MARINE TECHNOLOGY REPORTER

November/December 2024
www.marinetechnologynews.com

Gliders Enable Efficient Ocean Observation

Subsea Defense
Endurance is Key

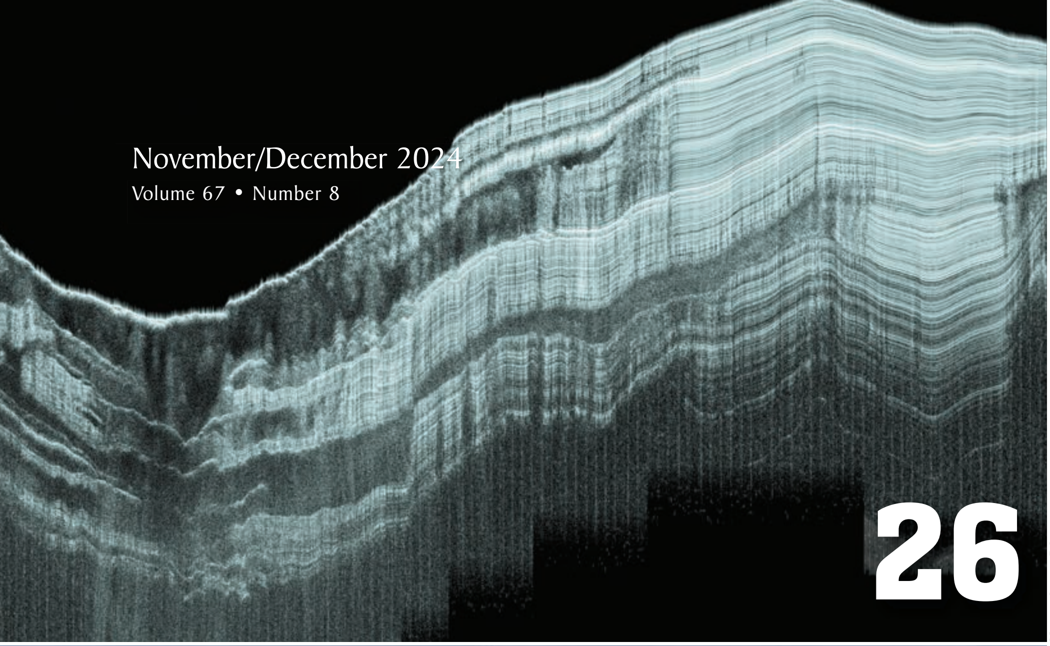
Sub-Bottom Profilers
Tracking Changes

Infrastructure
AI & Submarine Networks

Lander Labs
Ferrocement Anchors

Volume 67 Number 8

November/December 2024
Volume 67 • Number 8



Kongsberg Discovery

© Andrew Gelder, Teledyne Marine

Kevin hardy

On the Cover

Image by Jackson Schroeder, University of Georgia Skidaway Institute of Oceanography, taken off the coast of Richmond Hill, GA, USA, 2024 / Image courtesy Teledyne Marine 2024 Photo Contest

Qinertia

The Next-generation INS/GNSS Post-processing Software

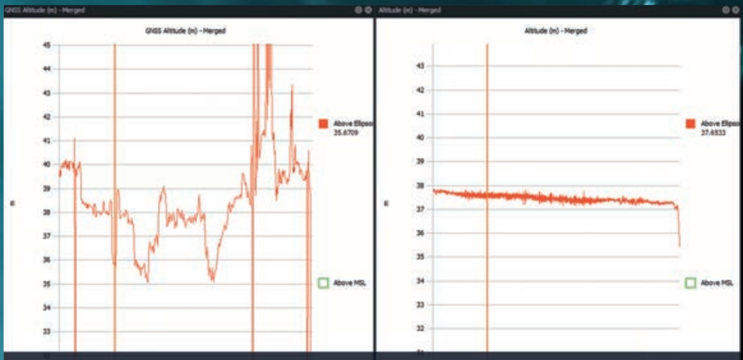
Quality: *Green -> centimetric position; Blue -> decimetric < 30cms; Red -> Raw GNSS data*

SURVEYING UNDER BRIDGES MADE EASY

This survey has been done with an APOGEE INS under very challenging conditions for the GNSS receiver (red dots).

