of The Continuum, a national collaboration among seven leading organizations dedicated to supporting ocean-focused entrepreneurs. Together, they have been awarded a \$13.9 million phase two grant by the NOAA Ocean Enterprise Accelerators program. The Continuum will focus on data-driven solutions for resilience and sustainable growth.

EPA Certifies Seascour

Hendry Holdings LLC, parent of Hendry Marine Industries Inc., has announced that its Seascour product has been certified by the U.S. Environmental Protection Agency's (EPA) Safer Choice program and earned the Safer Choice label, making it the first marine scale remover to be accepted into this program. The EPA Safer Choice label helps consumers identify products that are safer for families, pets, workers and ecosystems.

Seascour is engineered to remove scale, rust and other deposits from marine equipment without compromising the health of users or the environment.

Hill Expands Manufacturing

Hill has entered into a definitive agreement to acquire all of the assets of W International SC LLC and Vivid Empire SC LLC (collectively "W International"), a South Carolina-based complex metal fabricator specializing in the manufacture of shipbuilding structures, modules, and assemblies.

The manufacturing facility in Goose Creek, South Carolina, will operate within Hill's Newport News Shipbuilding division. The site will support the construction of nuclear-powered submarine and aircraft carrier modules and structures for U.S. Navy programs. All current employees will be offered positions with Hill to continue to work on site.

Svitzer Adds to Brazil Presence

Svitzer, a global towage and marine services provider, has begun operations in the Port of Itaqui in São Luís, Maranhão, marking another significant milestone in its expansion across Brazil. The Port of Itaqui, located in one of Brazil's largest port complexes, is vital to national and regional economic development. **ST**

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Precursor Event to Massive Hunga Tonga Eruption

Fifteen minutes before the massive January 2022 eruption of the Hunga Tonga-Hunga Ha'apai volcano, a seismic wave was recorded by two distant seismic stations. Now, researchers argue that similar early signals could be used to warn of other impending eruptions in remote oceanic volcanoes.

The researchers propose that the seismic wave was caused by a fracture in a weak area of oceanic crust beneath the volcano's caldera wall. That fracture allowed seawater and magma to pour into and mix together in the space above the volcano's subsurface magma chamber, explosively kick-starting the eruption.

The research was published in *Geophysical Research Letters*, an AGU journal. The results build on the researchers' previous work monitoring remote volcanoes. In

this case, the Rayleigh wave, a type of seismic wave that moves through the Earth's surface, was detected 750 km (approximately 466 mi.) from the volcano.

On January 15, 2022, Hunga Tonga erupted in the western Pacific Ocean with record-breaking energy, injecting 58,000 Olympic swimming pools of water vapor into the stratosphere, setting off an unprecedented lightning storm and generating a tsunami. That massive eruption was preceded by a smaller eruption on January 14 and, before that, a month of eruptive activity.

The researchers used seismic data to analyze the Rayleigh wave, which was detected by instruments but not felt by humans, at seismic stations in Fiji and Futuna. Researchers believe that this wave signified a precursor event and possible cause of the massive eruption. This seismic signal traveled a great distance, in-

dicating a huge seismic event. This precursor event could have begun an underground process that ultimately led to the eruption.

Detecting early eruption signals may give island nations and coastal areas more valuable time to prepare when faced with imminent tsunamis, even when the signal cannot be felt on the surface.

Chlorine and Cocoa Butter Could Mitigate Coral Disease

In the tropical Atlantic, stony coral tissue loss disease (SCTLD) is particularly severe because the disease is transmitted quickly, spreads to many hosts, and results in high mortality rates. Treatment methods to stop the spread of SCTLD are available. The most common is the use of antibiotics, but this comes with side effects such as increased antibiotic resistance.

Now, an international team of researchers has investigated if an alternative, antibiotic-free approach to treating infected corals could

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98

help avoid antibiotic pollution of the world's oceans while improving coral health.

The study, published in *Frontiers in Marine Science*, shows that direct treatment of SCTLD can help corals survive a disease outbreak and highlights that active management of disease is possible in the field.

The researchers compared the effectiveness of different treatments by applying them to infected corals of Horseshoe Reef, near the British Virgin Islands. Some corals were treated with amoxicillin, an antibiotic; others were treated with a paste mixed from chlorine and cocoa butter (the cocoa butter was the delivery mechanism).

The researchers applied both treatments directly to corals and re-visited the reef every four or five weeks to measure and describe lesions and to reapply the treatment as necessary. After roughly 80 days, the median percentage of tissue lost was 17.6 percent for chlorine-treated colonies and 1.7 percent for amoxicillin-treated colonies.

While the antibiotic treatment was more successful at containing SCTLD, the researchers said that unwanted side effects such as the development of antibiotic-resistant bacteria could be lessened when opting for the chlorine treatment, which also comprises lower-cost ingredients that can be found in drug and hardware stores.

Healy's Scientific Discoveries

The U.S. Coast Guard (USCG) Cutter *Healy* and embarked science teams have collaborated with the U.S. National Science Foundation, NOAA and the University of New Hampshire for the first two phases of the icebreaker's 2024 Arctic fall deployment.

