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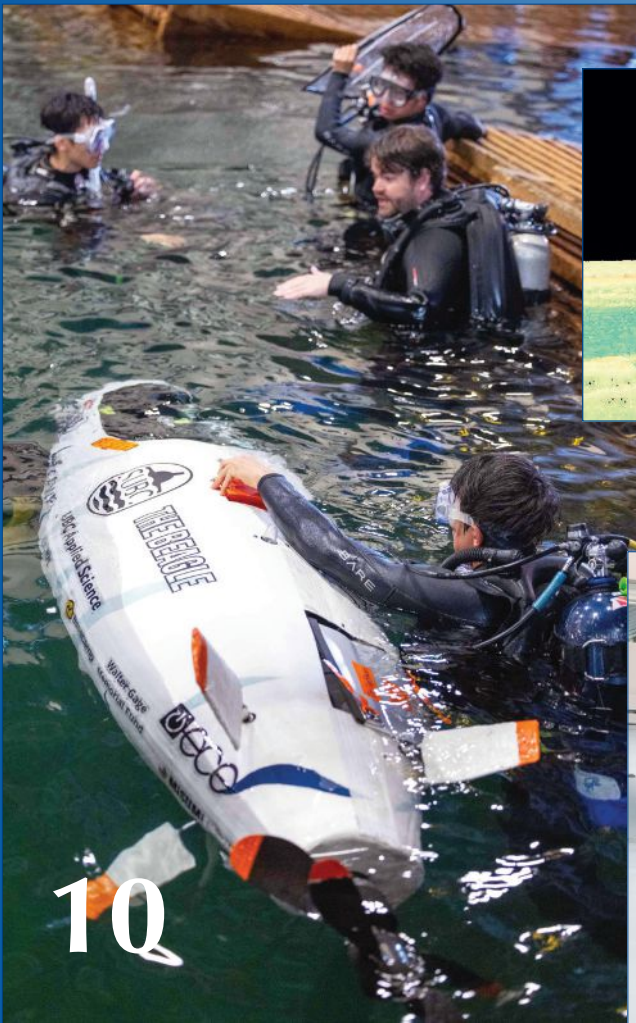
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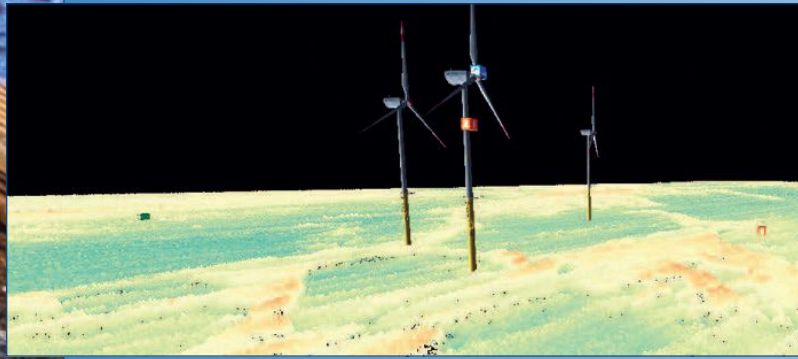
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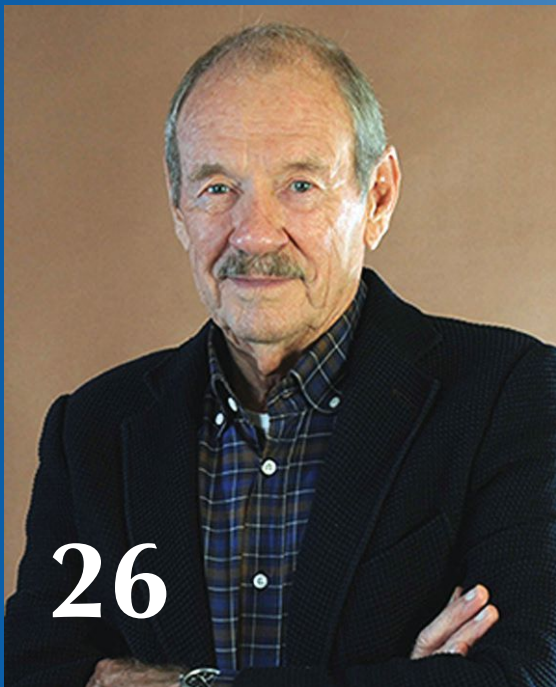




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COVER IMAGE

Virginia Tech entry *Kraken* waiting to race in the human-powered sub competition at ISR 2023. See story on p. 10.

NEXT MONTH

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)) Schmidt Marine Gives Grants for Sustainable Fisheries Tech Development. Schmidt Marine Technology Partners, a program of the Schmidt Family Foundation, has awarded \$3.5 million in grants to 10 organizations and universities in seven countries for the development of new tools and innovations that will improve the sustainability of global fisheries. “Tens of millions of jobs around the world depend on fisheries, and seafood is the primary protein source for 3 billion people,” said Wendy Schmidt, president and co-founder of the Schmidt Family Foundation. “The innovators chosen to receive these grants are ensuring that fishers and fisheries—and by extension all of us who rely on them—are secure and sustainable worldwide.” Although more investors are funding ocean technology today than in years past, developers need considerable early-stage support to advance from an idea to wide use of a technology. The sustainable fisheries initiative—to which Schmidt Marine has committed \$2 million in new funding, with partners Oceankind and Builders Initiative contributing the additional \$1.5 million—aims to address that gap. The 10 projects selected for grants—ranging from \$150,000 to \$500,000—seek to reduce bycatch, prevent illegal fishing, improve data collection on fisheries and fish populations, and increase the transparency of a fish’s journey from ocean to table. A team of seven expert advisers and additional tech reviewers from nonprofits, government, and industry helped evaluate proposals from a pool of 200 applications from 20 countries across six continents. Schmidt Marine selected grantees based on the environmental benefits of their proposed ideas, as well as their incorporation of sound fisheries science and management principles, and, where applicable, the practical appeal of the new technologies to fishers.

)) Fugro Expands in Virginia. Fugro will expand its Americas Center of Expertise for Offshore Wind in Norfolk, Virginia. The company’s Virginia operations have grown considerably over the past decade, in line with the boom in offshore wind projects on the U.S. East Coast. The expansion will create an additional 15 jobs in the state. Performing site characterization of offshore wind developments, Fugro provides critical information about seafloor and environmental conditions to guide safe and efficient project planning, design, and construction activities. “Virginia is poised to become the market leader in offshore wind technology, development and deployment,” said Governor Glenn Youngkin.

)) Microplastics Found in Antarctica. Over 400 million tons of plastic is produced each year worldwide, half of which is for single-use items, and 8 to 13 metric tons of plastic ends up in the ocean each year, making up 80 percent of all marine pollution. Ocean Legacy Foundation, a nonprofit organization that develops and implements worldwide plastic pollution programs with the goal to end ocean plastic pollution, released results from its plastic pollution study that took place in Antarctica in partnership with Ocean Geographic earlier this year, as part of the most recent Antarctic Climate Expedition 2023 (ACE 2023). The ACE 2023 was spearheaded by Dr. Sylvia Earle, oceanographer, marine biologist and explorer, and Michael AW, Ocean Geographic’s founder. Using surface sample trawls, the abundance of plastic pollution was quantified around icebergs and smaller chunks of floating ice. Samples were analyzed using microscopy at the University of British Columbia in partnership with Ocean Diagnostics. Results demonstrated that all wet samples recovered contained plastic pollution in the form of microfiber contamination and illustrated the prolific nature of plastic pollution presence in Antarctica’s open-ocean environment. This underscores the need to develop targeted methods to accurately study microfiber pollution to better understand its footprint in the polar waters of Antarctica. The ACE 2023 team formulated eight resolutions to drive global net-zero from an ocean perspective by 2035, including: protect marine ecosystems and implement climate-smart protected areas from the seafloor to the sea surface; create a circular economy at all levels; communicate the urgency of the ocean-climate crisis in ways that lead to action; and reduce wastage and maximize food proficiencies.

)) OET Explores Johnston Atoll. Ocean Exploration Trust’s (OET) Exploration EV *Nautilus* has set sail on an expedition this summer to explore deep-sea environments of ancient seamounts around Johnston Atoll. Located approximately 800 mi. south of Hawaii in the Pacific Remote Islands Marine National Monument (PRIMNM), this region contains some of the most pristine marine ecosystems on Earth, although large seafloor areas remain completely unexplored. The 27-day expedition utilized EV *Nautilus*’s ROVs and mapping capabilities to survey unexplored deepwater habitats around Johnston Atoll, diving as deep as 13,000 ft. (4,000 m). The expedition was funded by NOAA Ocean Exploration via the Ocean Exploration Cooperative Institute. While recent expeditions have increased our baseline knowledge of the deepwater resources of this remote region, large areas remain completely unexplored. Data associated with the region’s deepwater natural and cultural resources are particularly important now, as a monument management plan is under development, and the region is being considered as a new national marine sanctuary. If established, this new sanctuary would augment existing protections for PRIMNM, which hosts some of the most pristine ecosystems on Earth. The Johnston Atoll unit of the monument contains four islands and over 160,000 sq. mi. of open ocean, an area larger than the state of California. OET makes its work publicly available via NautilusLive.org, which provides 24/7 livestreaming of expeditions, in addition to highlight videos, photos and educational content. OET also submits data and samples collected on expeditions to publicly available repositories. **ST**

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The Perils of Deep Seabed Mining

Deep seabed mining (DSM), the prospective industry seeking to mine commercially valuable minerals from the seafloor, is a threat to our global climate and ecosystem that is being marketed as a climate change solution. Industry frames seabed minerals as necessary for a transition away from fossil fuels, but in June 2023, the European Academies' Science Advisory Council found that narrative to be misleading. By the time seabed minerals can come to market, innovations in battery technology and recycling may render seabed minerals unnecessary. Many battery makers have already moved away from cobalt and nickel, two key focuses of DSM.

The DSM regulatory space is fraught with uncertainty and potential liability. The deep ocean operates on much longer time scales than terrestrial land; restoration is impossible, and many habitats are irreplaceable. The deep ocean does not exist in isolation: DSM could damage our global carbon system, marine genetic resources that could be used in pharmaceuticals, the marine environment and biodiversity, underwater cultural heritage (including shipwrecks and human remains), fisheries, and human health. Who should be liable, and under what circumstances, for such damage?

The seabed beyond a single country's national jurisdiction (the "Area") is managed by the International Seabed Authority (ISA). The ISA is an anomaly: a body created under the United Nations Convention on the Law of the Sea, yet outside the UN's accountability system. The member countries are tasked with creating regulations for commercial DSM, but those regulations are far from complete. Instituting a moratorium or pause on DSM is a key part of the current ISA conversation, as there continues to be a lack of consensus on overarching topics.

The technology for DSM is unproven. The deep sea is an inhospitable place with near-freezing temperatures, 5,000+ pounds per square inch of pressure, and corrosive saltwater that tears up equipment. Repairs at sea need to be done at the surface. The Area proposed for mining, the Clarion Clipperton Zone, is far from shore, and the nodules are found at 3,500- to 6,000-m depth. In fall 2022, one company had a technical failure and spewed a slurry of nodules overboard during a test, igniting an active and growing opposition. Another company speculates about the potential to selectively remove nodules with no visible life from a vehicle that hovers above the seafloor, but the technology to identify desirable nodules is not yet developed.

DSM would be incredibly capital intensive and shares characteristics with ocean-based oil and gas projects, which frequently run over budget. The "Area" and its resources are to be managed for the benefit of humankind, which would include revenue sharing from DSM, but the discussion of the royalty regimes and benefit sharing is far from complete, and there is little consensus. The many potential liabilities also add to financial uncertainty.

There are also reputational concerns. The ISA Secretariat has come under scrutiny for internal practices, from bullying of staff to excessive spending, and its Secretary General is reported to have given confidential information (reserved for developing nations) to a contractor. The corporate front-runners in the DSM space have been accused of siphoning funds and misleading investors and are being investigated by the US Securities and Exchange Commission.

The deep ocean is home to untold biodiversity. It is also a place of deep cultural import. It would be unwise to pursue a financially, technologically and environmentally risky venture such as DSM that has no practical regulatory regime. The only sure thing is that DSM will destroy our deep ocean. **ST**

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Annual Review & Forecast

****** *Oceanology International Americas*, February 14-16, San Diego, CA

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MARCH

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

****** *Ocean Business 23*, April 18-20, Southampton, U.K.

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

****** *Offshore Technology Conference*, May 1-4, Houston, TX

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MAY

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****** *OCEANS 2023 Limerick*, June 5-8, Limerick, Ireland

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Ocean Resources Development & Coastal Zone Management

**IMAGE 2023, August 27-September 1, Houston, TX

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Serving the Global Ocean C

International Submarine Races

The Human-Powered Sub Competition Returns Post-Pandemic

By Charles D. Behrle



The 17th International Submarine Races (ISR) were held June 25 to 30, 2023 at the David Taylor Model Basin at the Naval Surface Warfare Center (NSWC), Carderock Division in West Bethesda, Maryland. Nineteen boats and 350 team members, representing four nations, gathered to set up their respective sites and assemble their boats from packing crates that had arrived from as far away as Poland. A sense of excitement, wonder and nervousness was in the air as the teams walked around to check out the competition.

Sponsored by the Foundation for Underwater Research and Education (FURE), the goal of the ISR is to provide a premier capstone science, technical, engineering and math (STEM) challenge that combines learning in the classroom, lessons from laboratory experiments

and small-scale testing results to design, build, test, and operate a submerged human-powered submarine over a timed 100-m course.

It became clear to the FURE volunteers that the four-year, in-water hiatus during the COVID-19 pandemic presented additional challenges. Returning teams no longer had anyone with knowledge of and experience at David Taylor Model Basin, so the learning curve was steep, and early week progress was slow.

Navy Leadership

The race was again hosted by the Naval Surface Warfare Center, Carderock Division, the U.S. Office of Naval Research, and the Program Executive Office (PEO), Submarines. The race enjoyed visits from senior

Navy officials, including Senior Executive Service members Dr. Brett Seidle, Deputy Assistant Secretary of the Navy for Research, Development, Test and Engineering; Matthew Sermon, Executive Director PEO Strategic Submarines; Michael McClatchey, Executive Director for PEO Undersea Warfare Systems; and Stefanie Link, Executive Director, in-service submarines, PEO Attack Submarines. NSWC Carderock leadership made several visits during race week as well. Each of these visitors spent significant time speaking with students about their accomplishments and future plans.