The boat is crossing multiple times three large bridges including one made of steel.

With Qinertia and its unique 100% in-house GNSS/INS tightly coupled forward / backward processing, data collected under the bridges are fully exploitable (blue / green trajectory).



Altitude – Left GNSS only, Right: Post-processed

The Fastest PPK Software

Log duration: 2h15
Processing Time: < 2 mins

Long GNSS Outages Handling

Example: up to 80 seconds
95% positions < 2 cms
Max error < 30 cms

Easy & Powerful Exporter

Easy export to third party software (SBET/ ASCII)

Many thanks to Hydro Systems Development (HSD Japan) for their kind collaboration.

Image by Jackson Schroeder, University of Georgia Skidaway Institute of Oceanography/ courtesy Teledyne Marine

www.marinetechnologynews.com

NEW YORK
118 E. 25th St., New York, NY 10010
Tel: (212) 477-6700; Fax: (212) 254-6271

CEO
John C. O'Malley
jomalley@marinelink.com

President & COO
Gregory R. Trauthwein
trauthwein@marinelink.com

Contributing Writers
Laurel Gallaudet
Kevin Hardy
Celia Konowe
Edward Lundquist
David Strachan

Production Manager
Irina Vasilets
vasilets@marinelink.com

Production & Graphic Design
Nicole Ventimiglia
nicole@marinelink.com

Corporate Staff

Manager, Marketing
Mark O'Malley
momalley@marinelink.com

Accounting
Esther Rothenberger
rothenberger@marinelink.com

Manager, IT Services
Vladimir Bibik

Circulation
Kathleen Hickey
mtrcirc@marinelink.com

Advertising
Vice President, Sales and Marketing
Terry Breese
breese@marinelink.com
Tel: (561) 732-1185

MTR Sales Director
Mike Kozlowski
kozlowski@marinelink.com
Tel: (561) 733-2477

Advertising Sales Manager
Frank Covella
covella@marinelink.com
Tel: (561) 732-1659

John Cagni
cagni@marinelink.com
Tel: +1 (631) 472- 2715

Editorial

I love this edition for multiple reasons, but none more so than two pictures that are found on page 2: the **Teledyne Slocum Glider**, and the **ferrocement anchor**. This, to me, is the core essence of our industry, from the high tech vehicle designed to operate for months autonomously, carrying the latest sensors and helping to unlock the mysteries of more than 67% of the planet. Next to it, a rudimentary anchor that you can make with cement, gravel, chain and a 5-gallon *'Homer'* bucket from Home Depot! [and as a side, a big shout out to **Kevin Hardy**. Kevin offers a lifetime of experience and knowledge in this industry, and his *'Lander Lab'*, which in this edition makes it an even dozen, is one of my favorites].

Justin Zuure

While I'm ladling praise, there are two more individuals that continue to make *Marine Technology Reporter* better every: **Rhonda Moniz** and **Mike Kozlowski**.

Rhonda Moniz is certainly no stranger to this audience, an industry veteran who has worked in this field for many years. It was about a year ago today that Rhonda and I connected to develop, produce and deliver **MTR's DEEP DIVE Podcast**. I'm in the media, so trust when I say that there is certainly no lack of content today. But if you haven't given DEEP DIVE a watch and/or a listen, please go to our website and listen, because Rhonda has had a full roster of amazing guests, most recently – **Dr. Dawn Wright** – and Rhonda continually delivers an insightful, even-handed and entertaining approach. Once you listen, I would be genuinely interested to hear your feedback, as well as your thoughts for future guests and topics.

Finally, congratulations to my colleague **Mike Kozlowski**, who takes sales responsibility lead for the entire *MTR* Brand – magazine, website, eNews, video + podcasts. This is a well-deserved promotion for Mike, who is a staple at conferences and exhibitions for *MTR* around the world. He, and our entire *MTR* crew, look forward to working with you in 2025 and beyond.