The interagency science mission to the Chukchi and Beaufort Seas north of Alaska combined oceanographic buoy deployments with a coordinated mapping effort to survey uncharted waters.

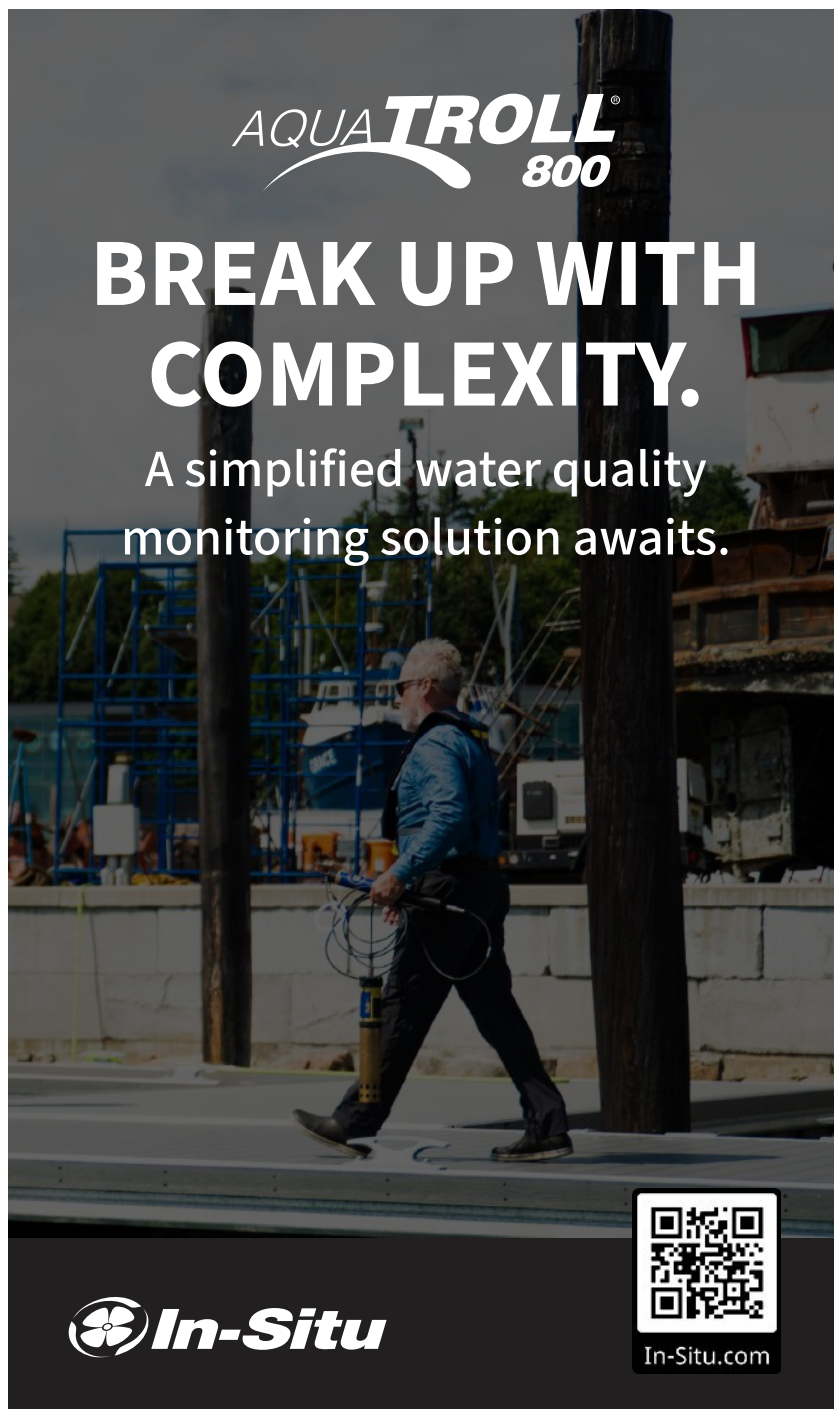
During the mission's first phase, a volcano-like feature was discovered, rising 500 m from the seabed, approximately 1,600 m below the water's surface at its shallowest

depth. The team detected a potential gas plume rising from just above the feature to near the water's surface, which poses no risk to navigation. Data analysis is ongoing.

Antarctic Sea Ice Melt Effects

Declining Antarctic sea ice cover is generating unprecedented ocean heat loss to the atmosphere and more storms, according to a new study led by the U.K.'s National Oceanography Centre. The

study, published in *Nature*, focused on the record low Antarctic winter sea ice cover in 2023 and provides the first clear picture of the impacts of the disappearing sea ice. Using data from the atmospheric layer just above the ocean surface, it found a doubling of heat loss to the atmosphere, matched by higher numbers of storms around much of the high latitude Southern Ocean. Antarctic sea ice loss could extend impact to the Northern Hemisphere. **ST**



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Wave, Vessel Motion Prediction



PredictifAI delivers a real-time, in-operation picture of the wave field around a vessel, providing deterministic prediction of ocean waves and vessel motion in the range of seconds to a couple of minutes in advance. PredictifAI pairs artificial intelligence with X-band radar and local high-accuracy wave height measurements to deliver a monitoring solution that automatically adapts to varying sea and weather conditions. Miros AS.