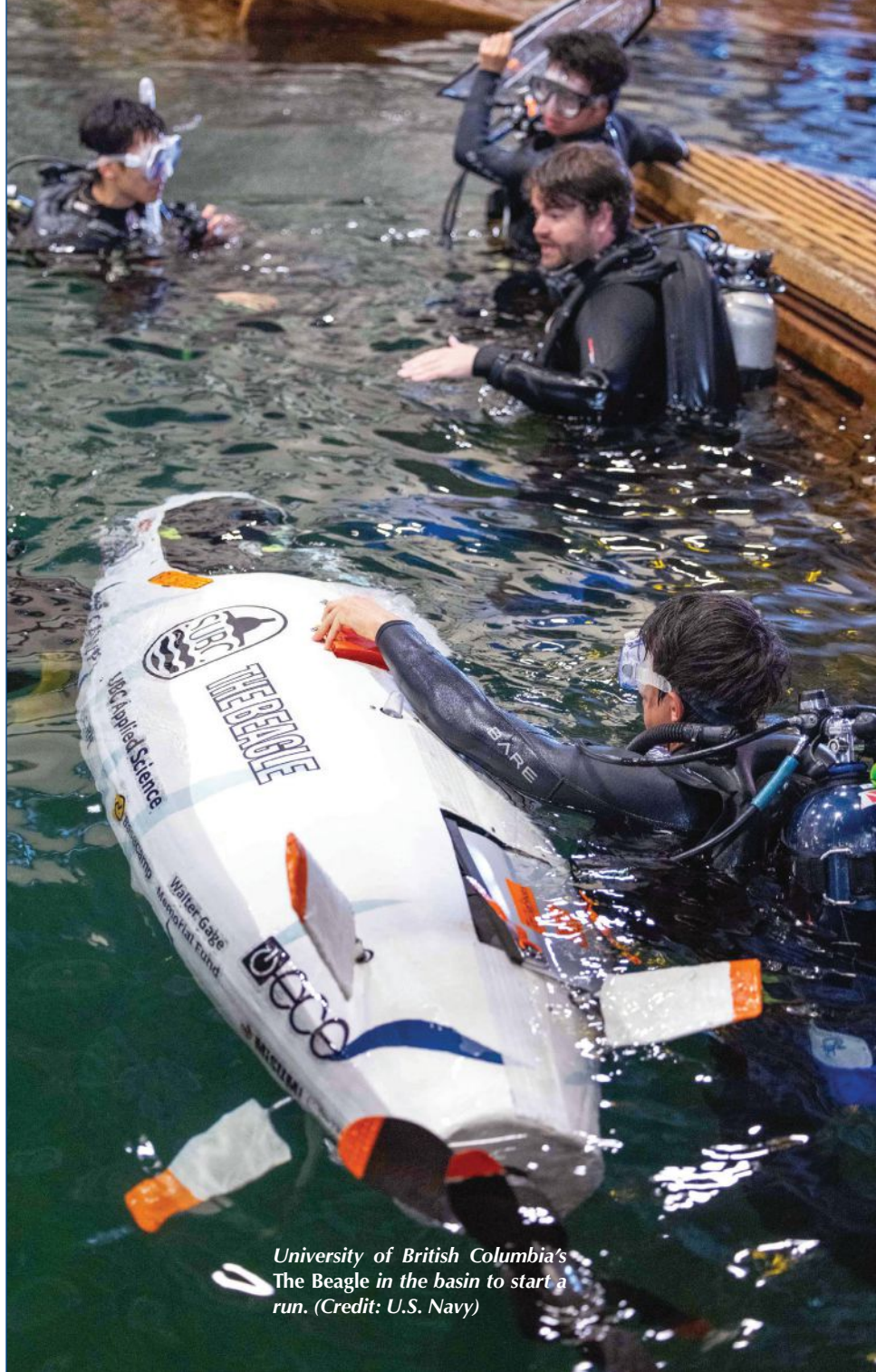
Sponsors

Industry and professional organizations provided significant financial support to ISR 17. Platinum-level sponsors included Maritime Technology Alliance. Gold-level sponsors included Gibbs & Cox, a Leidos Co. and Onshape PTC. The Scholarship sponsor was Poseidon International. Silver-level sponsors included American Systems, the Naval Submarine League and Patrona Corp. Bronze-level sponsors included Amentum, Behrle & Associates LLC, ELS Inc., Captain Christopher Pietras (U.S. Navy, retired), Qualisys Motion Capture Systems, Rite-Solutions, the Society of Naval Architects and Marine Engineers, Strategic Insight Ltd., Jamieson's Peace, and THOR Solutions LLC.

ISR 17 Participants

Participating universities included: the Polytechnique Montréal from Montreal, Canada, with *Archimede 9*; Florida Atlantic University with *Atlantic III*; University of Michigan with *Stingray*; University of Victoria from British Columbia, Canada, with *Sockeye*; University of Warwick from Coventry, U.K., with *Man-o-Warwick*; École de Technologie Supérieure from Montreal, Canada, with *Omer 12*; Virginia Polytechnic Institute and State University with *Kraken* and *Nautilus*; University of California San Diego with *Calypso*; University of British Columbia from Vancouver, Canada, with *The Beagle*; Gdansk University of Technology from Gdansk, Poland, with *Nautilus 2*; Texas A&M University with *The Maroon Marauder*; and University of Washington with *Orca*.

High-school teams included: Frederick County Career and Technology Center from Frederick, Maryland, with



University of British Columbia's *The Beagle* in the basin to start a run. (Credit: U.S. Navy)

Moby Dick; Dover Area High School of Dover, Pennsylvania, with *Cormorant*; Sanborn Regional High School from Sanborn, New Hampshire, with *Nautilus*; and Sussex County Technical School from Sparta, New Jersey, with *Umptysquatch X*.

Two independent teams also participated: Kids Into Discovering Science (KIDS) from Accokeek, Maryland, with *Propulsion*; and Impulse Submarines from Annapolis, Maryland, with *Javelin*.

Awards

Race week concluded with an awards ceremony

featuring the guest speaker Vice Admiral Francis Morley, Principal Military Deputy Assistant Secretary of the Navy for Research, Development & Acquisition. Morley thanked the participants for their hard work, persistence and out-of-the-box thinking in attacking a very difficult engineering challenge. He discussed where the U.S. Navy is heading with its submarine force and the many challenges it faces with new designs and shipbuilding programs. He emphasized that the United States needs young men and women such as ISR's participants to enter the Navy, federal service and the Navy's pool of industry partners to meet the challenges ahead.

The Overall Performance Award. A plaque and \$1,000 cash award were given to the submarine team from any design category that displays the best overall performance. Seventeen weighted parameters were ranked to determine the figure of merit. The analysis includes aspects of other awards and

***“The whole experience of teamwork,
often under pressure,
is something they take into their future careers”***

the team's attitude, persistence, and resourcefulness. This award was sponsored by the Maritime Technology Alliance. The runner-up team in this category received a plaque and \$500.

The winning team was *Omer 12* from École de Technologie Supérieure for its two-person, non-propeller submarine.

The runner-up team was the one-person, propeller-driven submarine *Orca* from the University of Washington.

The Most Innovative Propulsion System (Nonpropeller) Award. A plaque and \$750 cash award were

given to the submarine team from any design category that successfully incorporated the most innovative design and performance for a non-propeller propulsion system. This award was sponsored by Captain Christopher Pietras.

The winner of this award was *Omer 12* for successful development and operation of the submarine's counter-rotating Voith Schneider propulsion units. The use of two Voith Schneider systems enabled the pilot to control the direction of the thrust generated by each system independent of the other using electronically controlled stepper motors. The thrust can be used by the pilot to control depth and direction of the submarine.

The judges also awarded an honorable mention to KIDS's boat *Propulsion* for its flap/rowing system using automatically spring-loaded flaps that close moving forward and open when pulling aft.

The Best Use of Technology Award. A plaque and \$750 cash award were awarded to the team in any design category that exhibits the best and most successful use of technology to support their vessel's design, construction and/or performance. This award was sponsored by the Patrona Corp.

The winner was *Umptysquatch X* from Sussex County Technical School for the successful development and use of an autonomous self-correcting buoyancy system. This system maintains both the submarine's trim on an even keel and the submarine's neutral buoyancy at a set depth. The system can ballast or deballast during the submarine's run and can also transfer water between the forward and aft trim tanks to maintain the proper trim on the vessel.





University of British Columbia team members working on The Beagle. (Credit: U.S. Navy)
(Left) University of Washington's Orca at the start of a race. (Credit: U.S. Navy)

The Spirit of the Race Award, in memory of the late ISR contestant Steve Barton of team *Sublime*, is selected by the contestants themselves to recognize the team that displays the best gusto, fortitude, support for other teams and overall best spirit. This year's winner was the *Omer 12* team.

The Fastest Speed Awards were given for a combination of: one- or two-person boats; propeller or non-propeller boats; and independent, high-school and college-level teams. The winner of the one-person, propeller, college category was *Stingray* at 2.613 kt. The winner of the two-person, nonpropeller, college category was *Omer 12* at 1.564 kt. The winner of the one-person, propeller, high-school category was *Umptysquatch X* at 2.648 kt. The one-person, propeller, independent-team winner was *Javelin/Impulse* submarines at 0.863 kt. The winner of the one-person, nonpropeller, independent category was *Propulsion* at 0.224 kt.

FURE also awarded two \$2,000 scholarships to Grace Revoredo, a 2023 graduate of Sussex County Technical School who will matriculate to Albert Dorman Honors College at New Jersey Institute of Technology to pursue a degree in chemical engineering, and Luis Villa Castro who attends Florida Atlantic University.

Other Awards. The Absolute Speed winner was *Umptysquatch X* for a one-person, propeller-driven submarine with a speed of 2.648 kt.

The Best Design Outline Report Award was won by University of Warwick with *Man-o-Warwick*.

The Smooth Operator Award was awarded to a team in recognition of their efficiency in staging for the race course, racing the course, troubleshooting as necessary and otherwise preparing for their next run. The winner was *Stingray* from the University of Michigan.

The Experience

To FURE, a successful race week provides an experience that goes beyond the classroom; growth opportunities for participants across a spectrum of skill sets; and help in preparing the next generation of marine engineers.

"The whole experience of teamwork, often under pressure, is something they take into their future careers," said Nigel Denton, project adviser for the University of



Orca's control system. (Credit: U.S. Navy)

Warwick. "There's nothing like breaking the drivetrain and having to get it sorted and managing it within about three hours to concentrate the minds on how to overcome frustrating situations. It's not until they experience the event that they understand what it is they need to learn."

"Race week provides an intense team-building opportunity where the kids see how their unique contributions support the whole effort," said Paola Carls, adviser to KIDS. "It gives them a good perspective for life." She noted that KIDS participants have pursued physics and engineering degrees as a result of the project. "One student became a project manager because of skills learned during submarine team." In contrast, some students realized, "I had fun on sub team, but engineering is not for me.' That's a useful takeaway."

"Hard work and dedication to the project are a must," said Dylan Calvetti, member of the Texas A&M team. "We spent most of the past year with little to no funding and had to retrofit many of our old submarine parts to fit our current hull. I have learned to expect plan A and maybe plan B to fail so having contingencies and on-the-fly brainstorming is always good." Calvetti is a 2023 graduate and will begin his career with Huntington Ingalls Industries (HII) at Newport News shipbuilding as a propulsion engineer.

As a first-time entry, the father-and-son team Impulse Submarines with the one-person, propeller-driven submarine *Javelin* had a disappointing start to race week because of steering problems. The team worked through the night making modifications to the control surfaces and switching out the propellers. Success followed on their next attempt. Brian Barone, the father, said, "That experience of missing the mark, digging deep, not giving up and finding solutions was a huge learning lesson for Quinn [his son]." He added, "We were simply overwhelmed by the generosity and goodwill of all the participants, which vastly exceeded our expectations. We had very few divers available, mostly myself and my wife, and folks from the other teams came out of the woodwork to help us. We were one of the smallest teams in the race, but it also felt like everyone there was a part of our team."

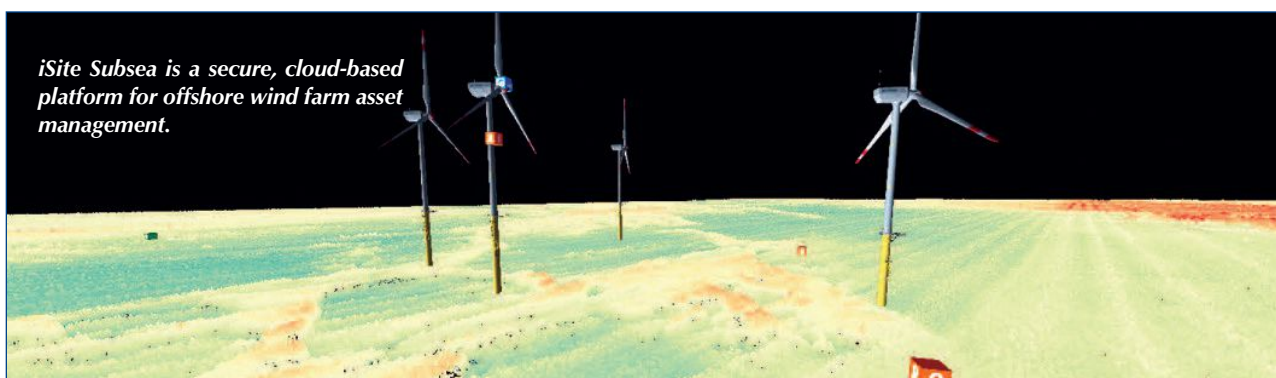
The event was a success by every measure. The contestants departed knowing they had given it their best, and they joined the unique community of human-powered submarine race veterans in the process. We look forward to ISR 18 in June 2025. **ST**

Charles D. Behrle is the president of FURE and principal at Behrle & Associates.

Subsea Asset Management

3D Data Visualization for Offshore Wind Farms

By Greg Hammond



Throughout the initial planning, construction and later operational phases of an offshore wind farm's life cycle, vast amounts of data are generated from various sources, producing extensive records and maintenance logs. Managing and processing this large volume of data can be challenging, especially considering the variety of data formats, users and teams who need access.

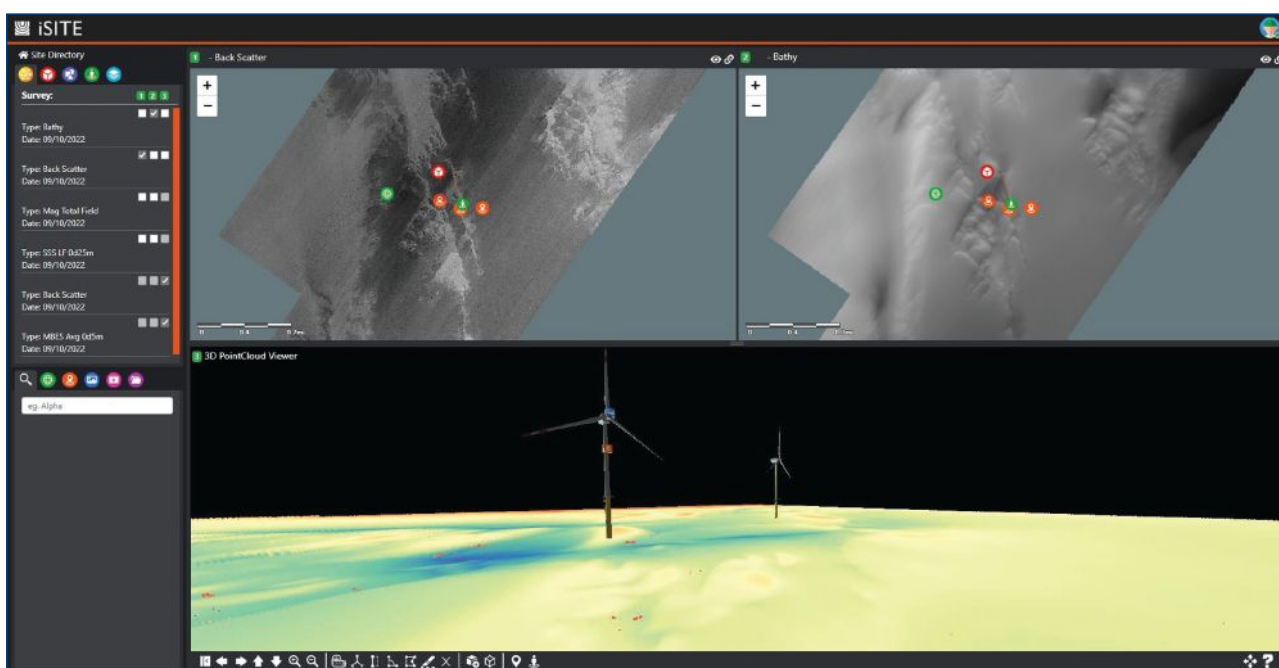
Subsea data are often collected at different stages by a multitude of stakeholders, including wind farm developers, operators, contractors and maintenance teams. Ensuring data transfer, accessibility, awareness and interoperability across different systems, formats and organizations can be a complex and disjointed endeavor. Subsea data can also be time sensitive, especially in scenarios where rapid action is required, such as detecting potential hazards.