Gregory R. Trauthwein
Publisher & Editor

MARINE TECHNOLOGY REPORTER
www.marinetechnologynews.com
Vol. 67 *No. 8*
ISSN 1553-276
118 East 25th Street,
New York, NY 10010
tel: (212) 477-6700
fax: (212) 254-6271

Marine Technology Reporter (ISSN 1559-7415) is published monthly except for February, August, and December by New Wave Media, 118 E. 25th St., New York, NY 10010-1062. Periodicals Postage Paid at New York, NY and additional mailing offices.

POSTMASTER: Send all UAA to CFS. NON-POSTAL AND MILITARY FACILITIES send address corrections to Marine Technology Reporter, 850 Montauk Hwy., #867, Bayport, NY 11705.

The publisher assumes no responsibility for any misprints or claims or actions taken by advertisers. The publisher reserves the right to refuse any advertising. Contents of the publication either in whole or part may not be produced without the express permission of the publisher.

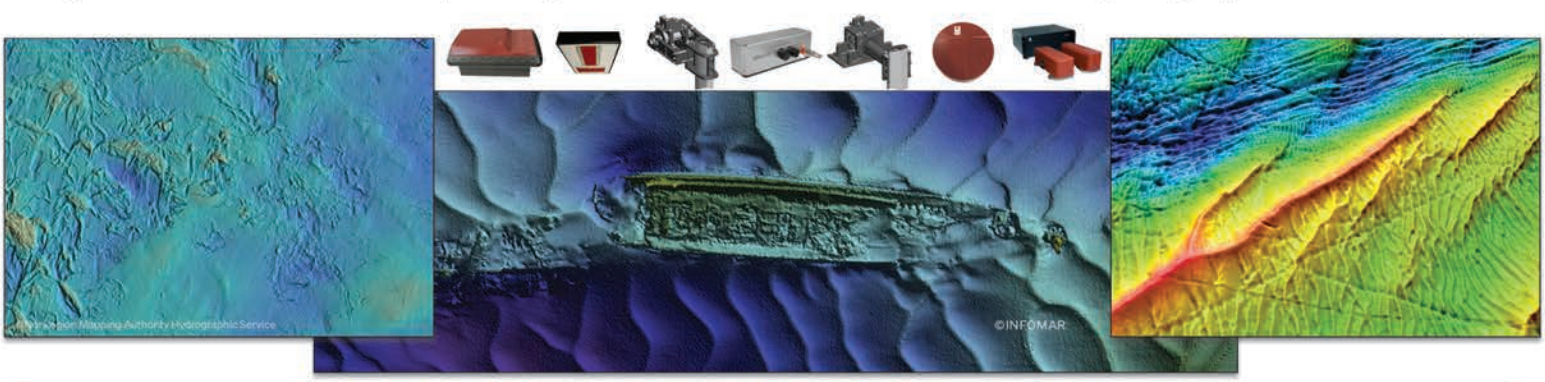
Subscription:
To subscribe please visit
www.marinetechnologynews.com

ECHO81 and USME Partner to Bring Kongsberg Discovery's Cutting-Edge Multibeam Technology to the USA

ECHO81, a leading provider of hydrographic solutions, and Universal Sonar Mount Equipment (USME), a specialist in sonar mounting equipment, today announced a strategic partnership to deliver Kongsberg's state-of-the-art Multibeam Technology to clients across the United States.

This collaboration brings together two companies with a shared commitment to quality, innovation, and customer satisfaction. ECHO81's expertise in hydrographic solutions combined with USME's superior mounting solutions will provide clients with a seamless and powerful experience when utilizing Kongsberg's advanced Multibeam Echosounders.
"This partnership will allow ECHO81 to leverage USM's superior mounting solutions, while also expanding our sales and support network given our recent addition of Kongsberg's Multibeam Echosounders to our product portfolio," said Damon Wolfe, President of ECHO81. "We're excited to collaborate with USME to deliver cutting-edge technology and exceptional support to our clients."
Brent Von Twistern, CEO of USME, added: "We are eager to partner with ECHO81 to deliver Kongsberg's Multibeam Echosounder solutions to our clients here in the USA. ECHO81's support offers the scalability required to maintain the expansive growth we anticipate in the market."