Solar Panel Mounting Frames

Marine-grade steel composes the solar panel mounting frame system, which can be installed on vessels as large as a bulk cargo ship. The rugged frames allow for flexible solar panels to be secured to decks and removed from the frames if needed. Teramoto Iron Works Co. Ltd.

Ship Design Software

The latest enhancements in ShipConstructor 2025 R2 and ShipbuildingPLM has updates for outfitting, production, project administrators, and working with sister ships. New features enable: modeling space allocations for use with conduit and penetrations; using accessory packages in ShipbuildingPLM; navigating to ShipbuildingPLM revisions directly from ShipExplorer; additional labeling features and production automation; comparing any two models in ShipExplorer; and calculating and reporting on the surface area of equipment. SSI.

Cable Transit Sealing Management

The ClassNK-endorsed Roxeltec Transit Operate supports the installation and maintenance of mechanical

cable and pipe seals of transits in critical marine environments, increasing ship safety. QR codes and floor plans are used to register and keep track of all installed transits on the ship digitally. A digital log and unique ID is created for each transit. Staff's tasks can be managed according to their access level set by the administrator. Roxeltec Japan K.K.

Connectivity Terminals

TracNet Coastal is a standalone system that uses a belowdeck power-over-ethernet injector. High-gain 5G/LTE antennas and a high-performance Wi-Fi bridge are housed in a compact radome, with intelligent hybrid switching. The system supports Wi-Fi calling, provided an external Wi-Fi network is connected. TracNet Coastal Pro has added features, including the DC-powered TracNet Hub that delivers intelligent hybrid switching between 5G, Wi-Fi, and up to two additional alternative networks, such as Starlink, OneWeb, VSAT, Iridium, or others. KVH Industries Inc.

Sub-Bottom Sonar



eBOSS (Buried Object Sonar System) can penetrate the seabed to accurately detect, locate, classify, and identify buried and partially proud objects. This low-frequency acoustic imaging system can be operated in real time for general survey purposes, such as cable and pipe tracking and route surveys. Data can also be post-processed utilizing synthetic aperture sonar (SAS) processing to render 3D images of buried objects.

The 3D volume captures the size, shape, and orientation of buried targets, thereby aiding in identification and geo-location. EdgeTech.

Chart Planning Station



PS100 delivers a comprehensive suite of commercial navigation functions via large, high-resolution 32-, 43- or 55-in. touchscreen displays. Features include: displaying ENC charts and ship symbols; showing tracked and AIS targets; enabling route planning and monitoring; providing a weather information layer and a document viewer; sharing of route information; displaying sensor information received from ECDIS when connected; and synchronizing ENC charts with ECDIS FMD-3xxx models. Furuno USA Inc.

Fishing Labor Safety App

A first-of-its-kind app for Android (and eventually iOS) uses advanced blockchain and decentralized technologies to increase privacy, security, and transparency, helping fishing industry workers and their families stay informed and safe. Secure data sharing and management via the app, based on the SelfFramework technology stack, can combat illegal labor practices. Self Research Institute and SafeWaters Foundation.

Dual-Fuel Solution for Engines

GC1000 turns diesel engines into dual-fuel engines, minimizing the dirtier diesel fuel while maintaining the power of a diesel engine. With no modifications needed, the change is fast and affordable. The solution allows for different options depending on various needs. Engines can operate on a mixture of diesel and gas, with an optimal 30

percent diesel and 70 percent natural gas. Governors America Corp. (GAC).

Vessel Compliance Reporting

This vessel reporting application now includes the functionality to support compliance with FuelEU Maritime. Accurate and efficient reporting is based on the Bunker Delivery Note (BDN) methodology. The BDN compliance method standardizes fuel documentation and aids in tracing fuel blending and bunkering. The reporting tool integrates with the OVD standard used by DNV and several other verifiers. Coach Solutions ApS.

Remote Email Access

GTMailPlus now allows users to access their emails from anywhere, even if their onboard systems are offline. Available as standard to GTMailPlus customers, GTMailPlus Cloud Access enables seamless real-time synchronization between ship and shore, ensuring uninterrupted communications for vessel

operators. Users always have access to their emails from any device, from anywhere in the world, without any need for additional backup solutions. GT Maritime.

Emissions Tracking, Reporting

The VesselBot platform provides air and ocean freight emissions tracking by using proprietary digital twin technology to deliver accuracy. It enables companies to keep in line with tightening environmental regulations. VesselBot.

Satellite Safety Comms

Iridium Certus GMDSS, a truly global GMDSS service, features distress alert, safety voice and maritime safety information. It includes additional regulated services, such as long-range identification and tracking and a ship security alert system, and provides the fastest weather-resilient broadband service available for conducting ships' business when other systems are blocked or unavailable. Iridium Communications Inc. **ST**

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Vaisala Acquires Nevis

Vaisala has expanded its offering for renewable energy customers by acquiring the U.K.-based software, weather monitoring systems and services company Nevis Technology Ltd. The acquisition enables Vaisala to further develop its business in the offshore wind area with solutions for safer and more efficient installation, crew transfer, and service operations.