Proper data management in this context refers to the effective acquisition, storage, analysis and utilization of data and critical safety logs, records, and operational information from above and below the waterline. This can include geodata on the seabed, array and export cable route planning, turbine foundation inspections, and on-shore and offshore substation records. A great deal of time and attention is paid to who, how, what and when data and information will be collected; however, what

happens to this key project information after acquisition is often overlooked.

Following the acquisition, this critical information needs to be securely stored and available for use throughout the minimum 20-year lifespan of a field. Developers and operators are often faced with challenges presented by disorganized, fragmented or missing data, and software limitations. This can hinder access to data for the asset owner and third parties prior to inspection, repair and maintenance operations and prevent comparison of data over time, resulting in delays to work schedules and additional unnecessary mobilizations to the asset. The limited availability of existing information can negatively affect decision making, with time and budget routinely wasted searching for historic information.

We live in a world where cyberattacks, unauthorized access and data breaches are a real threat; therefore, choosing a data management solution with robust security measures, encryption protocols, and strict access controls is crucial to safeguard sensitive subsea data and maintain data privacy. Storing and managing large volumes of subsea data also requires adequate infrastructure, including reliable storage systems, high-speed networks and scalable computing resources, which can be a particular challenge in remote locations.



(Top) The platform provides stakeholders with the necessary data and insights for planning, operations and maintenance. (Bottom) Display featuring seabed geodata.

In addition to the need for effective collection and storage, extracting meaningful insights from subsea data in a timely manner is required for optimizing offshore wind farm operations and reducing downtime. Advanced data management and analytics techniques can enable effective data-driven decision making if the right tools are in place.

Secure, 24/7 Cloud-Based Platform

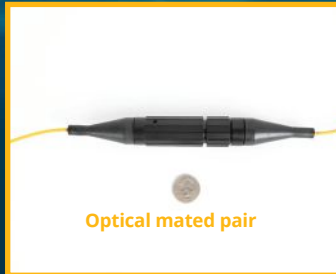
Addressing this multitude of challenges requires a

smart approach that combines technology, industry collaboration and best practices in data management. A streamlined end-to-end service delivery, including data input, storage, visualization and interaction can significantly enhance management efficiency for offshore wind farms, ensuring that the latest and correct data sets and information are always available to users while eliminating the risk of double handling, incomplete entries, multiple versions, and lost or inaccessible data.

iSite Subsea, developed by UTEC, a geo-services brand in Acteon's Data and Robotics division, is a next-generation cloud-based platform that gives users an intuitive visualization of subsea assets and data. Operators can source, view, manage and report on seabed, survey, and asset data using a single, secure cloud-based interface. It

Finally.

Compact Wet Mate connector technology has arrived.

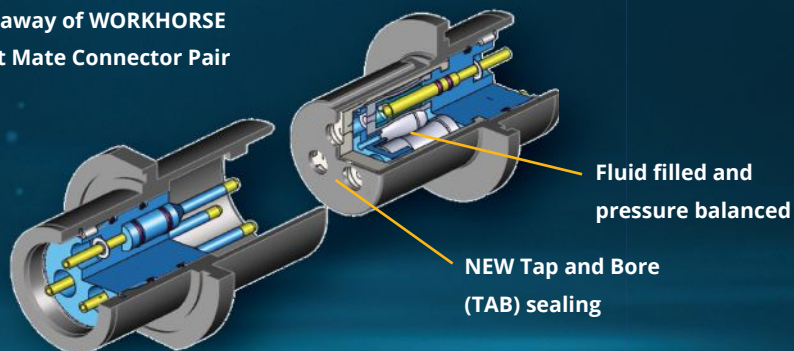


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technology on page 26.**

“Implementing a digital solution for asset management can enable remote monitoring and control of subsea assets.”

enables interrogation and comparison of data over time, remotely, 24/7 and without need for specialist software knowledge. iSite Subsea helps to optimize performance, reduce costs and lower risks while enhancing health and safety and enabling better informed and faster decision making.

The platform simplifies the digital handling and delivery of various surveys and inspections throughout the life span of a subsea asset or field, including geophysical, geotechnical and maintenance surveys, as well as structural integrity monitoring. It provides developers, operators and contractors with the necessary data and insights to plan, assess and address safety, environmental, and risk-related scenarios.

For users seeking to consolidate essential georeferenced survey and inspection information, iSite Subsea is an ideal solution. It seamlessly interfaces with existing databases, resulting in additional long-term cost savings.

The Benefits of a Digital Solution

The UTEC team responded to the industry challenges outlined earlier in this article by creating an interactive graphical visualization, enhanced with “critical” data, as a powerful tool to drive informed decisions.

iSite Subsea can facilitate digital delivery to stakeholders by: consolidating data from any source in any format, including videos, documents and reports; bringing structure and accessibility to data management; futureproofing data storage and management via the cloud; making data centrally accessible to developers, the supply chain and third parties; preparing the asset for a lifetime of data management from the offset, thus providing consistency; enabling parallel comparison of data over time; offering intuitive measurement and interrogation tools; managing large volumes of data for entire wind farm operations; and facilitating remote desktop access to assets 24/7.

Implementing a digital solution for asset management can enable remote monitoring and control of subsea assets. This capability eliminates the need for frequent manual inspections and reduces the exposure of personnel to hazardous environments. Remote operations also minimize the reliance on expensive vessel mobilizations, as asset owners can remotely access data, monitor asset performance and plan operations without physically deploying personnel to the site. This not only enhances safety but also reduces operational costs and environmental footprint significantly.

Collaboration among multiple stakeholders involved in subsea asset management enables knowledge sharing

so asset owners can benefit from the collective expertise, avoid duplication of work and optimize resources.

The benefits of the iSite suite are clear from a user survey, with the following results: 87 percent of respondents recorded significant cost savings, principally from fewer physical site mobilizations; 100 percent stated that they leverage value from iSite multiple times per week; and 35 percent observed that it brings more effective communication and project planning advantages multiple times on a daily basis.

Extended Capabilities

For more than 10 years, offshore platforms, vessels, FPSOs and onshore facility owners have been enhancing safety and reducing costs significantly using the iSite suite. The original iSite product was launched in 2012 and now has over 3,000 users managing more than 50 assets globally. This digital platform has been widely recognized, including winning the prestigious Press and Journal Gold Award for Innovation.

The iSite solution can service the balance of plant above the waterline as well as below, extending to offshore and onshore substations. The platform’s visualization capability enables the user to tour any asset, take accurate as-built measurements onscreen, and view or download all project deliverables in multiple formats, such as drawings, 3D models, photos, reports and high-definition point cloud for engineering purposes.

Operators need to support their existing infrastructure with customized information management systems, including structured query language (SQL) databases and mobile solutions to fulfill reporting requirements. iSite is a scalable solution that can be tailored to meet these requirements while providing direct integration with existing integrity and maintenance information, whether that be held in MS Excel sheets, SAP/IBM Maximo databases or as files within folder structures. This is achieved through iSite Inspect, a client-specific data handling and reporting suite that can be implemented as a standalone service or applied as an integrated module within iSite or iSite Subsea.

To find out how the iSite suite could help reduce costs, lower risk, enhance health and safety, and better inform decisions for your assets, visit: <https://acteon.com/products-services/isite>, where you can also book a demo. **ST**

Greg Hammond is the digital lead at UTEC.

USV for Nearshore Survey

Small, Lightweight Unmanned Solution Offers Flexibility

By Chris Blake



Unique Group's in-house R&D department enables advancements in seabed engineering technologies and techniques.

Sea floor engineering involves a range of activities focused on designing, constructing, installing and maintaining structures and systems both on and below the seafloor. Modern seafloor engineering has undergone significant advancements. These improvements can be attributed to the integration of advanced technologies such as ROVs, AUVs and robotic systems that have revolutionized the field. These cutting-edge tools enable precise inspections, maintenance and installation operations even in challenging underwater environments.

Advancements in the field include the utilization of remote sensing and mapping techniques. Modern methods employ high-resolution sonar systems, such as multibeam bathymetry, and satellite imagery to accurately map the seafloor. These technologies enable suitable locations for infrastructure placement and potential hazards to be identified; the optimization of design choices; and the minimizing of environmental impact.

Modern seafloor engineering takes a proactive approach to environmental sustainability. Projects now prioritize the least ecological impact; protection of marine habitats; and implementation of measures for waste management, noise reduction and emissions control. By considering these environmental factors, the industry strives to maintain a balance between engineering progress and the preservation of our delicate ocean ecosystems.

Small and Light USV

Unique Group, a company of global innovators in subsea technologies and engineering, has emerged as a leader in the field by developing state-of-the-art solutions, such as the Uni-Pact USV. Utilizing over 30 years of experience to build the best-in-class unmanned survey solutions, the development of Unique Group's USV technologies has been instrumental in creating more opportunities to remove personnel from high-risk environments



The Uni-Pact USV supports various near-shore applications.



and dangerous offshore conditions by enabling remote monitoring operations to be managed from onshore.

Uni-Pact, one of Unique Group's leading USVs, is a small and light unmanned solution (length 3 m, beam 1.6 m, draft 0.45 m and weight 412 kg) that is adaptable for various applications. It can be used to support a wide variety of nearshore projects, such as hydrographic surveys, data harvesting, UXO (unexploded ordnance) surveys, coastal and harbor monitoring, habitat mapping, seabed mapping and classification, data harvesting, and survey of freshwater reservoirs where the use of petrol and diesel engines is prohibited.

Designed and developed in house by a specialist team of engineers, the Uni-Pact's compact, versatile and stable nature enables it to complement larger, traditional manned survey vessels. These vessels are typically longer than 35 m and ideally have a small crane capable of deploying the Uni-Pact quickly and efficiently on site. The Uni-Pact can also work in conjunction with a small traditional manned survey vessel, and it can act as a force-multiplier with any traditional manned survey vessel so as to double the survey coverage and reduce time on site. Uni-Pact is designed to operate in locations where conventional platforms struggle to perform. With a survey speed of up to 4 kt., the USV can operate over Wi-Fi, mesh radio or 4G without the need for costly satellite communication.

The Uni-Pact offers several advantages in seabed engineering. Survey time is significantly reduced, compared to traditional methods, resulting in cost savings for clients. The USV is environmentally friendly. It operates using electric engines, generating zero noise and emissions. This eco-friendly approach minimizes disruption to the aquatic ecosystem and aligns with sustainability goals. Another benefit is its autonomous and remote capabilities, enabling surveyors to monitor projects from a distance. This feature enhances both safety and efficiency in the surveying process. Additionally, the Uni-Pact USV offers quick and easy deployment. Its lightweight and user-friendly design simplifies surveying, making it an accessible solution, especially for near-shore projects.

Bathymetry Survey in Australia

The Australian Institute of Marine Science (AIMS) partnered with Unique Group to perform a carbon-conscious bathymetric survey at Cape Ferguson in April 2022 for an upcoming jetty extension project. The goal was to acquire bathymetry data for seabed modeling. Unique Group's Uni-Pact USV was selected as the autonomous survey vessel to meet the client's requirements.

The project encountered several challenges, including managing tidal swings, scheduling battery recharge based on tide conditions, and dealing with patchy 4G coverage. Unique Group's Uni-Pact USV, equipped with the NORBIT iWBMS (wideband, high-resolution multibeam) and a sound velocity probe, proved to be the ideal solution for the project. The USV, although capable of over-the-horizon navigation and sensor control via its 4G connectivity, was operated on site via its Wi-Fi and mesh radio links. The 4G connectivity did enable remote monitoring from Brisbane, over 900 km away.

The project's success showcased the time-saving, cost-efficient and eco-friendly nature of the Uni-Pact USV, earning high praise from the client.

Inshore Pipeline Survey in the Netherlands

Modus, a specialized survey company, was tasked with surveying an existing 36-in. pipeline along a 177-km route, including a challenging inshore portion, in November 2022. Traditional inshore survey vessels faced difficulties in conducting surveys in such shallow waters. To address this, Modus partnered with Unique Group and utilized the Uni-Pact USV.

The main challenge of this project was integrating multiple survey sensors onto the Uni-Pact, including the Teledyne TSS HydroPACT 660E pipe tracker, NORBIT WINGHEAD multibeam echosounder and FiGS CP (cathodic protection) system. Unique Group proposed a novel configuration: mounting the TSS 660E on a raft pushed ahead of the USV, with the FiGS CP sensors mounted on the deck and the NORBIT multibeam fitted to a retractable survey pole. This provided enough sensor isolation to enable satisfactory operation of all systems simultaneously.

The Uni-Pact's shallow draft, along with the innovative sensor configuration, allowed for simultaneous data collection and satisfactory operation of all systems. The USV's autopilot coped well with the additional weight, and its dedicated onboard PC running survey software ensured flexibility and easy reconfiguration for different survey requirements. The success of the project demonstrated the benefits of the Uni-Pact USV's adaptability in the field and its ability to acquire high-quality data in challenging environments.

Conclusion

Unique Group remains committed to innovation and efficiency, continually developing its USV technologies to provide greener surveying solutions. With electric motors that enable the capability to conduct nearshore surveys without emissions or noise, these USVs contribute

to sustainable operations and help reduce the industry's carbon footprint.

Commitment, curiosity and consciousness are the values that remain at the forefront of operations at Unique Group. The aim is to approach every project with safety, quality, innovation and environmental consciousness. In line with the company's values, its highly skilled in-house R&D department has enabled the development of USV technologies to provide a greener approach to survey applications. The company's vision is to drive sustainable operations for itself and its clients. Year over year, the company is making a 4 percent improvement to reduce its carbon footprint.