This partnership represents a significant step forward in the marine technology sector, empowering clients across various industries with access to the most advanced underwater exploration tools available. Together, ECHO81 and USME are poised to drive innovation and growth in the US market, setting a new standard for excellence in hydrographic solutions.



About ECHO81
ECHO81 is a leading provider of hydrographic solutions, offering a wide range of products and services to clients across various industries. With a focus on innovation and customer satisfaction, ECHO81 is committed to delivering cutting-edge technology and exceptional support.

www.ECHO81.com

About USME
USME specializes in providing superior sonar mounting solutions for a variety of applications. With a dedication to quality and customer service, USME is a trusted partner for clients seeking reliable and effective mounting equipment.

www.universalsonarmount.com

About Kongsberg
Kongsberg is a global technology leader, providing innovative solutions to various industries, including the maritime sector. Their Multibeam Echosounder technology is renowned for its accuracy, reliability, and performance in challenging environments.

KONGSBERG
www.kongsberg.com

Authors & Contributors

Konowe

Laursen

Lundquist

Konowe
Celia Konowe is originally from Reston, VA and earned her bachelor's degree in environmental studies from the University of Rochester. She also has studied in France and Ecuador and currently lives in Halifax, N.S., recently completing her master of environmental studies at Dalhousie University.

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

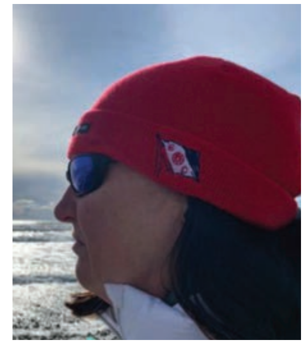
Lundquist
Edward Lundquist is a retired naval officer who writes on naval, maritime, defense and security issues.

Moniz
Rhonda J. Moniz is host of Marine Technology Reporter's DEEP DIVE podcast. She is an underwater forensics expert specializing in diving technologies and subsea systems. She has more than 25 years of experience as a ROV pilot, master dive instructor, scientific diver, and dive safety officer. She is the president of the board of directors for the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS).

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

Waddington
Chris Waddington is Technical Director at the International Chamber of Shipping (ICS), responsible for the development and implementation of ICS policy on technical, operational and environmental regulatory risks affecting international shipping.