Nevis Technology specializes in providing and maintaining helideck and environmental monitoring systems and data portals for the offshore energy industry, with offshore wind parks as a growing customer segment. The main applications for its systems are offshore platforms and vessels.

The acquisition strengthens Vaisala's position as a weather systems and intelligence partner for the offshore wind market, in line with the company's priority of expanding in the energy transition.

WindWings Market Expansion

BAR Technologies (BAR), a specialist in wind propulsion and a simulation-driven marine engineering consultancy, has expanded its partnership with WindWaves (formerly Nervion Naval Offshore), a specialist in floating offshore wind platforms. WindWaves will manufacture, sell and deliver BAR's new 20/24-m WindWings wing sail design in Europe.

In February 2024, the two companies announced a similar deal for the larger 37.5-m WindWings.

The new deal will give European customers, and customers utilizing drydocks in the region, access to an enhanced provision of products across the WindWings range.

WindWaves will manage the value chain of procurement and construction of 20- and 24-m WindWings and their installation at shipyards across Europe.

Additionally, WindWaves will manage the servicing of WindWings during their operational life cycle, alongside crew training on the op-

eration of the wing sails. The new 20/24-m WindWings models are a compact and lightweight version of the original patented three-element design, which saves more than 500 t of CO₂ per WindWing per year at less than five years payback.

Investor Funding for Gazelle Floating Offshore Wind

Gazelle Wind Power, the developer of a next-generation floating offshore wind platform technology, has secured €11.4 million in a funding round led by Indico Capital Partners, a premier investor in ocean-related sustainable technologies. Other investors in the round included DST Group, August One, Wah Kwong and E2IN2. The funding will accelerate the development of Nau Azul, Gazelle's 2-MW grid-connected demonstrator in Aguçadoura, Portugal.

Gazelle's next-generation floating offshore wind platform addresses critical industry challenges such as: high mass production and installation costs, complex supply chain logistics, limited suitable installation sites, the need to reduce the levelized cost of electricity, and mitigating the environmental impact of traditional platforms on marine ecosystems.

The platform's patented dynamic mooring system reduces pitch and balances movement in response to external forces, including wind, waves, and tide. Its lightweight, modular design is based on naval engineering principles; does not use active ballasting systems; and allows for scalable, adaptable configurations, making it a more affordable and accessible solution for deepwater deployment. The modularity of Gazelle's components also enables cost-effective fabrication in shipyards, with final assembly near the wind farm site.

River Tidal Turbine Power

ORPC's operations team has traveled to remote areas of Alaska and Canada to perform feasibility assessments for three off-grid com-

munities along the Yukon River. This river spans nearly 2,000 miles, from its origins in British Columbia through Canada's Yukon territory, and west through Alaska to the Bering Sea.

In fall 2024, as part of a project to evaluate the potential of marine energy power generation in 59 of Alaska Village Electric Cooperative's diesel-dependent communities, ORPC performed site assessments in two Alaska Yukon River villages. In October, the team traveled to Canada to perform transect and bathymetry measurements for a similar project in partnership with Northern Energy Capital.

The next step is ice studies, to coincide with winter storms.

Joint Offshore Renewables Insurance Business

NorthStandard and NIORD have announced a new partnership to build a joint offshore renewable energy underwriting business.

Under an agreement that came into effect January 1, 2025, the global marine insurer NorthStandard will provide \$30 million in additional capacity to insure fixed and floating wind farms, as well as renewables devices.

This is part of a risk management partnership that anticipates the development of other sector-specific liability products.

NIORD already has an established capacity of \$115 million in the sector.

Available capacity increased to \$160 million at the start of this year, including the \$30 million from NorthStandard and \$15 million from Beazley and Blenheim.

Wave Power Now Available On Israel's Grid

Eco Wave Power Global AB's project in Israel has been fully activated and is now exporting electricity into Israel's power grid.

The Israeli National Electric Co. is the purchaser of all the clean energy produced by this project.

This is the first array of wave power generators to be connected to an electricity grid in Israel and in the Middle East. **ST**

Europe's First Fully E-Tug

Damen Shipyards Group has delivered six RSD tugs 2513 to the port of Antwerp-Bruges in Belgium. The delivery comprises five RSD Tugs 2513 and one RSD-E Tug 2513, which is the first fully electric tug to operate in a European port.

RSD-E Tug 2513 paves the way to zero-emission operations. The other five vessels also contribute to cleaner operations with onboard Damen NOx reduction systems to remove harmful emissions from exhaust gases, ensuring IMO Tier III compliance.

The Port of Antwerp-Bruges aims to become carbon-neutral by 2050.

AI2050 Program

Schmidt Sciences has chosen 25 scholars working at the forefront of artificial intelligence (AI) as AI2050 fellows and will award them with up to \$12 million to advance research that fully realizes the potential of AI to benefit humanity. The program funds senior researchers and early-career scholars for two years to address a wide range of global challenges in AI.