As the industry moves toward a greener future, innovative USV technologies such as Uni-Pact will continue to drive advancements in seafloor engineering and survey, supporting the growth of renewable energy projects and ensuring efficient data acquisition for various marine applications. **ST**

Chris Blake is the vice president of survey at Unique Group. He has over 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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Polar Monitoring

CHINARE's Submerged Buoys Enable Long-Term Polar Observation

By Haifeng Zhang • Yinyue Xia • Jianming Pan

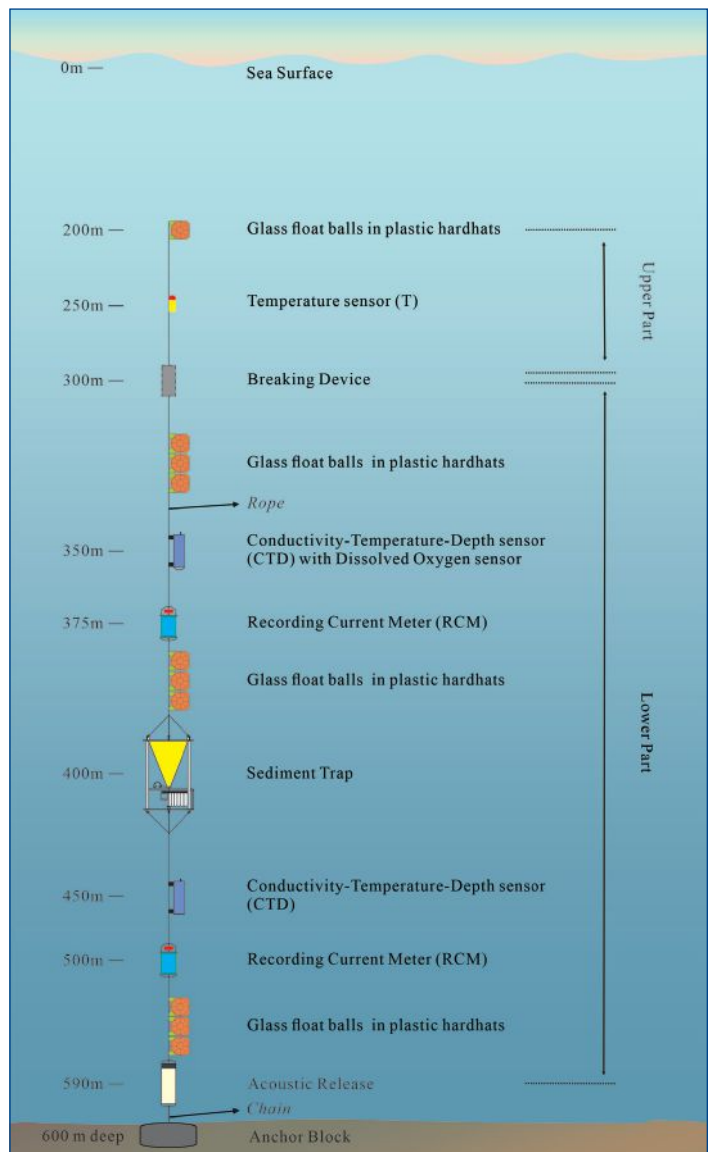
Oceanographic moorings play a crucial role in the three-dimensional monitoring of the ocean, enabling fixed-point, long-term and multiparameter observation of the marine environment. Subsurface moorings in the form of submerged buoys have become a primary tool for seabed observations in polar oceans due to their advantages of long observation times, concealment and less disturbance by sea surface meteorological conditions. Improving their safety and reliability continues to be a challenge.

Submerged buoys are a staple of the Chinese National Antarctic/Arctic Scientific Expedition (CHINARE). The first CHINARE submerged buoy was deployed in the Southern Ocean through Sino-U.S. cooperation during the 15th Antarctic cruise (1998 to 1999). It was successfully recovered during the subsequent cruise, marking a significant milestone for CHINARE's submerged buoys in polar oceans. This program was suspended for 10 years until it was resumed during the 26th Antarctic cruise in 2009 to 2010.

In the Arctic Ocean, CHINARE's submerged buoys started operating during the second Arctic cruise in the summer of 2003. From 2003 to 2023, submerged buoys have become a routine operation of CHINARE, promoting long-term observation and oceanographic research in polar oceans.

Since CHINARE's first Antarctic cruise in 1984, it has carried out 39 Antarctic cruises and 12 Arctic cruises. The authors of this article have participated in more than 20 CHINARE cruises, engaging in the deployment, recovery and related studies of submerged buoys for an extended period. This article summarizes the progress and challenges faced by

A typical CHINARE submerged buoy design. (Credit: Haifeng Zhang)





CHINARE in submerged buoy polar observation; shares some research based on mooring data; and calls for further collaboration and discussion to advance polar ocean observation technology.

Mooring Setup

A typical CHINARE submerged buoy consists of an anchor, some chains or lines for instrument attachment, and flotation devices to prevent the line and instrumentation from sinking to the seafloor. The attached instruments include: CTD sensors, seawater chemical sensors, current meters or acoustic Doppler current profiler, and a sediment trap.

To prevent damage caused by drifting icebergs in the Antarctic Ocean, a cylindrical “breaking device” has been developed and mounted on submerged buoys about 300 m below the sea surface. It is designed to break into two pieces when tension exceeds 300 kg. If the submerged buoy is dragged by an iceberg, the upper part above the breaking device will break off, while the lower part below the device will remain intact, similar to a gecko discarding its tail to escape. This breaking device demonstrated its effectiveness when the lower part of a submerged buoy was recovered from the eastern part of Prydz Bay during CHINARE’s 31st Antarctic cruise.

Deployment and Recovery

With decades of operation, CHINARE has acquired extensive knowledge in the deployment and recovery of oceanographic moorings in polar oceans, utilizing the RV *Xuelong* and RV *Xuelong 2* as primary operational platforms.

For deployment, CHINARE typically uses the internationally recognized anchor-last technique. The entire mooring is sequentially deployed into the water from top

to bottom, with the anchor being the last component to be dropped at a predetermined location.

During recovery, although ultimately relying on the winch or crane on board to complete the final step, one of two methods is used, depending on whether recovery is boat or ship based, each with its own advantages and disadvantages. Ship-based recovery involves using the recovery vessel as a mobile platform to capture the target. Boat-based recovery involves using rubber or steel small boats carried by the recovery vessel as mobile platforms. Practical experience suggests that when the waves exceed 1 m, the wind speed is more than 10 m/s, or the sea ice concentration is more than 60 percent in the operating area, ship-based recovery is a better method than boat-based recovery.

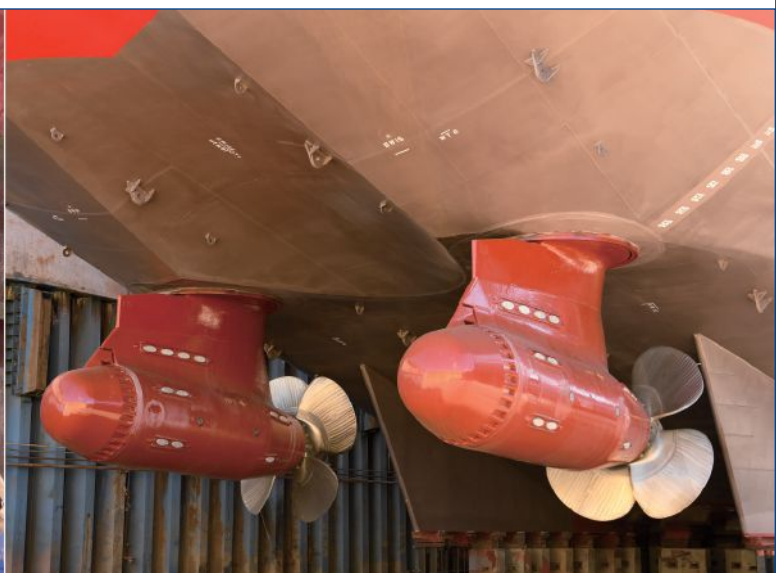
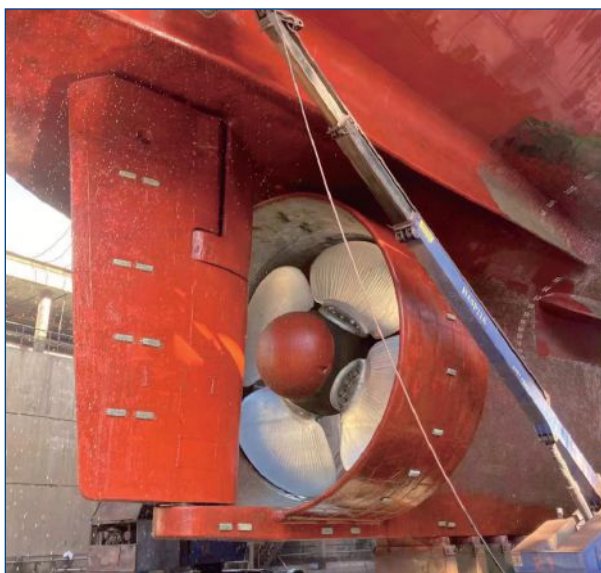
Experience suggests that the recovery of submerged buoys in polar regions is a more challenging task than their deployment. The deployment process is generally safer and quicker due to the shallow water depth and shorter ropes in the shelf seas. However, there is a certain level of risk associated with the westerlies in the deep-sea region of the Southern Ocean. Conversely, adverse environmental conditions, particularly the presence of sea ice, can lead to various unexpected difficulties in the recovery process, potentially resulting in delayed or failed recovery of the buoys. Statistical results show that the recovery success rate of CHINARE’s submerged buoys in the past 20 years is about 82.8 percent, with sea ice or iceberg activity causing about 81.8 percent of the losses.

Overall Challenges

Meteorological Conditions. The unique marine environment in polar oceans is characterized by a high frequency of severe weather and rapid changes in meteorological conditions, which significantly affects the



Boat-based recovery (left) and ship-based recovery (right). (Credit: Bing Zhu and Jun Zhao) (Below) The propulsion systems of RV Xuelong (left) and RV Xuelong 2 (right). (Credit: Quan Shen)



recovery of submerged buoys. Convective weather processes can cause the wind to strengthen, the sea surface to surge and visibility to decrease. These conditions not only limit boat-based recovery but also seriously affect the window of ship-based operations. Closure of the recovery window due to weather factors frequently occurs during on-site operations in polar areas, necessitating changes in operational tasks and plans to create opportunities for recovery.

Sea Ice. Seasonal sea ice is another significant threat to the recovery of submerged buoys in polar seas. During the summer, sea ice melts rapidly and is highly mobile with the wind and current, causing rapid pile-up or dissipation. Even with the more mature international sea ice forecasting model, it is difficult to accurately predict the short-term movement trend of sea ice. When there is a

large area of ice on the sea, the moorings cannot float to the surface because the ice blocks the surface, or the surface may be partially obscured and an opening may be isolated by the floating ice, increasing the difficulty and potential failure of recovery.

Positioning Accuracy. The precise determination of the location of a submerged buoy is critical during recovery. The accuracy of a three-point positioning method used in deployment depends on the system accuracy of the acoustic release, which is affected by its data processing method, such as use of the default speed of sound in seawater (1,500 m/s). Previous study indicated that the error can reach up to 2 percent of the water depth. Moreover, the horizontal displacement caused by ocean currents as the mooring moves to the surface may result in the inability to accurately calculate where the

“With decades of operation, CHINARE has acquired extensive knowledge in the deployment and recovery of oceanographic moorings in polar oceans”

mooring will emerge on the surface. In polar seas, these errors and uncertainties may increase the risk of recovery operations with the presence of ice.

Ship Characteristics. The two recovery platforms during CHINARE cruises have their own advantages and disadvantages due to their structural differences. RV *Xuelong*, with its long hull and large displacement, has the disadvantage of a large turning radius, high operational difficulty and poor maneuverability. However, its ducted controllable-pitch propeller is protected by a circular flow deflector, making it more suitable for ship-based recovery. RV *Xuelong 2* is smaller and uses a new type of electric hoist propulsion system. Its diesel-electric propulsion has two new podded electric propulsion propellers, resulting in a small turning radius, more flexibility and strong maneuverability. However, due to the lack of protection from the flow deflectors, mooring lines are prone to entanglement in the propellers, meaning that boat-based recovery is more appropriate from *Xuelong 2*.

Research Observations

Research based on data from CHINARE's submerged buoys has contributed to the fields of physical oceanography, marine biogeochemistry and marine ecology. The CTD data obtained from the moorings in Prydz Bay have revealed that the strongest intrusion of the warmer modified Circumpolar Deep Water (mCDW) over the inner shelf from March to July is associated with the variability of westerly winds north of the shelf break from January to May. This intrusion is likely to reduce the shelf water density and threaten Antarctic bottom water formation.

The sediment trap samples have provided new insights into particle fluxes, primary production, biological pump efficiency, and trace element compositions and their relationship with the marine environment in the Southern Ocean polynyas. The composition and flux of siliceous micro-organisms (i.e., radiolarians, diatoms, dinoflagellates and sponge spicules) in the polynyas have shown strong seasonal changes, which are closely related to the unique marine environment of the study area, especially the seasonal changes in sea ice. Similar work has also been conducted in the Western Arctic Ocean, yielding new insights into sea ice-related marine ecosystems.

Our latest data reveal that there are 86 species of polycystine radiolarians classified into 49 genera and two orders in the trap deployed during 2014 to 2015 in a Prydz Bay polynya. Among these, 35 genera and 67 species of *Nassellarida* accounted for 77.91 percent of the total species, while 14 genera and 19 species of *Spumellaria* accounted for 22.09 percent of the total species. The individuals of *Nassellarida* were approximately 61.58 times more abundant than those of *Spumellaria*, and the flux

was two orders of magnitude higher. These data suggest that *Nassellarida* has a clear advantage over *Spumellaria* in terms of species density and flux, which is related to the nutrient supply of the waters in the polynya. This feature persists throughout the year, particularly in early summer when *Spumellaria* almost disappears.

Conclusion

Over the last two decades, CHINARE has conducted extensive submerged buoy monitoring and related research in the polar oceans. The recovery success rate during Antarctic cruises is approximately 81.3 percent, whereas it is 87.5 percent during Arctic cruises. Research based on polar submerged buoy data contributes to the fields of physical oceanography, marine chemistry and marine ecology, enabling a more profound comprehension of the marine environment and ecosystem in polar oceans and their relationship to global climate change.

CHINARE's polar observation tools still face challenges, such as unique meteorological conditions, sea ice distribution and iceberg activities, as well as the positioning accuracy and operational platform characteristics that affect buoy recovery. To overcome these challenges, improvements are necessary in meteorological support, route planning and technological innovation.

Acknowledgments

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We would also like to thank: Bing Zhu, Jun Zhao, Quan Shen and all the cruise members of CHINARE.

References

For a list of references, contact: zhanghf@sio.org.cn. **ST**

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Yinyue Xia is a senior engineer at the Vessel and Aircraft Management Division, Polar Research Institute of China, Ministry of Natural Resources. He has served as the director of the laboratory of RV Xuelong during CHINARE cruises and has extensive experience in marine scientific surveys in polar oceans.

Jianming Pan is a professor at the Key Laboratory of Marine Ecosystem Dynamics, Second Institute of Oceanography, Ministry of Natural Resources, China, with experience in polar ocean observation, marine chemistry research and ecological risk of hazardous chemicals.

Q&A: Dr. Jim Cairns

Jim Cairns has had a long and distinguished career as an inventor and entrepreneur in the field of oceanographic research. He studied under the late, legendary Walter Munk, one of the world's greatest oceanographers. Oceanographic research led Cairns to introduce underwater connector technology that has enabled critical programs throughout the world's oceans. His work continues with a new company to create his latest connector technology. He spoke with *Sea Technology* about his work in the industry over the decades and his most recent startup venture.