Moniz



Strachan

Waddington

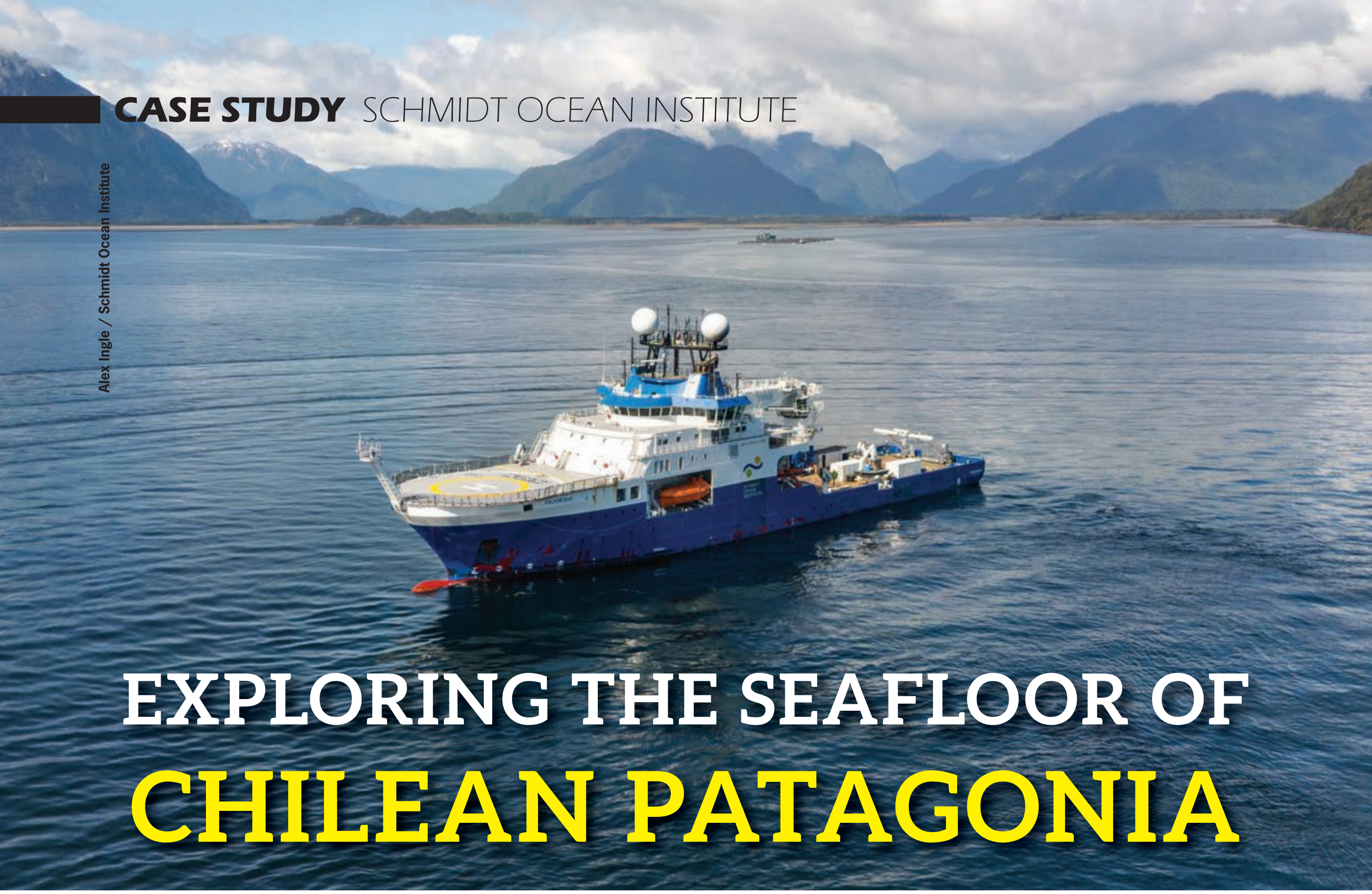
MTR Editorial Advisors

Gallaudet

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

Hardy

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



Alex Ingle / Schmidt Ocean Institute

EXPLORING THE SEAFLOOR OF CHILEAN PATAGONIA

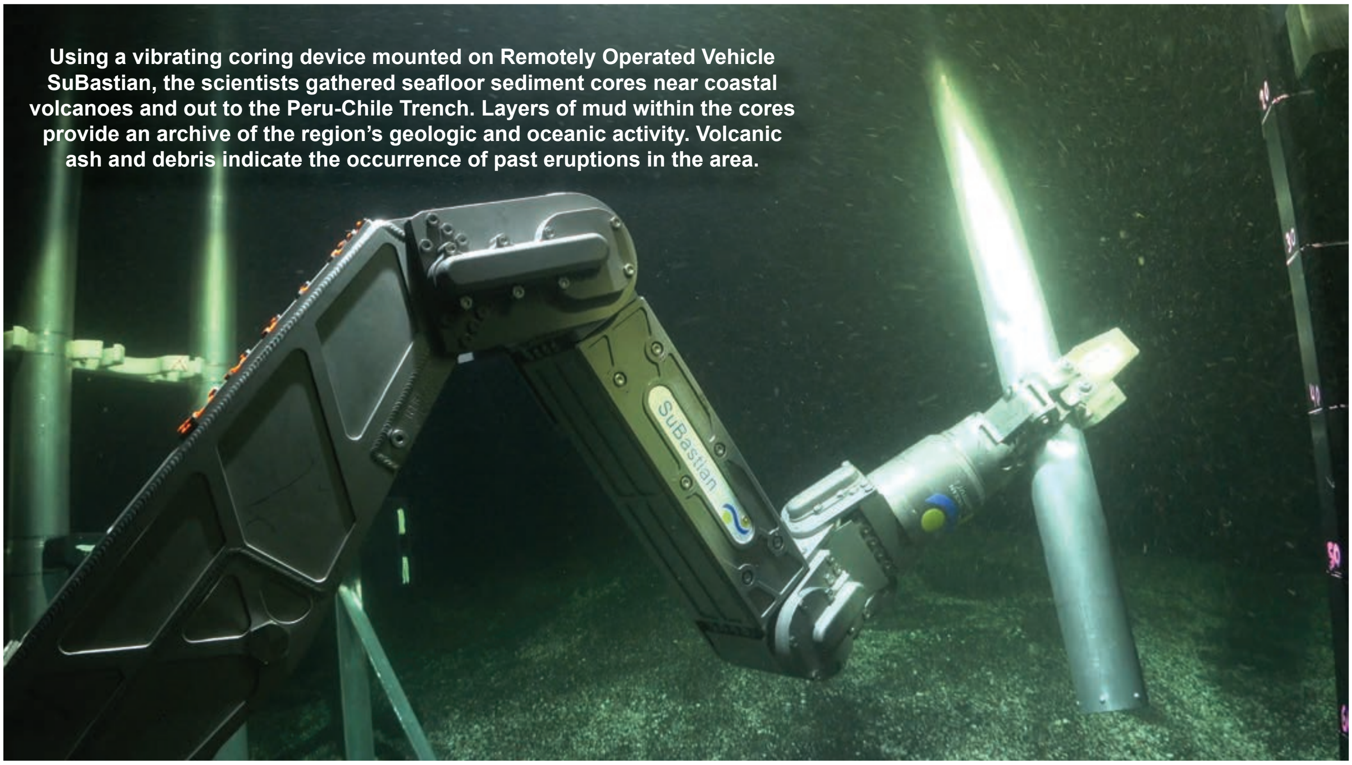
Examining evidence of past volcanic behavior is the key to improved knowledge of future geohazards in Northern Patagonia and their impacts on marine ecosystems.