The AI2050 program asks researchers to imagine the year 2050 in a way that AI has been hugely beneficial and to pursue projects to help society realize this scenario. Learn more at: <https://ai2050.schmidtsciences.org/hard-problems>.

Maritime Battery Forum Grows

Cenex, the U.K.'s first center of excellence for low-carbon and fuel cell technologies, has joined the Maritime Battery Forum.

Cenex focuses on low-emission transport and associated energy infrastructure. It operates as an independent nonprofit research technology organization and consultancy specializing in project delivery, innovation support and market development.

As on-road battery electrification has grown, the technology developed for road transport is now being adopted in other sectors. Cenex has been involved in multiple small

ferry electrification projects, as well as electric RIB and small-scale charging systems for small farms and small leisure craft.

Currently, Cenex is a partner in the collaborative research and development project Virtual Bunkering of Electric Vessels Demonstrator. The project aims to demonstrate the potential value of electric vessels to the grid by using a battery pack on an electric RIB in conjunction with a V2G (vehicle-to-grid) charger to be installed at a marina.

Cenex's history in automotive V2G projects in the U.K. will help accelerate maritime electrification.

Vessel Autonomy Collaboration

Lomar's corporate venture lab, lomarlabs, and Mythos AI, specializing in advanced autonomous systems, will collaborate for a safer and smarter shipping industry.

This collaboration combines Mythos AI's expertise in autonomous navigation with lomarlabs' focus on maritime sustainability, supported by access to Lomar vessels for pilot testing of new technologies. Together, they aim to unlock the next generation of shipping solutions, tackling critical challenges such as navigational safety, operational efficiency and sustainability.

Mythos AI's flagship technology includes the Archie unmanned survey vessel, enabled by autonomy and an advanced pilot assist system, which is ideal for congested coastal and inland waterways and built for working coasts. Equipped with advanced sensors and real-time data acquisition systems, Archie delivers COLREGs-compliant autonomous navigation, ensuring optimal performance in a rapidly evolving maritime landscape.

Autonomous technology can enhance bridge resource management and enable precise route optimization and fuel efficiency while offering enhanced safety through real-time situational awareness and consistent alertness. Moreover, with the right levels of cybersecurity in place, a cloud-based data inter-

face will allow seamless access to actionable insights, empowering stakeholders to make informed decisions.

Smarter USV-ROV Tech

Robosys Automation, ACUA Ocean and Offshore Renewable Energy Catapult (OREC) have jointly secured grant funding through Innovate UK for a project exploring collaborative autonomy in USVs and ROVs across maritime autonomous surface ships (MASS) operations.

The Collaborative Automations for Subsea Intervention (C.A.S.I.) project, led by Robosys Automation, aims to address a growing market need for improving operations and maintenance and inspections of offshore assets with smarter, zero-emission, collaborative USV-ROV technologies.

The global asset integrity management market is projected to grow to £21.5 billion by 2026. This rapid market growth is expected to increase the demand for subsea intervention vessels.

Remote IRM Work

Petrobras has signed a 175-day addendum to Fugro's current inspection, repair and maintenance (IRM) services contract, performed by the *Fugro Aquarius*, to include fully remote subsea inspection surveys of shallow-water infrastructure in Brazil.

Work was to begin in January, leveraging Fugro's advanced Blue Essence USV and Blue Volta electric ROV to enhance inspection safety, efficiency, and sustainability (*Sea Technology*, September 2024). Fugro's Remote Operations Center in Rio das Ostras will support the work.

Corvus to Power NY/NJ Ferries

Corvus Energy will supply energy storage systems (ESS) for Statue City Cruises' ferries servicing the Statue of Liberty and Ellis Island routes in New York Harbor. Corvus Energy ESS will be integrated aboard Statue City Cruises' current fleet of nine ferries to reduce fuel consumption and emissions along the New York/New Jersey waterfront. **ST**

Seaweed Business Merger

Blue Evolution, specializing in regenerative ocean farming and seaweed product development, has merged with Blu3, a company specializing in regenerative ocean technologies. This vertical integration will have expertise across the entire seaweed value chain, from cultivation and biorefining to the development of market-ready applications in food, agriculture, biomaterials, and critical minerals.

The combined entity will leverage enhanced R&D capabilities to drive innovation and commercialize new seaweed-based products across multiple sectors. Blue Evolution is now positioned to expand its global footprint and bring its sustainable seaweed solutions to a wider range of markets. The merger strengthens the company's commitment to regenerative practices, promoting ocean health and contributing to a circular economy.

Coast Guard Foundation Awards Scholarships

The Coast Guard Foundation, a nonprofit committed to strengthening the U.S. Coast Guard community and service by supporting members and families, has awarded 207 new scholarships in 2024, totaling \$750,000 in support for the 2024 to 2025 academic year.

Since the program's inception in 1990, the foundation has awarded \$8.3 million for more than 2,400 scholarships, ensuring Coast Guard children can build strong futures through a college education or technical school training.

More Corals at Risk Of Extinction

Forty-four percent of 892 warm-water, reef-building coral species are at risk of extinction, according to the IUCN Red List of Threatened Species.