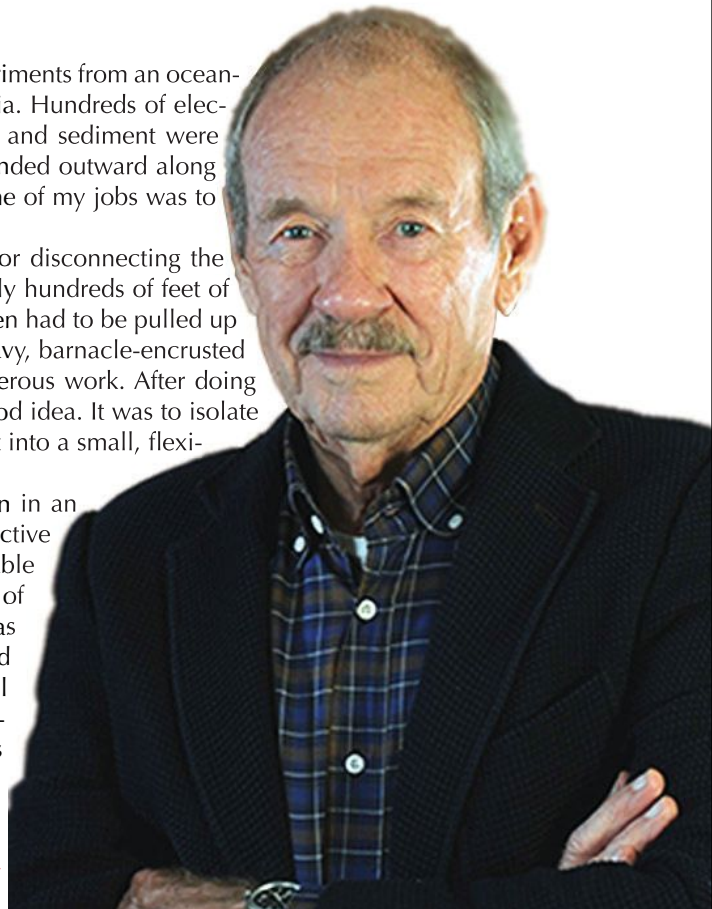
You patented the world's first oil-filled, pressure-balanced underwater connectors in 1968, followed eventually by 60 U.S. patents on subsea electrical and fiber-optic interconnect devices. What spurred the idea for your first patented invention?

As a young oceanographer in the 1960s, I conducted experiments from an oceanographic research tower offshore of Mission Beach, California. Hundreds of electronic sensors measuring various properties of the seawater and sediment were arrayed on cables that ran down the tower's 60-ft. legs, extended outward along the seafloor, then were buoyed upward in vertical arrays. One of my jobs was to keep them all working.

No reliable electrical connectors existed for connecting or disconnecting the sensors underwater. To replace a faulty sensor, it, and possibly hundreds of feet of cable joining it back to the topside instrument laboratory, often had to be pulled up for repairs. Diving under and around the tower, dragging heavy, barnacle-encrusted cables in murky, sometimes frigid water was grueling, dangerous work. After doing that hundreds of times, misery led me to a fundamentally good idea. It was to isolate the point of electrical contact from the seawater by moving it into a small, flexible chamber of benign, insulating fluid.

Its basic elements were to make the electrical connection in an electrically insulating fluid of choice, not corrosive, conductive seawater; provide that fluid in a flexible, sealed, penetrable chamber; and balance the chamber's interior pressure to that of the outside seawater to avoid pressure-induced leakage. I was able to secure the first patent ever filed on the oil-filled and pressure-balanced concept: U.S. 3,522,576. It contained all the basic elements of fluid-filled underwater mateable connectors that some years later revolutionized subsea operations worldwide.

Tell us about your relationship with the legendary oceanographer Walter Munk when you were a grad student at Scripps Institution of Oceanography. How did he influence

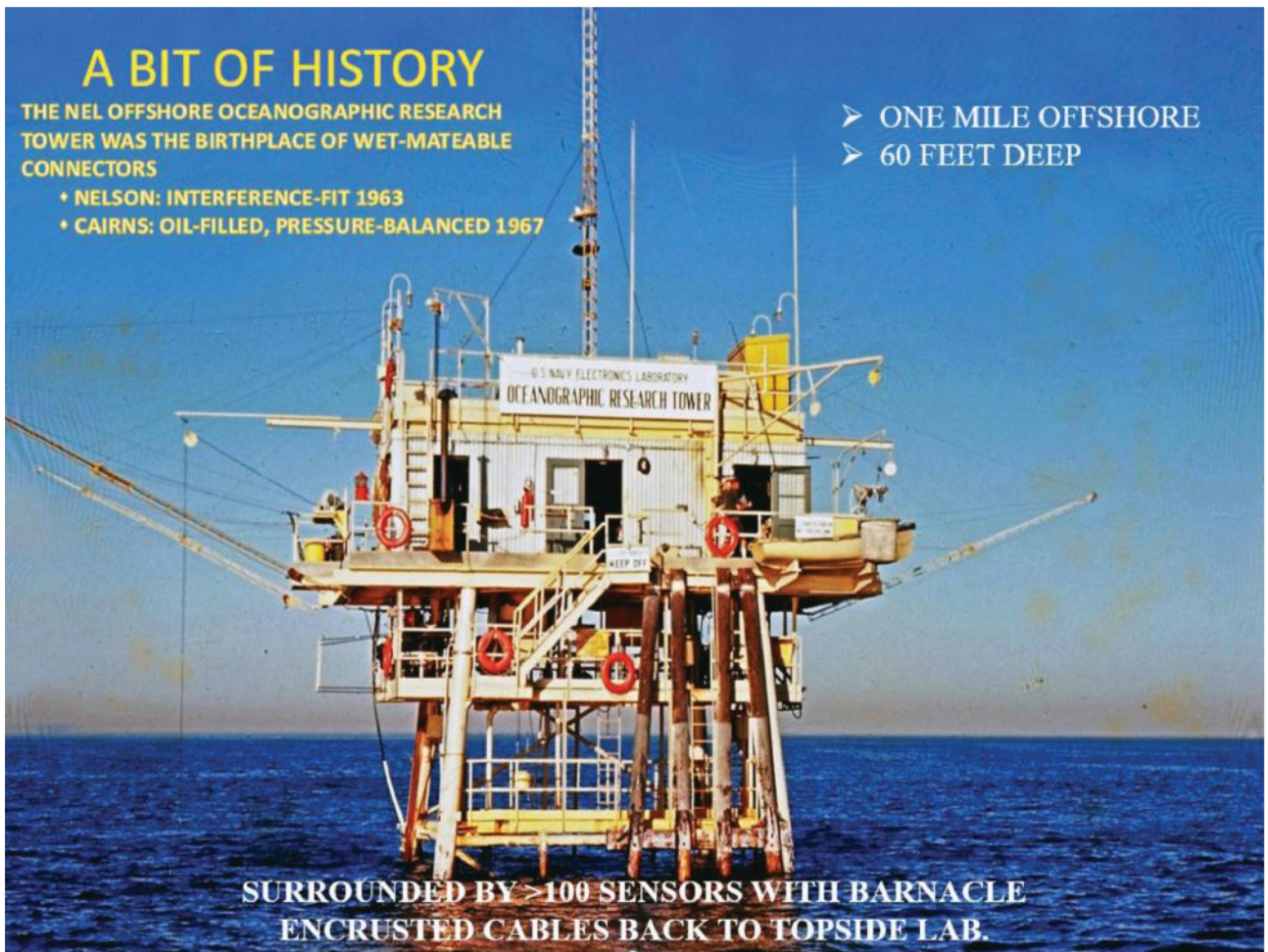


A BIT OF HISTORY

THE NEL OFFSHORE OCEANOGRAPHIC RESEARCH TOWER WAS THE BIRTHPLACE OF WET-MATEABLE CONNECTORS

- NELSON: INTERFERENCE-FIT 1963
- CAIRNS: OIL-FILLED, PRESSURE-BALANCED 1967

- ONE MILE OFFSHORE
- 60 FEET DEEP



SURROUNDED BY >100 SENSORS WITH BARNACLE ENCRUSTED CABLES BACK TO TOPSIDE LAB.

your work? What were the most important lessons you learned from him?

In 1969, I was accepted as a Ph.D. candidate at the Institute of Geophysics and Planetary Physics [IGPP] at Scripps Institution of Oceanography [SIO] at the University of California San Diego. Professor Walter Munk established IGPP on the SIO campus and for most of his later life conducted his research there. He became my thesis adviser and mentor. I worked in Walter's group from 1969 through 1976 both as a student and later as a post-doctorate researcher.

In late 1976, I accepted a three-year research position with NATO in La Spezia, Italy. Walter and I continued to work together long distance the whole time I was there. Those years in Italy changed my outlook on life, and when my NATO contract ended I decided to take some time off from research to see if I could make a living as an inventor.

I was nervous about telling Walter of my decision because we had worked together for so long and he had devoted so much time educating me as an oceanographer. I went to stay with him and his wife Judith to explain my plans. Instead of being upset, he urged me to follow my passion. He and Judith invested in my first startup business and in my other businesses that followed.

Walter taught me by example how to think clearly about complex problems. He had a wonderful mind ca-

pable of parsing the most daunting issues into a few basic, solvable elements. He always led the way for others.

His curiosity never wavered. Several days before his death I visited him in the hospital in intensive care. He asked me to bring some prototypes of a small invention which I was working on. Semi-reclined on his bed and adorned with tubes and sensors, he listened as I explained the parts laid out on his chest and, as usual, he asked pertinent questions. That was the last time I saw him.

You are not just an inventor. You're also an entrepreneur. What companies have you founded, and why did you start those businesses?

As a research scientist I seemed as far away from being an entrepreneur as one could imagine, but it was the only way to get my ideas into public use.

Independent inventors have two main paths open to them. One is to license or sell rights to their patented products. Early in my inventing career I took that path, licensing my patents many times to others. It was not very satisfying because I couldn't get my hands into the works, but it allowed me to accumulate enough funds to take bigger risks.

The independent inventor's other path is to set up a business to develop, produce and sell his invention. He becomes an entrepreneur.

In 1981, my friend John Folvig, who has a financial background, and I started our first business, Challenger Marine Connectors Ltd. Our financial investors were a few family and friends, including Walter and Judith Munk. Sectioned off by a low wall in part of an auto mechanic's garage and benefiting from all their fumes, loud music and cursing, we set up to manufacture underwater connectors. We purchased a mailing list from *Sea Technology* magazine and sent out a flier describing our only product. Within weeks, we received calls from several defense contractors. Soon after, Lockheed Corporation executives came to our shop. Almost immediately, they set us up in a proper facility, guided us technically and, two years later, purchased Challenger Marine for just under \$4 million.

In 1988, John, I, and the same close-knit investors started Ocean Design Inc. [ODI] based on new inventions. ODI grew steadily over the next two decades and was purchased by Teledyne Technologies in 2009 for approximately \$110 million.

Had I not become an entrepreneur, none of that would have happened.

What have been the greatest challenges you've faced in developing technology and in developing a business, and how did you resolve those issues?

Invention-based companies often begin with nothing more tangible than an idea or two. Simultaneously developing an invention and setting up all other aspects of a business is a formidable challenge. If you take it on, don't overestimate your own business talents. I got help in my weak areas, trying to leave as little to chance as possible. Others often eagerly identified my own shortcomings, for which I am indebted to them.

Another challenge is to convince the marketplace to

accept new technology. People are reluctant to put aside old technology that works, no matter how limiting it is, and switch to something better but unknown. Oil-filled connector technology was not fully embraced by the offshore oil industry until 15 years after its introduction. Persistence finally overcame the acceptance challenge.

Surprisingly, rapid success is another threat. Once fluid-filled connectors were accepted, orders came in faster than revenues. Money was needed to fill the orders before payments arrived from sales of shipped products. The best way around it is to have solid banking relationships in place beforehand, but that's not easy for a startup business. We almost lost our rapidly growing company because of it.

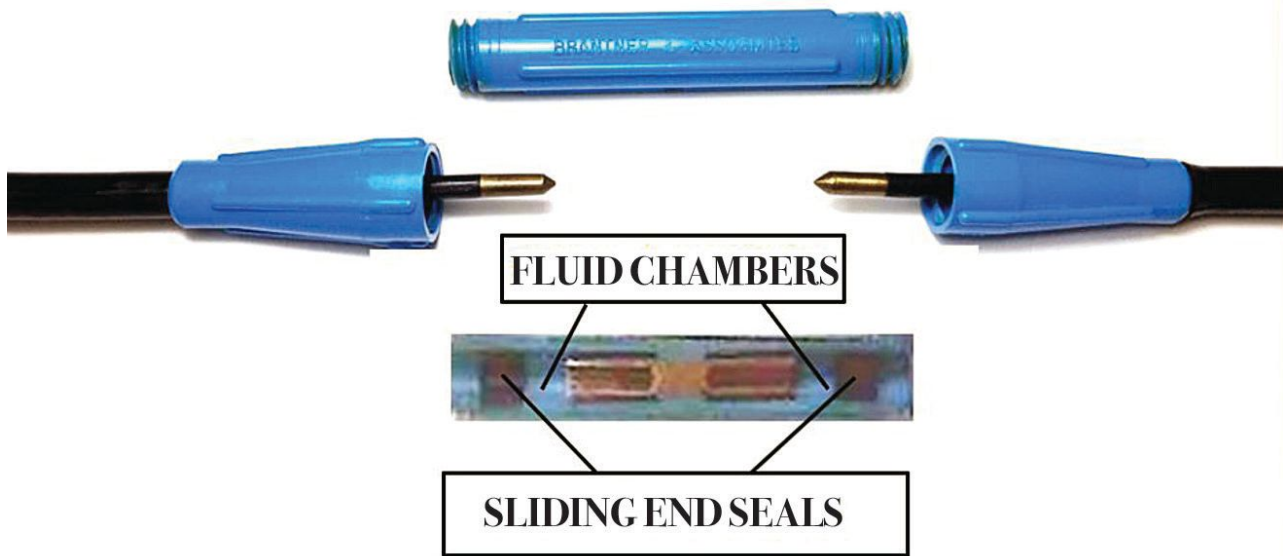
Finally, it's painful to let employees go who have been essential to the startup company but are no longer competent in the same role in a much larger company, but it must be done. Finding new roles for them in the growing organization was rarely possible.

You set up the Cairns Foundation to support the next generation of innovators. What made you decide to establish that charity? What philosophy/principles do you seek to impart to those students?

The Cairns Foundation was established in 2003 to encourage young people to develop their creative potential through mentoring and financial help. In its early years, it funded scholarships at Bethune Cookman University, a historical black institution.

Then from 2013 through 2022, in cooperation with local schools and government, the foundation hosted an annual Innovation Challenge to identify eager student entrepreneurs. Students applied for the opportunity to pitch their ideas to a large group of potential investors. Of the many applications received each year, six individ-

FIRST COMMERCIAL PRODUCTION OF US PATENT 3,522,576





uals or teams were chosen for the pitch competition. The first, second and third place winners received significant cash prizes totaling \$15,000. The first-place winner also received a one-year residency valued at \$5,000 at the University of Central Florida's Daytona Beach Business Incubator. The students were coached on how to set up nascent commercial activities; how to define, protect and mature their inventions; how to fund their operations; and how to avoid pitfalls along the way. I often had the opportunity to mentor those with invention-based business plans.