An international team of scientists is reconstructing the impact of the 2008 Chaitén volcanic eruption on the marine environment following an expedition onboard Schmidt Ocean Institute's R/V Falkor (too). During the 21-day research cruise in September, scientists found eruption debris more than 25 kilometers (15 miles) away from the volcano, transported into the sea via the local river system and then dispersed by ocean currents. Their findings provide new insights into the fate of volcanic debris in marine environments and the strength of the current systems in Chile's Northern Patagonian Sea. This, along with new seafloor maps, will help scientists understand volcanic hazards in Southern Chile and how they have changed over time.

After 9,000 years of dormancy, the Chaitén Volcano erupted without warning on May 2, 2008. Ash spewed 30 kilometers (18 miles) into the air and blanketed the landscape. Heavy rain in the following days triggered devastating volcanic mudflows known as lahars that cascaded down mountainsides and into the Northern Patagonian Sea. The town of Chaitén evacuated as the powerful mudflows inundated and transformed the landscape, flooding the city with mud and destroying the buildings on the southern side.

Using a vibrating coring device mounted on the Schmidt Ocean Institute's ROV SuBastian, the scientists gathered seafloor sediment cores from the Northern Patagonia Sea offshore to the Peru-Chile Trench. Layers of mud within the cores provide a record of the region's geologic and oceanic activity. Volcanic ash and debris indicate the occurrence of past eruptions in the area. These event layers are better preserved in ocean sediments than on land, shedding light on past events and providing the data needed to predict future volcanic hazards and assess how eruptions impact the marine environment.

"Our observations will allow us to explore how active volcanoes affect marine environments and infrastructure, ranging from fisheries to communication cables," said the expedition's chief scientist, Sebastian Watt, from the University of Birmingham in the United Kingdom. "A range of hazards can



Using a vibrating coring device mounted on Remotely Operated Vehicle SuBastian, the scientists gathered seafloor sediment cores near coastal volcanoes and out to the Peru-Chile Trench. Layers of mud within the cores provide an archive of the region's geologic and oceanic activity. Volcanic ash and debris indicate the occurrence of past eruptions in the area.