The last assessment, in 2008, listed one-third as threatened.

Climate change is the main threat to reef-building coral species. The latest assessment considered

the most recent status update of coral reefs from the Global Coral Reef Monitoring Network, alongside current and future threats, such as the projected increase in warming events and major bleaching events, using Intergovernmental Panel on Climate Change data for future warming scenarios. Corals are also affected by pollution, agricultural runoff, disease, and unsustainable fishing.

Canola Potential as Fish Feed

Onda, the largest contract research organization in Canada specializing in aquaculture research, is working with the Canola Council of Canada on a new Canola Agri-Science Cluster research project examining the use of canola-based feed meal for sustainable aquaculture production, with a goal of expanding the market for Canadian canola.

Aquaculture has become an essential source of global protein, but concerns about the environmental impact of fish feed ingredients have prompted the industry to seek more sustainable alternatives.

The long salmon production cycle of 1.5 to three years provides an opportunity to use canola meal in cost-effective feed formulations.

Maine Island Gets Broadband

Isle Au Haut has installed its first subsea telecommunications, bringing access to universal broadband internet to this unbridged year-round island community for the first time.

The 10-km submarine cable now connects Isle au Haut to Stonington on Deer Isle in Maine, with terrestrial connections to the mainland.

At the behest of the state of Maine, Axiom Technologies spearheaded the project and will provide services via the now-installed cable. Axiom commissioned Pioneer Consulting to advise and connect the project to pivotal resources.

Funding came from a \$1.2 million grant from the National Telecommunications and Information

Administration and the state of Maine as part of a larger \$28 million grant being administered by the Maine Connectivity Authority to support broadband expansion into underserved, rural communities.

NOAA Funding to Support Climate-Ready Fisheries

A \$147.5 million Inflation Reduction Act investment will enable NOAA to modernize its science enterprise, delivering critical information and tools to support decision making and adaptation strategies for rapidly changing marine ecosystems. NOAA Fisheries will use \$107.5 million to enhance science and data collection to account for the effects of climate change and improve fish and marine mammal stock assessments.

Another \$40 million will fund the Climate, Ecosystems, and Fisheries Initiative to provide resource managers and fishing communities with the information they need to build resilience and adapt to changing marine ecosystems.

NOAA will allocate \$20 million to NOAA Fisheries and \$4 million to NOAA's National Ocean Service to enhance regional capacity to forecast future ecosystem conditions, evaluate risks, and provide actionable advice for climate-informed resource management and community adaptation. An additional \$16 million will go to NOAA Research to develop forecasts and long-term projections of ocean and Great Lakes conditions needed to evaluate risks and identify strategies for adaptation and resilience.

Northern Endurance CCS

Technip has been allowed to proceed with the first all-electric integrated project by the Northern Endurance Partnership (NEP), a joint venture of bp, Equinor and TotalEnergies. This follows NEP's financial close and entry into the execution phases of the CO₂ transportation and storage infrastructure project in the U.K.'s East Coast Cluster.

Technip will supply and install an all-electric subsea system, including trees, manifolds, umbilicals and infield flowlines. **ST**

people

Two new chief scientists have been appointed to the U.K. National Oceanography Centre's (NOC) Marine Autonomous Robotic Systems (MARS) Group. **Dr. Veerle Huvenne** and **Dr. Filipa Carvalho** will work to increase engagement with the marine science community, raise awareness of the robotics available to them and seek input on future technological developments. Huvenne is a marine geoscientist with more than 20 years of experience in the study of complex deep-sea environments. Carvalho is an oceanographer interested in biophysical interactions and the biological carbon pump.



Dr. Diane Foster has joined Woods Hole Oceanographic Institution (WHOI) as vice president for academic programs and dean. Foster brings a wealth of experience and a strong commitment to academic excellence and innovation. Since 2019, she has led the University of New Hampshire's (UNH) School of

Marine Science and Ocean Engineering. Prior to that, she was the director of the Center for Ocean Engineering at UNH.

EV Maritime of New Zealand has appointed **Christopher Mazzoni** as vice president of sales in the Americas. Mazzoni will develop and implement strategic initiatives that will enhance EV Maritime's position in the passenger ferry market across North America. He will interface directly with clients, industry professionals and regulatory boards to develop strong partnerships and identify opportunities for differentiation and growth.

Eco Wave Power Global AB has appointed **Ran Atias** as vice president of engineering for the Eco Wave Power Group. He is based in Eco Wave Power's headquarters in Tel Aviv, Israel. With more than 10 years of engineering experience, he has demonstrated success in product scaling across a variety of industries, including automotive, defense and robotics.

Hill's board of directors has elected **Kari Wilkinson** as president of its Newport News Shipbuilding (NNS) division. She succeeds **Jennifer Boykin**, who is retiring after 37 years with Hill. Wilkinson is the 21st president of NNS, founded in 1886. She was president of Hill's Ingalls Shipbuilding division since 2021.

Morten Hougaard Sørensen is now the chief business development officer at Blue World Technologies. Having

worked in the fuel cell industry since 2006, he will help bring HT PEM fuel cell technology to market at scale.