The prize money helped the winners get started, and participating in the challenge gave all pitch competitors a bit of much-needed public speaking experience. Several successful ongoing companies were hatched through the Innovation Challenge.

The foundation tries to impart to students that becoming an entrepreneur, even as an inventor, can be a viable career choice. As it did with me, it can start out as an avocation and mature into a full-time activity.

Your creations have enabled tech systems at offshore depths for diverse purposes. How do you see your tech fitting into the energy transition?

Alternate energy sources such as floating and fixed wind farms and ocean current and wave energy generators are proliferating, as are the devices to install and service them. Inspection and maintenance of the new submerged systems, as well as monitoring their security, all require flexible, easily deployed work vehicles such as drones. Lightweight, inexpensive cable and connector hardware for both electrical and optical systems will be needed. Not all have to be connected and disconnected subsea or in splash zones, but many do. Putting a 3-kilogram, \$100,000 wet-mateable optical connector on a small drone makes no sense. New connector options are required.

Optical contacts must be immaculate at the moment of engagement in order to function. That is often daunting in a dry laboratory, and a much greater challenge in

field use. That's one of the challenges we've addressed at my new company, Pontus. Pontus optical and hybrid electro-optical connectors can be connected and disconnected repeatedly subsea, or nearly anywhere else, without cleaning. They are small, lightweight and relatively inexpensive. They should address many of the connector industry's growing needs.

What are you working on now?

I've been working with a company I started, Pontus Subsea Connectors, to address the growing need for smaller, less expensive and more versatile harsh-environment connectors. Commercially available fluid-filled connectors and ancillary components have primarily been developed for rugged subsea use. Highest-quality electrical connectors and rolling-seal optical connectors are superbly reliable. They've been designed to withstand extremely rough handling and up to 30-year immersion at full ocean depths. But fluid-filled connectors currently on the market are limited. Unfortunately, none of them can be downsized appreciably due to several factors, including their complex chamber-sealing mechanisms.

The most crucial element of fluid-filled connectors is the penetrable end-seal that allows a plug pin to sealably enter and subsequently be withdrawn from a fluid chamber housing a receptacle socket.

Pontus has developed a remarkable new end-seal that does away with the springs, pistons, actuator rods and other mechanisms used to operate the end-seals in existing fluid-filled connectors. The new seal consists simply of an elastomeric end-wall with a crescent-shaped axial perforation. The uncut portion of the crescentic cut serves as a substantial elastic force to return the seal to its unperforated, sealed position when the pin is withdrawn. It's hard to imagine anything simpler.

The new sealing technique allows fluid-filled connectors to be much smaller, lighter, with reduced part count, and less expensive than current products. It should open up new markets for use with modern, lightweight systems.

“I’ve been working with a company I started, Pontus Subsea Connectors, to address the growing need for smaller, less expensive and more versatile harsh-environment connectors.”

Pontus connectors with the new one-piece end-seals can be connected and disconnected in almost any environment without further cleaning. Shipboard or terrestrial battle zones come to mind, as well as commercial outdoor and urban subterranean fiber-optic networks.

Anything you’d like to add or emphasize?

Before the availability of oil-filled connectors, the intervention of complex subsea systems was practically limited to diver zones. Now, nearly 60 years later, modularized assemblies can be constructed and repaired worldwide at full ocean depths. The ability to operate throughout the oceans has led to rapid development of manned and autonomous underwater work vehicles. As that technology continues to grow, so will the opportu-

nities to build things on the seafloor. We can begin to do ‘normal’ sorts of work on much of our planet’s surface that heretofore has been inaccessible.

That’s going to put a lot of pressure on the underwater connector industry. Current high-reliability, fluid-filled products for heavy-duty use are not suitable for many of the new applications. Connector manufacturers I’ve talked to recently say they are struggling to fulfill customer orders for their existing products and don’t have the bandwidth in their organizations to take on new development projects. They’re not taking up the challenge.

Where’s the new technology coming from? The manufacturer who is able to introduce it should already have a commanding industry position lasting for decades.

For more information, visit www.pontus-subsea.com. **ST**

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Danish 3D Printing Project

Tuco Marine Group, specializing in fast workboats constructed with composite materials, is participating in the innovative research project, RoboPrint, which aims to revolutionize the production of high-strength fiber composites using 3D printing.

DTU, the leading partner, together with FORCE Technology, is responsible for developing the technology itself. Other partners include Robot At Work, providing the RAW 3D printer, and the American company Cosine Additive, responsible for developing the printer head.

Currently, the production of composite boats is a labor-intensive process involving manual cutting, laying and laminating of glass or carbon fiber in a mold. These manual methods pose risks of material defects, require careful handling of materials due to health considerations, and result in significant material waste. Moreover, the design flexibility is limited by the need to create a mold for each new design.

The RoboPrint project will change this paradigm by developing technology to reduce manual work in the manufacturing process, decrease costs, and enhance production quality. The digitalization of the manufacturing process will also enable automated storage facilities and the production of new 3D designs.

Thermal Camera Supports Iceland Fishing Vessel

Since its formation in 2005, Sónar has grown to become one of Iceland's leading players in the import, sale and service of navigational, fishing, and electronic communication equipment for ships and boats. One of its most recent projects was installing Teledyne FLIR's M364's camera on a commercial fishing vessel, with the specific goal of improving safety in the challenging conditions the boat's crew faces on a regular basis.

The 72.5-m *Vikingur AK 100* benefits from the M364 as a high-definition, low-light camera with advanced FLIR thermal imaging cores, enabling the crew to see ice and other objects in the water.

Ocean Research Partnerships

The Nippon Foundation-GEBCO Seabed 2030 Project has partnered with The Nippon Foundation-Nekton Ocean Census, the largest program in history dedicated to species discovery in the ocean. With the shared goal of unraveling the mysteries of the deep and enabling sustainable management practices, the partnership will greatly strengthen the future of ocean science and marine conservation.

Seabed 2030 has also made new partnerships with the Marine Biodiversity Observation Network and Marine Life 2030. The memorandum of understanding signed by the parties outlines their commitment to advancing the field of ocean exploration, with a particular focus on the

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observation of marine life. In addition, Seabed 2030 has partnered with the Memorial University of Newfoundland's Fisheries and Marine Institute, a leading center of excellence for marine research and education.

Underwater Defense Company Grows in Australia

Forcys has expanded in Australia with a new office in Sydney to work with customers developing innovative underwater autonomous systems. Forcys offers the global maritime naval sector remote, autonomous and networked control capabilities, delivering integrated situational awareness. This is made possible by integrating and bringing to market solutions from leading technology partners Chelsea Technologies, EIVA, Sonardyne, Voyis and Wavefront Systems.

MATE Joins MTS

The Marine Technology Society (MTS) has integrated MATE Inspiration for Innovation (MATE II) and its signature program, the MATE ROV Competition, into the society's lineup of program offerings. By combining efforts, MTS and MATE can enhance their reach and impact to inspire young minds and prepare them for careers in marine technology. MATE II will operate as a division of MTS.

The MATE ROV Competition was created in partnership with the MTS ROV Committee in 2001 to address the industry's need for up-and-coming talent.

Dual-Fuel Ammonia Engines Coming to Market

Swiss marine power company WinGD is on track to deliver its first X-DF-A dual-fuel ammonia engines by the first quarter of 2025, with the first X-DF-A-powered vessels in service from 2026. Combustion tests have been conducted at WinGD research facilities in December 2022.

Geotechnical Survey for Offshore Wind

Avangrid has awarded TDI-Brooks a shallow-water geotechnical site investigation survey at block OCS-A-0508, "Kitty Hawk Wind." The data collected will inform the design of the export cable and interarray packages for a project to develop a commercial-scale, offshore wind energy facility. It will have up to 69 wind turbine generators, an offshore substation, interarray cables, an onshore substation and up to two transmission cables making landfall in Virginia Beach, Virginia, and connecting to the Pennsylvania-New Jersey-Maryland Interconnection energy grid.

Chesapeake Tech Aided *Titan* Search

Chesapeake Technology Inc. provided software for the search effort to locate the OceanGate *Titan* submersible that imploded in June, resulting in the deaths of all five passengers. International teams searched a large and deep area of the ocean for the sub in a 96-hr. time frame. The U.S. Coast Guard is investigating the accident. **ST**



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NGA Chooses TCarta for Satellite-Derived Bathymetry Around the World

TCarta Marine, a global provider of hydrospatial products and services, has been awarded a contract to deliver satellite-derived bathymetry (SDB) and seafloor classification data for the coastal zones of 13 regions around the world to the National Geospatial-Intelligence Agency (NGA) under contract to Maxar Technologies.

TCarta will deliver seabed depth and feature maps from high-resolution multispectral Maxar WorldView-2 and WorldView-3 satellite imagery for the 13 regions. SDB measurements are accurate to depths of 20 to 30 m depending on water conditions, with 2-m spatial resolution. Feature classification includes coral reefs, large rocks, sandbars and other navigation hazards.

TCarta has processed thousands of Maxar satellite images for the project, including hundreds of high-resolution scenes for one nation alone. By the time all deliverables have been submitted and approved by NGA, TCarta will have mapped the entire subsurface coastlines of the 13 regions over the 12-month period of performance.

California Wave, Tidal Energy Bill Progresses

The California Assembly Committee on Utilities and Energy has unanimously approved California Senate Bill 605 – Wave and Tidal Energy (SB 605). The bill aims to put California on the path to developing a new source of clean, renewable energy to help the state meet its carbon-free targets while bolstering its electric grid.

Earlier this summer, the California Senate voted in favor of SB 605 after it was unanimously approved in five separate policy committees. The bill directs the California Energy Commission to work with relevant state agencies to study the feasibility and potential for wave and tidal energy development in California and sets deadlines to report its findings to both the California legislature and governor.

SB 605 also calls for the Energy Commission to consider wave and tidal energy pilot projects that “assess the technological feasibility and provide research and demonstration of the technology” in the investment planning process for the Electric Investment Charge program. This California Energy Commission program “invests in scientific and technological research to accelerate the transformation of the electricity sector to meet the state’s energy and climate goals.”

The legislation is sponsored by AltaSea at the Port of Los Angeles, a 35-acre ocean technology campus that is the home of Eco Wave Power’s first wave energy power station in North America. The pilot project is set to be installed in the coming months.

California aims for a carbon-free energy grid by 2045. The National Renewable Energy Laboratory has determined that the energy potential in California is 140 TWh/year, which could power 13 million homes and is equal to 69 percent of California’s 2019 net electricity generation.

There is momentum along both U.S. coasts for wave energy, with pending legislation also in New Jersey. The bill, AB 4483, encourages New Jersey to explore a deployment plan for wave and tidal energy technologies on the state’s coastline and provides funding for feasibility studies and pilot programs.

DOT Allots \$40 Million for Port Infrastructure

Ports have received nearly \$40 million in federal funds from the U.S. Department of Transportation (DOT) in the fiscal year 2023 round of funding from the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) program. These grants, totaling more than \$2.2 billion for this fiscal year, aim to invest in infrastructure that promotes safety, equity and strong critical supply chains.

One recipient is PortMiami, which received \$5 million to complete portions of a critical master plan to continue its net-zero program. The plan aims for the port to achieve carbon neutrality, construct two inland cargo centers and reduce fossil fuel use.

Another recipient is the Puerto Rico Port Authority, which will receive \$3 million to fund a feasibility study and other preparatory initiatives related to the improvement of Avenue C, a critical roadway link and the only connection to the port’s eastern wharves. This design will improve the efficiency of cargo operations and environmental impacts. **ST**

Li-Ion Ocean Power

The advertisement features a blue background with a red header. It displays several images of battery systems: a yellow 6x1 MWh Energy Storage System with an API17F certified label, an All-Electric motor, a Vehicle Charger & Batteries unit with a MILITARY STANDARD label, and a set of Li-Ion Batteries. The text 'Li-Ion PowerPack™ - Underwater Power Solutions' is prominently displayed. Below this, it states 'Highly reliable, efficient and safe Li-Ion batteries AC+DC Made for harsh offshore and subsea conditions such as offshore energy, scientific and AUV or ROV equipment'. A 'Learn more' button is present. At the bottom, there is contact information for SubCtech GmbH and logos for UN, ISO 9001, and SubCtech.

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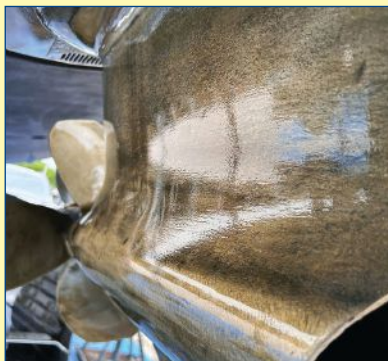
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Machine Learning for Contracts

Green Charter uses machine learning-based data streams to implement new legal frameworks in charter party agreements. Using digital twins, it generates dynamic optimization recommendations, performance reports and alerts that are shared to drive collaborative outcomes. The technology will be used to implement new commercial clauses that ensure every action achieves peak efficiency across fleets for increased profitability and reduced emissions for both sides of the charter party. Nautilus Labs.

Predictive Analytics Monitoring

HydroCorrect is a new quality assurance/quality control assistant for Aquarius that leverages machine learning to automate and standardize workflows, detect data anomalies, and enforce data standards throughout an organization. This tool facilitates optimization and scaling of your monitoring program. Aquatic Informatics.

Analyzer Service API

Chart producers and hydrographic offices of all sizes can use this API to activate the S-57/S-100 validation engine of SevenCs Analyzer in workflows such as chart production and data quality assurance procedures. It can be installed on an in-house physical server or on a virtual server that the customer manages and administers. It can also be hosted by SevenCs, with users accessing the 7Cs Analyzer Engine through the API feature on an as-needed basis. SevenCs GmbH.

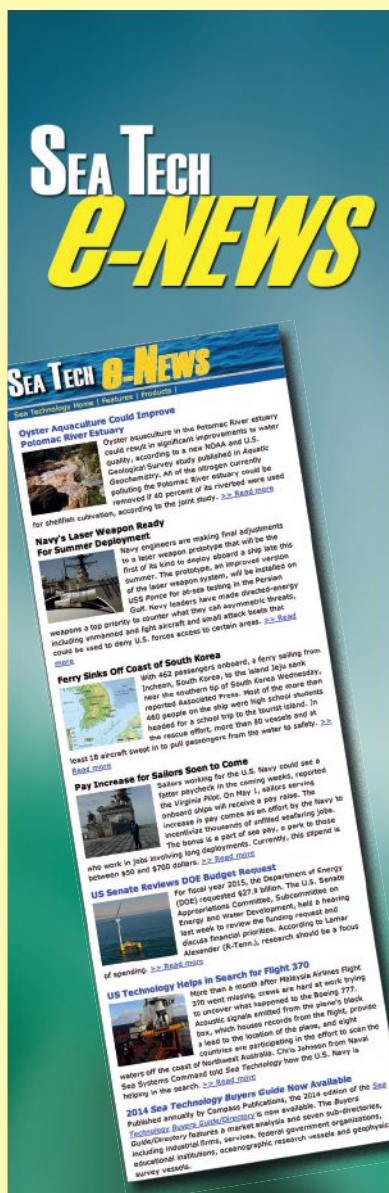
Containerized Battery Room



Corvus BOB (Battery-On-Board) has DNV type approval as a standardized, plug-and-play battery room solution available in 10- and 20-ft. ISO high-cube container sizes, designed for easy integration with existing ship systems. The A60 battery room container comes with batteries, a battery management system, HVAC, thermal runaway exhaust, and firefighting and detection systems. Corvus Energy.