ROV SuBastian / Schmidt Ocean Institute

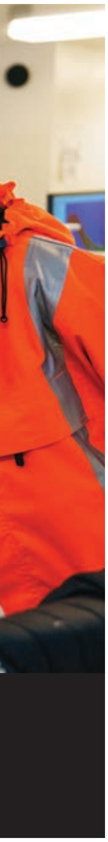
Members of the research team gather in the Computer Electronics Lab onboard Research Vessel Falkor (too) during the deployment of a suite of sensors.

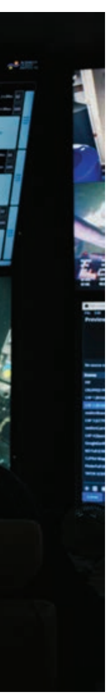
Rebecca Totten (Micropaleontologist, University of Alabama) and her colleagues run through maps and GIS data while they firm up plans for the coming days of searching for volcanic debris in marine environments.

Diego Droguett (Student, University of Valparaíso) and Gianluca Fedele (Student, University of Valparaíso) work with sediment samples.

Silhouetted against screens, Remotely Operated Vehicle pilots take vibracorer samples using ROV SuBastian.

All images this page: Alex Ingle / Schmidt Ocean Institute





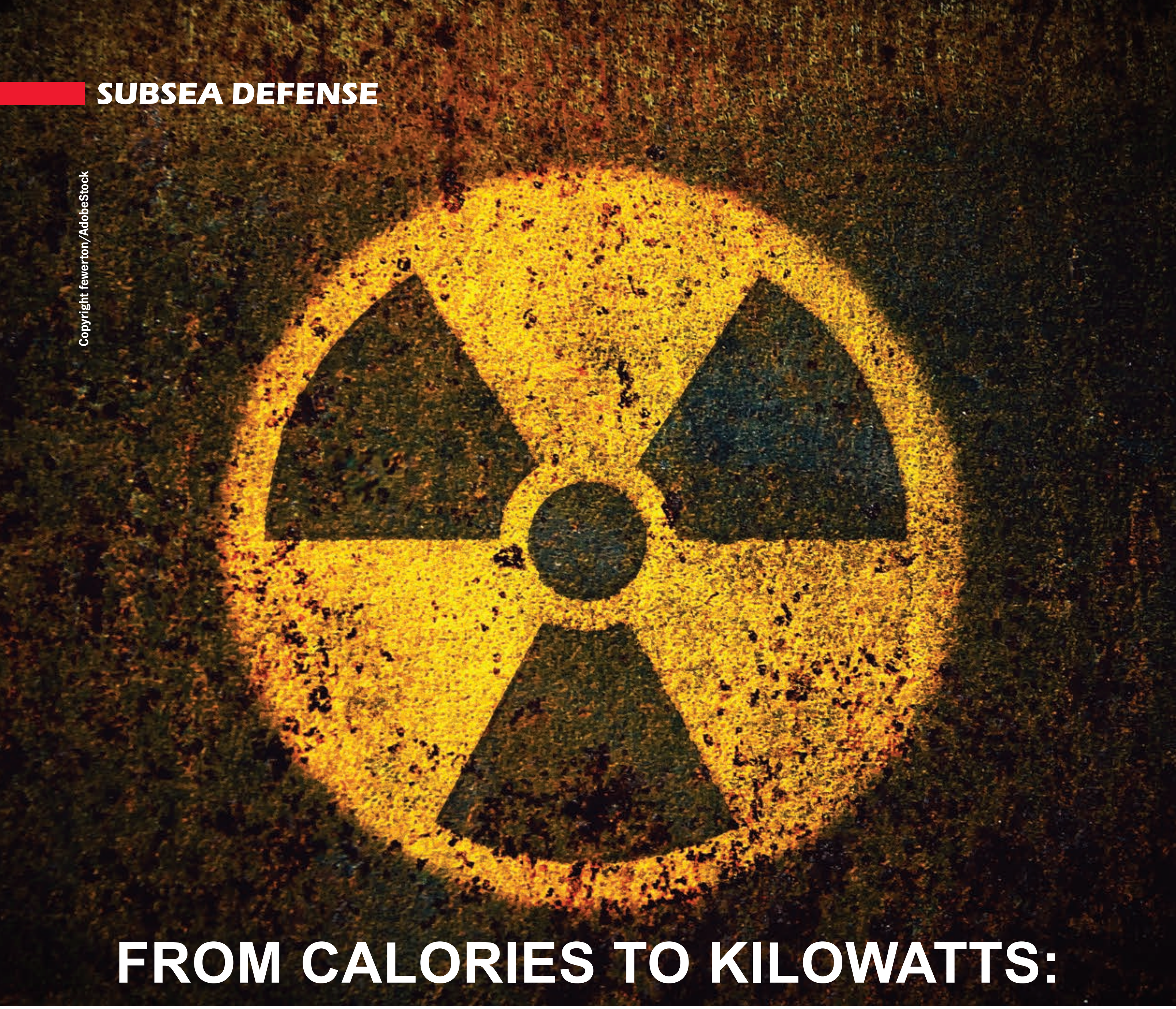
impact communities in the aftermath of volcanic eruptions, and the information we gather from studying the 2008 Chaitén eruption is relevant for coastal and island volcanoes globally."