Sea Machines Robotics Inc.'s Founder **Michael Gordon Johnson** will now serve as president and chief technology officer, while **David "Chip" Wasson** has joined as CEO. Wasson has experience as a naval flight officer, an investment banker and an executive at Hill.

C-Job Naval Architects has appointed **Kasia Romanowska** as managing director of C-Job Gdansk, where she will oversee sales and engineering teams in Poland. She was previously location director for Damen operations in Gdansk and served in various leadership roles at ULSTEIN Poland and REMONTOWA Marine Design & Consulting.

Greensea IQ has appointed **Brooks Converse** as director of business development. Converse will drive the growth and adoption of EverClean, the company's flagship proactive in-water hull cleaning solution. Brooks holds an M.S. in international transportation management.

Teledyne Oceanscience has promoted **Jason Baluyot** to product line manager.

Ted Curley has joined Klein Marine Systems as general manager. He has more than 35 years of experience in the underwater technology industry. **ST**

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contracts

Wärtsilä, Helsinki, Finland, will supply an integrated propulsion package for a new vessel being built for a U.K.-based tanker owner and operator. This order includes the fuel flexible Wärtsilä 32 main engine and is the third in a series of three such vessels, all with a similar Wärtsilä scope of supply for efficiency and lower emissions. Pritchard-Gordon Tankers Ltd.

WinGD, Winterthur, Switzerland, has won an order for 16 X-DF dual-fuel engines after a late-stage switch by a major shipowner. Undisclosed.

Climeon's, Stockholm, Sweden, Organic Rankine Cycle waste heat recovery technology, HeatPower 300, will be installed on a new methanol dual-fuel cement carrier. The HeatPower 300 unit will generate up to 300 kW of sustainable electricity on board the world's largest cement carrier by harnessing low-grade waste heat from the engine cooling water and exhaust gases. NovaAlgo-ma Cement Carriers.

KVH Industries Inc., Middletown, Rhode Island, will equip a fleet with the OneWeb advanced low Earth orbit (LEO) satellite offering from KVH. This will deliver shore-like internet connectivity at sea, supporting a digital transformation strategy. Seaspan Corp.

Svitzer, Copenhagen, Denmark, has signed a contract with a Hong Kong shipyard for four new Svitzer TRAnverse 2900 tugs for delivery in 2026. The 29-m tugs will deliver bollard pulls of up to 80 tonnes, plus side-pushing capabilities. Cheoy Lee.

RINA, Kuala Lumpur, Malaysia, will carry out a preliminary front-end engineering design study for a carbon capture and storage (CCS) project in Malaysia. This will support the country's efforts to achieve net-zero emissions. PETRONAS CCS Solutions Sdn Bhd.

Metis, Athens, Greece, will collaborate to leverage cloud-to-cloud integration for seamless data exchange, delivering two unique services to support the optimal management and execution of bunkering processes. Nereus Digital Bunkers.

Auramarine, Turku, Finland, will provide methanol safety systems and automation for two newbuild 650-TEU methanol-fueled container vessels. A2B-online.

Bureau Veritas Marine & Offshore, Paris La Défense, France, is partnering to develop floating CO₂ storage units and CCS projects in South Korea to reduce greenhouse gas emissions. Samsung Heavy Industries Co. Ltd. **ST**

meetings

MARCH

March 12-13—European Green Steel Industry Summit, Dusseldorf, Germany. www.wplgroup.com/aci/event/the-european-green-steel-industry-summit.

March 25-27—Undersea Defence Technology (UDT), Oslo, Norway. <https://udt-global.com>.

March 26-27—Digitalised Smart Ports Conference, Valencia, Spain. www.wplgroup.com/aci/event/digitalised-smart-ports.

March 30-April 1—Canadian Underwater Conference & Exhibition: Man & Machine Underwater, Vancouver, Canada. www.cuce.ca.

APRIL

April 2-4—NOIA Annual Meeting, Washington, D.C. www.noia.org.

April 8-10—Interspill, London, U.K. www.interspill.org.

April 8-10—Ocean Business, Southampton, U.K. www.oceanbusiness.com.

MAY

May 12-14—Intelligent Ships Sym-

posium, Philadelphia, Pennsylvania. www.navalengineers.org/symposia/ISS-2025.

May 20-21—TugTechnology, Antwerp, Belgium. www.ast-reygar.com.

JUNE

June 2-5—Capitol Hill Ocean Week, Washington, D.C., and virtual. <https://marine-sanctuary.org/chow-2025>.

June 16-19—OCEANS 2025 Brest, Brest, France. <https://brest25.oceansconference.org>.

June 19—East Med Maritime Conference, Athens, Greece. <https://emmc.me>.

June 24-26—Electric & Hybrid Marine Expo, Amsterdam, Netherlands. www.electricandhybrid-marine-world-expo.com/en.

SEPTEMBER

September 10-11—International Antifouling Conference, Gothenburg, Sweden. <https://international-antifouling-conference.confetti-events>.

September 10-12—INMEX SMM India, Mumbai, India. www.inmex-smm-india.com.