Submarine Rescue System

For the first time, a full SRS can be transported via commercial aircraft, drastically increasing the range of air transport options in comparison to current systems. This ensures the SRS can get to the DISSUB location as quickly as possible within the 72 hours' time to first rescue (TTFR) window. The optimized footprint and flexible, containerized configuration makes the SRS adaptable for a wide variety of rescue scenarios. JFD.



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Doubled-Capacity Battery

Deep Blue Battery 80 leverages lithium iron phosphate (LFP) chemistry and delivers 80 kWh of energy storage, twice the capacity of the previous generation of Deep Blue batteries. The high volumetric energy density (272 Wh/L) is particularly important for larger, heavier displacement vessels, such as cruising yachts and commercial vessels. Torqeedo GmbH.

Electronic Record Books

ERB is a user-friendly application used on board ships to maintain several different types of log books, including oil record books. It can be used in parallel with traditional paper books or to replace paper books entirely. SHIP IP LTD.

Data Transport Device

DTS1X brings a 10-Gbit Ethernet interface to applications that require the storage and protection of large amounts of data on UUVs, USVs and other unmanned craft. The high-speed recorder captures data at speeds of ~450 MB/s. The device stores up to 8 TB on a removable XRM memory cartridge. Curtiss-Wright Defense Solutions.

Wave Attenuator

Standard Lite-Duty, Heavy-Duty Max and Heavy-Duty Super Max are new product lines designed and manufactured to be the first line of defense against wind- and

vessel-driven wake. They use proprietary frames and components configured for maximum energy absorption, with the built-in strength to stand the test of time in the harshest marine environments. Marine Development Inc.

Single-Man Portable ROV



SeaDrone MINI is a professional ROV for users of all experience levels. It can be carried and deployed within minutes. The ROV can operate in 3-kt. cross-current. The MINI's control system actively stabilizes the vehicle and enables the capture of crisp and stable footage. The base MINI robot includes a wide-angle video camera for 12-megapixel stills and 1080/30p H.264 video. SeaDrone Inc.

Robot for Ship Welding

MR4Weld (Mobile Robot for Welding) welds steel structures during the vessels' building stage in the shipyards. It is a high-payload,

six-axis articulated robot fitted with a welding torch installed on a tracked undercarriage. An integrated vision system autonomously identifies welding joints. Comau and Fincantieri S.p.A.

Data Logger

HOBO TidbiT MX2205 is ideal for monitoring streams, wetlands and fields prone to flooding. It has an internal sensor for ambient temp monitoring and an external sensor with rapid response time for highly accurate monitoring of fast-changing temperatures. The rugged design withstands harsh conditions. Configuration allows for wireless data downloads that don't require pulling up the logger. Onset Computer Corp.

Enhanced Soil Testing

Auto-Minivane is a self-contained, standalone miniature vane shear testing device that can be used in a 0.5-m vertical-stroke format by an onshore or offshore laboratory. The 1-m-stroke format can be mounted onto a box corer at sea to measure soil strength deep into the box core soil sample. TDI-Brooks International Inc.

Bell Safety Harness

This harness can lift an unconscious diver from the water. Sturdy lifting points on the back and front ensure safe attachment of recovery hoist. Northern Diver International Ltd. **ST**

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SEA-KIT USV for ThayerMahan

SEA-KIT International has been preparing to deliver on its export deal with American autonomous maritime solutions provider ThayerMahan, which ordered a SEA-KIT X-class USV last year, having seen the 12-m design proven on numerous commercial operations around the world. The USV has been undergoing extensive sea trials in the U.K. before being shipped to the U.S. to commence operations this summer.

The X107T is the seventh X-class to leave SEA-KIT's production facility in the East of England. It features several enhancements and technology developments, including a new winch system developed by SEA-KIT to integrate with the company's proprietary G-SAVI virtual helm station to enable deployment of large, towed arrays and sensors down to 3,000 m. The company has also further developed G-SAVI, taking the technology another step toward becoming a fully classed autopilot system while continuing to advance its situational awareness suite.

ThayerMahan will use the USV to support introduction of the technology into government service, as well as for its own activities in U.S. and international waters.

Ferry Propulsion Conversion

The Government of Åland has ordered a feasibility study from Elomatic on replacing the propulsion system of the archipelago ferry MS *Skarven* to make operations more efficient and reduce carbon dioxide emissions. Alternatives to be evaluated include electrifying the ferry and converting it to a hybrid vessel. MS *Skarven* plays an important role in Åland's internal traffic, and the modernization will help enable the local green transition.

MS *Skarven* is an archipelago ferry operated by the government of Åland that runs in the Åland archipelago all year. The ferry is of great importance to the inhabitants of the archipelago, as well as for tourism and business. In addition, it serves as a transport route to the east.

One potential solution would be to convert the ferry to electric power, which would reduce both greenhouse gas emissions and operating costs. The benefits of electrification also include a reduction in noise levels and a smoother ride. Another option that Elomatic will study is the feasibility of hybrid power.

The project builds on a history of cooperation between the government of Åland and Elomatic regarding hydrogen production for ferry transport. The feasibility study began in earnest in August, and Elomatic will submit the final reports to the government by the end of September.

Electric Vessel in London

The *Oceandiva London* began plying the waves of the River Thames this summer as a fully electric vessel, relying on power from the energy storage systems supplied by EST-Floattech. Designed and built by the Dutch energy technology and storage solutions specialist, the Green

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Orca system is made up of two lithium battery packs with an total capacity of 2.2 MWh.

The batteries are charged by both green fast-charging shore power and onboard solar panels, with a biofuel generator as backup for longer excursions. The *Oceandi-va London* will be an eye-catching flag bearer of the Net Zero Marine Services program to decarbonize the river in London.

The 86-m-long, 17-m-wide vessel is the largest floating event venue on the Thames, offering 2,625 m² of flexible indoor and outdoor space spread across three decks.

The vessel was built by VEKA Group of Werkendam in the Netherlands. Electrical system integrator Werkina Werkendam commissioned EST-Floattech for the energy solution.

Council for Zero-Emissions Chargers for Ships

e5 Lab Inc., Marindows Inc., e-Mobility Power Inc., CHAdemo Association, The Japan Ship Technology Research Association, Mitsubishi Shipbuilding Co. Ltd. and Development Bank of Japan Inc. have established the Promotion Council for Zero Emission Chargers for Ships to promote the widespread use of standardized shore-to-ship power stations. The Port and Harbor Bureaus of the cities of Kobe and Yokohama are participating in the council as observers.

Japan has committed to achieving carbon neutrality by 2050 and to reducing emissions by 46 percent by

2030 compared to 2013 levels. Japan has also agreed with the U.S. to cooperate on carbon-neutral ports.

The first phase of the newly formed council's work aims to install prototype standardized universal zero-emissions chargers for ships in Hanshin Port and Keihin Port by fiscal year 2025. These are international strategic ports where domestic and foreign freight and ships are concentrated. These chargers will then be expanded to ports and marinas nationwide and overseas.

Autonomous Innovation Hub

Exail has opened a new innovation hub that will engage in all aspects of marine autonomous operations to help meet the challenges of the growing blue economy. The new hub is located at the University of New Hampshire (UNH), a recognized leader in the field of ocean mapping research. Specifically, the hub is situated within UNH's Olson Advanced Manufacturing Center to facilitate collaborative work with UNH's Center for Coastal and Ocean Mapping.

Exail will use the new center to deliver increased operational advantage to U.S. civil and government customers. The center will house the U.S. production of Exail's DriX USV; serve as a remote operation center to conduct worldwide remote autonomous operations; establish local operations, maintenance and training facilities; and provide expertise on maritime autonomy while training future generations on the use of autonomous vessels. **ST**



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environmental monitoring

Study on Shifting Seagrass Species in Chesapeake Bay

VIMS researchers and their collaborators have evaluated the causes and consequences of a new dominant seagrass species rising in the Chesapeake Bay, demonstrating both new threats and management opportunities, in a study published in the *Proceedings of the National Academy of Sciences*. The researchers combined 38 years of data on nutrient and sediment pollution from runoff, temperature, plankton blooms, and river flow with aerial seagrass surveys to describe the causes and consequences of shifting seagrass foundation species across 26,000 hectares of habitat in Chesapeake Bay.

Marine heatwaves and poor water clarity in Chesapeake Bay over the last few decades have cut the area occupied by the previously dominant seagrass, eelgrass, in half. At the same time, successfully implemented nutrient reductions throughout the bay have encouraged the rapid expansion of another seagrass, the cosmopolitan widgeongrass. Confined to a fringing area of shallow brackish waters until the mid 1990s, widgeongrass has now replaced eelgrass as the most abundant seagrass in Chesapeake Bay by expanding over 150 percent due to high temperature tolerance and long-lasting seeds that enable rapid recovery after disturbance.

The causes of these fluctuations have been difficult to understand because widgeongrass and eelgrass appear to respond differently to climate change and nutrient pollution stressors. Yet when the researchers examined long-term, large-scale data on climate stressors and watershed pollution in tandem with year-to-year aerial survey imagery of seagrass meadows, they found that while widgeongrass is resistant to heatwaves and high temperatures, it is highly vulnerable to periods in spring when high rains can bring huge influxes of nutrient- and sediment-loaded water into the bay, reducing water clarity.

This study underscores that, because species differ in their traits and stressor sensitivities, managing for conservation of living habitats requires more community- or species-focused research, monitoring, and actions under climate change. Climate change is shifting the landscape of species composition, creating new winners in these novel environments, and management needs to shift too. Detailed monitoring data allow agencies to focus on each species and encourages them to manage for community or individual habitat requirements, adapting strategies as species composition changes.

Overlooked Marine Trace Gas

A new evidence review spotlights the often overlooked marine trace gas dimethylsulfide (DMS), covering its production and fate, its importance for climate cooling, and the key knowledge gaps.

DMS is produced mainly by phytoplankton and bacteria and is the most abundant biological sulfur compound emitted from the ocean to the atmosphere, contributing to the distinctive smell of the sea. Once in the atmosphere, DMS plays a key part in the production and growth of atmospheric sulfate aerosols that influence the radiative properties of clouds and ultimately affect Earth's climate.

The natural climate cooling effect of DMS is estimated to be of a similar magnitude to the warming that has been driven by human CO₂ emissions, although the overall climate warming from increasing CO₂ will always outweigh any cooling. Nevertheless, DMS is considered a crucial player in the delicate balance of Earth's climate.

DMS is still crudely represented in climate models. This comprehensive review of DMS research, published in *Nature Reviews Earth & Environment*, emphasizes the urgent need for a greater scientific focus on unraveling the key biological processes controlling DMS production and understanding its

role in climate regulation, as well as improving the accuracy of DMS flux and climate models.

The paper, led by Plymouth Marine Laboratory in partnership with Bigelow Laboratory for Ocean Sciences (U.S.) and the University of East Anglia, argues for the development of low-cost, low-energy autonomous DMS sensors for deployment on buoys or unmanned vehicles to target under-sampled regions or capture sporadic events, such as dust-stimulated algal blooms, which could increase DMS production.

Record Volcanic Lightning

The January 15, 2022, eruption of Hunga Volcano in Tonga continues to break records. According to a new study in *Geophysical Research Letters*, the eruption created a "supercharged" thunderstorm that produced the most intense lightning ever recorded. There were nearly 200,000 lightning flashes in the volcanic plume throughout the eruption, peaking at more than 2,600 flashes every minute. High-resolution lightning data from four separate sources, never previously used all together, have enabled scientists to peer into that plume, teasing out new phases of the eruption's life cycle and gaining insights into the weather it created.

Hurricane Chasing

The SD 1045 Saildrone, which captured the first live video inside Category 4 Hurricane Sam, was redeployed from Charleston, South Carolina, for NOAA's 2023 Atlantic hurricane mission. The ocean off of South Carolina has relatively shallow waters combined with the strong, warm currents of the Gulf Stream that supply energy to a storm. Hurricanes going over these warm waters often intensify, potentially right before they make landfall.

In 2021, SD 1045 was one of five Saildrones chasing hurricanes in the Tropical Atlantic.

Last year, NOAA added two more Saildrones to monitor the Gulf of Mexico.

This year, a total of 12 Saildrones will take part in the mission. **ST**

PLAR Davit for Croatian Navy

The Croatian Navy has placed a repeat order for Vestdavit's PLAR-4000 davit to retrofit an offshore patrol vessel (OPV). The davit, with boat-handling capacity of 4,000 kg, is designed with an aluminum frame that makes it 30 percent lighter than steel-structured equivalents to enhance vessel stability while minimizing corrosion. Reduced weight of onboard equipment also results in better energy efficiency with lower fuel consumption that enables an OPV to operate farther from shore and remain longer at sea, as well as improved speed responsiveness and maneuverability.

The lightweight PLAR system has been preferred for fast patrol boats in the Royal Australian Navy, the Royal New Zealand Navy, the Danish Navy, the Swedish Navy, the U.S. Coast Guard and others.

Integer Technologies to Develop ONR Strategic Technology Roadmaps

The U.S. Office of Naval Research (ONR) has selected Integer Technologies to create three unique roadmaps—a Naval Power Systems (NPS) Science and Technology (S&T) Roadmap, an Expeditionary Energy (E2) S&T Roadmap, and a Naval Diversity Equity and Inclusion Workforce Development (NDEI-WD) Roadmap.

The NPS S&T Roadmap will identify basic and applied research needs across multiple power and energy (P&E) technology areas, and the E2 S&T Roadmap will outline a similar research framework for the energy systems that will support future expeditionary force operations conducted by the Navy and Marine Corps.

The two S&T roadmaps will also address how investments in P&E research can support the Navy's broader goals and meet upcoming existential challenges. These include identifying how technology development can build climate resilience into Navy platforms and how that development can accommodate increasing risks to international supply chains.

The NDEI-WD Roadmap will outline an ONR-wide strategy for stabilizing and strengthening the science, technology, engineering and math (STEM) workforce across the Naval Research Enterprise.

UAV-USV Joint Platform

UMS SKELDAR and Hydronalix will create a joint platform featuring the SKELDAR V-200 unmanned aerial vehicle equipped with a Hydronalix USV system. The purpose of the platform is to offer solutions to emerging operational challenges within, for example, complex, contested littoral areas where supporting networks of manned-unmanned systems are required for efficient, resilient operations.

Hydronalix's USV can be employed as a communications link between the different users in all domains. This combined system will provide the Marine Corps and Navy the capability to adapt to complex littoral environments rapidly thanks to its ability to be quickly deployed day or night over sea. Additionally, the intelligence, surveillance, reconnaissance and targeting benefits offered by launching USVs teamed with UAVs in conflict zones greatly broadens the operational picture for users.