September 15-19—London International Shipping Week, London, U.K. www.LISW.com.

OCTOBER

October 7-9—International Boat Builders' Exhibition and Conference, Tampa, Florida. www.ibexshow.com.

October 22-24—WISTA International AGM & Conference, Barcelona, Spain. <https://wistainternational.com>.

NOVEMBER

November 5-6—European E-Fuels Conference, Hamburg, Germany. www.wplgroup.com/aci/event/european-e-fuels-conference.

For more industry meetings, visit sea-technology.com/meetings. **ST**

Civil Engineering Needs an Overhaul—Bill Wallace

Bill Wallace has more than 40 years of environmental engineering experience. He is the inventor of the Envision sustainable infrastructure rating system. For this work, he received *Engineering News-Record's* 2013 Award of Excellence and the American Society of Civil Engineers' (ASCE) President's Medal in 2014. He teaches "Principles of Sustainable Engineering Design" at the University of Florida.



I wrote a book as a last resort to push civil engineers and others working in the built environment—or drag them kicking and screaming—into the 21st century. It's called, "The Great Civil Engineering Overhaul," published by ASCE: www.asce.org/bookstore.

We live in a time when global warming is changing the Earth's climate and affecting almost every aspect of civil engineering. Climate-related codes and standards are no longer reliable and, therefore, neither is the infrastructure that was built according to them. Engineering practices for the built environment must be revised now.

Climate change has overturned a fundamental assumption in civil engineering: past climate conditions are good predictors of future climate conditions. This assumption, climate stationarity, means that regardless of day-to-day regional weather conditions, the climate was statistically constant. This allowed engineers to design and build long-lived infrastructure projects, confident they would operate safely and reliably within a predicted range of climate and weather conditions, the rest being too rare for concern.

Unfortunately, climate change invalidates that assumption. Climate variables are no longer statistically constant. They are changing in ways that are not readily predictable.

The assumption of climate sta-

tionarity is baked into civil engineering standards and practices. Civil engineers are educated, tested, and licensed to practice based on their proficiency in applying accepted standards and practices created using historic climate conditions. Not following these standards and practices exposes engineers to claims and litigation.

As a result, infrastructure designs that consider future climate conditions are not the norm. A 2022 survey of architecture and engineering professionals found that few use climate projections to make design decisions. The main barriers were that clients were not asking for them, and firms did not have the in-house expertise to apply them.

In my book, I discuss the impacts of a changing climate on the 17 industrial and commercial sectors listed in the American Society of Civil Engineers Report Card for America's Infrastructure. This includes physical and operational impacts on ports and other elements of the maritime industry sector. Because of their location on open coasts, rivers and deltas, ports are highly exposed to extreme weather conditions. As sea levels rise, seaports and surrounding areas become exposed to storm surges and flooding. High winds reduce ship maneuverability, berthing and port load/unload operations. Extreme temperatures reduce worker productivity and safety.

Not revising is costly. According to NOAA, the U.S. has suffered 396 climate and weather disasters since 1980, costing U.S. taxpayers \$2.8 trillion, inflation-adjusted. NOAA's cost assessments are conservative in that they are mostly confined to physical damage in the U.S. They do not consider environmental degradation or supply chain or contingent business interruption costs.

According to the UN Trade and Development's Review of Maritime Transport, 80 percent of the world's traded goods are transported by sea,

making port and coastal infrastructure critical to the world's economy. Ports are exposed to extreme weather events that can cause extensive physical damage and costly downtime. A 2023 study in *Nature Climate Change* assessed global maritime transport, trade, and supply chain network risks, estimating an annual total of \$81 billion of global trade and \$122 billion of economic activity is at risk from climate change-related port downtime.

Recognizing these risks, Congress passed two landmark pieces of legislation in 2021 and 2022: the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA). They represent a total investment of \$1.25 trillion to reduce greenhouse gas emissions and create resilient, adaptive infrastructure. The IIJA provides \$17 billion for improving ports and waterways, noting their criticality in our supply chains and international competitiveness. The IRA calls for a \$3 billion investment in port electrification. In this law's first year, at least \$141 million was awarded to the ports of Long Beach, Jacksonville, Portland (Oregon), Honolulu and Miami.

Yet all of this essential investment may come to a halt because President Donald Trump and the proposed Republican policy agenda, Project 2025, sees climate change as a hoax. Thus, work on the cause of a changing climate (carbon emissions from fossil energy sources) or its impact (rising seas, heat waves, floods, wildfires, storms) could cease as the policy emphasis returns to fossil fuels.

Perhaps we, as civil engineers, should also embrace climate change ignorance. Let's continue applying old codes and standards and get paid for our work. When infrastructure projects fail, we fix them and get paid again. It's a new take on an old commercial slogan: Pay me now *and* pay me later. **ST**

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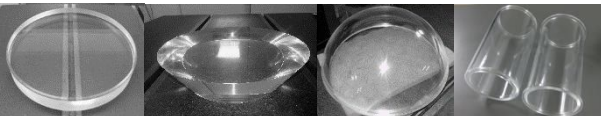
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february advertiser index

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R.M. Young Company www.youngusa.com	33

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