US Navy LCS Commissioned Abroad

The U.S. Navy's *Independence*-variant littoral combat ship (LCS), the future USS *Canberra* (LCS-30), has been commissioned at the Royal Australian Naval Base Garden Island in Sydney Harbor—a rare commissioning abroad for the U.S. Navy.

Behind the scenes, an all-civilian committee of Navy League members worked for months as part of the commissioning to support the ship and its crew ahead of this historic event that celebrates and exemplifies the strong relationship between the two nations.

Mid-Life Upgrade of Horizon Frigates

France and Italy have agreed on the mid-life upgrade of the four Horizon frigates of their respective navies. The modernization will be entrusted to Naviris, the 50/50-owned joint venture by Fincantieri and Naval Group, and Eurosam, a consortium formed by MBDA and Thales. Industrial partners include Leonardo, Thales, MBDA and Sigen.

This upgrade will focus on the anti-aircraft defense system (including the radars, weapons and associated control and command), the platform and combat system, and the electronic warfare system. Naviris will manage the combat system modernization, while Eurosam will modernize the anti-aircraft warfare chain. **ST**



offshore oil & ocean engineering

Wellhead Fatigue JIP

Systems engineering expert 2H has launched the second phase of its Measurement-Based Wellhead Fatigue joint industry project (JIP), which aims to improve riser, wellhead and conductor fatigue estimates and make drilling operations more reliable and efficient.

In phase one of the project, 2H collaborated with nine major operators to gather and analyze field measurements from 10 drilling campaigns in the Gulf of Mexico and the North Sea. The data covered a range of environments, water depths, soil characteristics, riser and wellhead configurations, and vessel types. Findings from the analysis verified that industry assumptions for wave and vortex-induced vibration fatigue assessments are conservative, and remaining fatigue life tends to be higher than that determined by typical design methods. A more accurate prediction of remaining fatigue life can eliminate the need for costly mitigation methods or unnecessary upgrades and downtime during severe events.

In the second phase, the field data analyzed in phase one will be used to explain uncertainties identified in the riser, wellhead and conductor fatigue analysis. The findings will further improve the accuracy of future wellhead fatigue assessments and provide an industry consensus on design methodology.

Currently, seven major oil and gas operators have agreed to join the second phase of the JIP. 2H invites other interested industry partners to participate and, in turn, benefit from the field data insights. Interested parties may contact Bulent Mercan for more information: bulent.mercan@2hoffshore.com.

Connected Hull Monitoring Retrofit for OSVs

Light Structures AS, a Norway-based supplier of fiber-optic condition monitoring systems based on Fiber Bragg Grating technology (FBG), and its Dubai-headquartered partner Elcome International LLC

have been contracted to provide precision SENSFIB hull stress monitoring systems for 10 offshore supply vessels (OSVs) owned by a major Middle Eastern-based offshore support services provider.

Scheduled for delivery and installation on all 10 OSVs this summer, the SENSFIB system has been selected for a retrofit project designed to provide instrumentation that fulfills requirements under the new SMART Structural Health Monitoring (SHM) notation from the classification society American Bureau of Shipping (ABS), as well as following elements of the Hull SMART notation from Bureau Veritas (BV). Both notations provide a framework for the use of structural stress and fatigue monitoring data as part of a condition-based maintenance program, with the expectation that significant OPEX savings can be made by reducing the number of drydock visits during an average vessel's lifetime if onboard instrumentation can deliver compliant, verified data.

Precision measurements from SENSFIB fiber-optic sensors on board all 10 OSVs will be made available digitally to ensure that the latest hull stress and fatigue data are always available to inform maintenance decisions. Light Structures will provide comprehensive annual reports for all vessels based on the collected data, supporting a long-term monitoring approach to ensure operational safety and to help extend the vessels' operational life.

IMCA Revises Offshore Diving Code of Practice

The International Marine Contractors Association (IMCA) has made Revision Three of its flagship guidance document on diving operations, the IMCA International Code of Practice for Offshore Diving (IMCA D 014). The revised guidance will be particularly helpful to those currently managing shallow-water diving operations in the offshore wind industry.

The latest revision clarifies the types of commercial diving activi-

ties covered by the code, as well as introducing new guidance on therapeutic chamber availability where offshore diving operations inside territorial waters are conducted in less than 10 m (33 ft.) of seawater.

FPSO Nitrox Diving System

Unique Group has delivered a cutting-edge, fully bespoke nitrox commercial diving system to OSC Marine. The exceptional system was custom designed in collaboration with OSC Marine, meeting the stringent requirements for offshore operations on a floating production, storage and offloading (FPSO) platform.

By working closely with OSC Marine, Unique Group developed a tailored nitrox commercial diving system that surpasses industry standards.

ABS witnessed the design, manufacturing and testing of the system for quality assurance, ensuring robustness and reliability in demanding offshore environments.

The system also complies with the latest IMCA guidelines for safety.

Robots, AI for UXO

More than 1 million tons of munitions dumped in the North and Baltic Seas during and after World Wars I and II pose a threat to both humans and the environment. This waste also has economic consequences, as it affects industries such as fishing, shipping and tourism, and hinders the construction of offshore installations and submarine cable laying.

The Robotics Innovation Center of the German Research Center for Artificial Intelligence (DFKI) is developing robots to handle unexploded ordnance (UXO). Thanks to AI, the robotic systems should be able to detect ordnance underwater and prepare its removal autonomously.

AI solutions for the CleanSeas project will focus on: precise navigation in the close range of critical objects; 3D reconstruction of objects using various sensors; and whole-body control for (partially) autonomous object manipulation.

DFKI's AUV Cuttlefish serves as the robotic test platform. **ST**

contracts

Inmarsat Maritime, London, U.K., a Viasat business, will connect Wärtsilä ANCS's new floating laboratory, AHTI, and its shore operations, to support the data exchange for advanced technology testing and the ship's day-to-day operations. Inmarsat Maritime's Fleet Xpress connectivity will be packaged with unlimited backup from FleetBroadband. Wärtsilä.

Rivada Space Networks, Munich, Germany, has signed a memorandum of understanding to enable innovative connectivity solutions for land and maritime communications. Rivada's unique architecture combines intersatellite laser links with advanced onboard data routers to create an optical mesh network in space. The data stay in space as part of an ultrasecure satellite network with pole-to-pole reach. IEC Telecom.

ZeroNorth, Copenhagen, Denmark, has been selected by a leading global merchant and processor of agricultural goods to help accelerate the company's decarbonization journey by providing data-driven optimization services to improve vessel performance and reduce fuel consumption across a chartered fleet of approximately 200 vessels. Louis Dreyfus Co.

Fugro, Bremen, Germany, has awarded a new hydrographic survey contract for the 2023 MAREANO seabed mapping program to cover a 2,887-km² region in the North Sea at 140- to 335-m water depths. The high-quality, seamless data sets will integrate bathymetry and acoustic backscatter data to improve understanding of the marine environment in the North Sea. The Norwegian Hydrographic Service.

Hill's, McLean, Virginia, Mission Technologies division was awarded a five-year contract to continue supporting an IT enterprise cloud migration. National Geospatial Agency.

Light Structures AS, Oslo, Norway, will deliver and install hull stress monitoring systems for eight new-build LNG carriers owned by two separate consortia for operations in the Middle East. China Merchants Hoi Tung. **ST**

meetings

OCTOBER

October 3-5—International Boat-Builders' Exhibition and Conference, Tampa, Florida. www.ibexshow.com.

October 18-20—NOIA 2023 Fall Meeting, Amelia Island, Florida. www.noia.org/event/noia-2023-fall-meeting.

October 22-25—AAPA Annual Convention & Expo, Aurora, Colorado. <https://aapa.getregistered.net/2023-annual-convention-and-expo>.

October 23—Offshore Wind Executive Summit, Galveston, Texas. offshorewindsummit.com.

October 23-25—Deepwater Operations and Topsides, Platforms & Hulls Conference & Exhibition, Galveston, Texas. www.offshore-event.com.

October 24-27—WISTA International AGM and Conference, Montevideo, Uruguay. <https://wistainternational.com/event/2023-wista-international-agm-conference>.

NOVEMBER

November 7-9, CLEAN GULF—San Antonio, Texas. www.cleangulf.org.

November 13-16—BlueTech Week, San Diego, California. info@tmablue.tech or <https://tmablue.tech.org/bluetech-week>.

November 29-December 1—Underwater Intervention | International WorkBoat Show, New Orleans, Louisiana. www.workboatshow.com.

boatshow.com/underwater-intervention.

DECEMBER

December 4-6—AAPA LATAM Convention of Ports, Barranquilla, Colombia. <https://aapa.getregistered.net/latam-convention-of-ports>.

December 4-6—Marine Renewables Canada Conference, Ottawa, Canada. <https://marinerenewables.ca/event/marine-renewables-canada-2023-conference-december-4-6-in-ottawa>.

December 4-7—Egypt Defence Expo, Cairo, Egypt. www.egyptdefenceexpo.com.

2024

JANUARY

January 30-February 1—EUROMARITIME, Marseille, France. www.euromaritime.fr.

FEBRUARY

February 5-7—Floating Wind Solutions, Houston, Texas. <https://floatingsolutions.com>.

February 26-29—Blue Innovation Symposium, Middletown, Rhode Island. <https://blueinnovationsymposium.com>.

APRIL

April 9-11—Undersea Defence Technology, London, U.K. www.udt-global.com.

April 14-18—OCEANS 2024 Singapore, Singapore. <https://singapore24.oceansconference.org>.

MAY

May 6-9—Offshore Technology Conference, Houston, Texas. 2024.otcnet.org.

NOVEMBER

November 4-7—EURONAVAL, Paris-Nord Villepinte, France. www.euronaval.fr.

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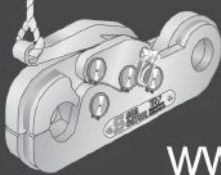
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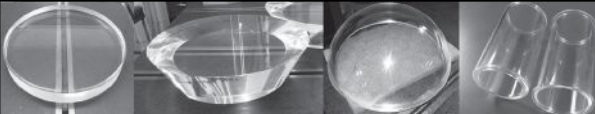
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'High-Def Awareness' Will Unlock Better Business in Shipping—Angus Whiston

Angus Whiston is the communications director at DeepSea Technologies. He is part of the company's international team that is pioneering world-class AI in the shipping industry. DeepSea works for optimization and decarbonization in shipping by using cutting-edge technology and new ways of thinking. Whiston promotes the proven benefits of AI to show what an unprecedented level of awareness can yield for business.



The mysteries of the seabed have recently returned to the forefront of the public imagination with the fatal OceanGate submersible disaster in June. The deep places of the sea, and what we might find there, hold an endless fascination that attracts explorers to dangerous depths.

It has been said many times before that we know more about the Moon than we do about the deep sea, but what about the ocean's surface? It is not just what happens in the uncharted depths that remains a mystery to us. The surface of the ocean is also poorly understood.

Specifically, I am referring to how the ocean's surface affects the logistics of the world's most important trading system: the global fleet of container ships, bulkers, tankers, gas carriers, etc. that have to navigate the complex maritime environment every day.

Each year, over 300 million tonnes of marine fuel are burned, a significant proportion of which is due to the impact of surface conditions. Arguably, with the planet struggling to face up to the climate challenge before us, truly understanding the surface before the depths should be objective number one.

To clarify, we have a good idea about the individual factors we're dealing with on the surface of the ocean. Any number of sources can

tell us the wave height, the current speed, the wind direction—but how these all combine, and how each particular combination affects the vessels that sail through it, is a different story.

With the various technologies available to us today, we are able to gradually create 3D surface maps of the ocean's floor, the peaks and troughs that represent geophysical phenomena. Similarly, the ocean's surface can also be represented as a 3D map, except the peaks and troughs will not represent physical objects or individual phenomena but, instead, the resistance that a ship would face when sailing through. Building this sort of map would be the key to navigating the surface of our oceans in the most efficient way possible.

This type of map isn't straightforward to generate because resistance isn't an independent factor; it is a product of the object encountering it, in this case, the ship. How fast it sails, how heavily it is laden, how fouled its hull is will all have a profound impact on how this "resistance map" looks. Before we can create this resistance map, which is the key to an optimal voyage, we need to have an in-depth and accurate model of how the individual vessel behaves with regard to the almost infinite permutations of factors that it could encounter on an ocean crossing. In other words, we need to understand ships in high definition.

By and large, the industry lacks this level of vessel understanding. In a survey of vessel operators I completed earlier this year, 56 percent of respondents said they understood their vessel's behavior in good weather conditions "quite well" (as opposed to "very well"). Thirty percent of respondents said that decreased to only "a little" when sailing in bad weather. The average level of accuracy with which fuel consumption was predicted was 85 percent. The results of this

survey show that the industry is far from the high-definition insight we need to optimize an ocean crossing. We're low-definition right now, like YouTube circa 2005.

The reality that shipping continues to function in a state of self-aware "low definition" is a systemic issue that involves not only a lack of transparency but a level of apathy toward understanding the full picture. My research confirmed that there is indeed an elephant in the room: When it comes to accuracy and truly understanding vessel performance, a shift in mentality is required for the industry to truly acknowledge, and take advantage of, the power of readily available optimization solutions.

The more forward-looking shipping companies already know the benefit that the high-definition revolution will bring them. Before talking about alternative fuels, wind power and expensive retrofits, these companies see that immense progress can be made just by doing the same things better. For instance, in DeepSea Technologies' work with Wallenius Wilhelmsen, we created high-definition vessel behavior models for its fleet, then used those models to create optimal route and speed plans, essentially via the resistance map approach I mentioned earlier. The outcome of this change was a fully validated 7 percent decrease in fuel consumption, with no physical change to the ships at all.

You might be thinking: How can you build these unique behavior models for your vessels; generate a specific resistance map per voyage; and use it to find the precise, optimal speed and route plan to minimize fuel consumption and maximize voyage profit?

The answer is: artificial intelligence. AI is revolutionizing the industry by bringing high-definition awareness to vessel operations. All that's needed is the push to make this mainstream. **ST**

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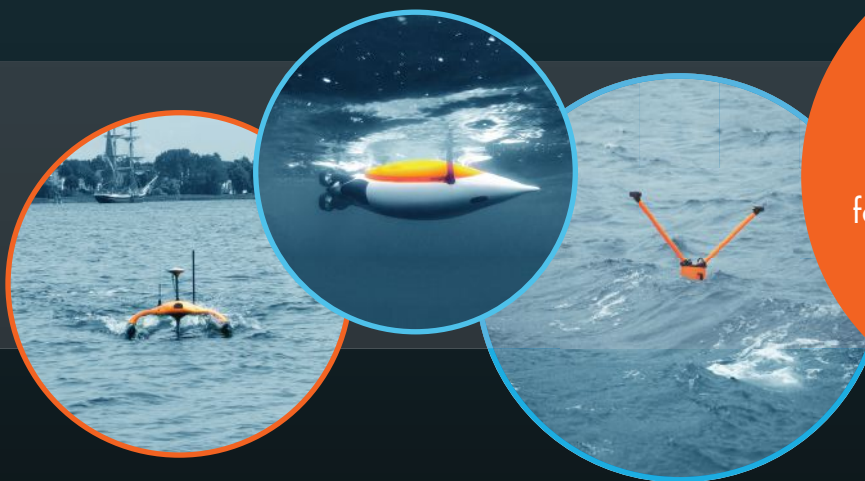
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