The international team included scientists from the United Kingdom, Chile, the United States, Italy, Malta, and New Zealand and was co-led by Dr. Rodrigo Fernandez of the Universidad de Chile, Dr. Rebecca Totten of the University of Alabama (United States), and Dr. Giulia Matilde Ferrante of the National Institute of Oceanography and Applied Geophysics (Italy). Throughout the expedition, scientists from three Chilean universities and the Chilean Geological Survey (SERNAGEOMIN) worked closely with the local Chaitén community to raise awareness of volcano science, geologic hazards, and the local marine environment.

"Communication with local communities and a broader global audience was just as important as the science activities of our expedition," said Fernandez. "Months before the expedition, we introduced the project to the local schools. On our science team, we also included a teacher, Danny Leviñanco, who experienced the 2008 eruption from her nearby home of Chuit Island. With her help, we conducted lessons and ship tours with almost every child in this rural, remote region."

The scientists mapped an area of seafloor approximately 2700 square kilometers (1042 square miles) in the fjords of the Northern Patagonian Sea and collected subseafloor data, imaging meters below the seafloor, to assess the build-up and movement of sediment. The mapping revealed a stunning, glacially sculpted seafloor. Scientists have long known that the area was carved by glacial erosion but were surprised by the magnitude of observable ice scouring.

Other findings include undersea mega-dunes made from volcanic sediment outside a river delta transformed by the Chaitén eruption. The mega-dunes cover an area approximately three times the size of New York City's Central Park. The scale of the dunes paired with high-resolution maps indicates a strong current system capable of moving large quantities of sediment. "Approximately half of the earth's volcanoes are islands or located near coasts, like Chaitén," said Schmidt Ocean Institute's Executive Director, Dr. Jyotika Virmani. "It is amazing that as recently as 2008, this volcanic eruption wasn't predicted. Understanding volcanic activity and its footprint on the offshore ecosystem provides data to more readily predict the frequency and severity of events, which is essential to saving lives and cultures."



FROM CALORIES TO KILOWATTS: ENDURANCE IS (STILL) KEY IN UNDERSEA WARFARE

By David Strachan, Founder, Strikepod Systems

"Everything is very simple in War, but the simplest thing is difficult."

Writing nearly 200 years ago, Prussian general and military theorist **Carl Von Clausewitz** understood the tendency for unpredictable or uncontrollable factors to disrupt, degrade, or even completely derail the most meticulously planned warfare operations. While Clausewitz was speaking of 19th century land warfare, his words still ring true today, particularly in the undersea domain, where navigation, communication, and endurance can be the source of myriad operational challenges, both anticipated and unforeseen.

Endurance is one of the most critical elements of undersea dominance. **Admiral Hyman Rickover,** the father of the nuclear navy, understood this, and it is still the case today, seventy years after the USS Nautilus put to sea. But for nuclear-powered submarines, with their nearly unlimited energy supply, endurance is largely a human endeavor, limited only by food stores and crew morale. Uncrewed underwater systems, while they may have no need for calories, are, however, voracious consumers of a different kind of stored energy – kilowatt-hours. And ensuring that they are properly nourished is one of the enduring challenges of uncrewed underwater operations.

For years, lithium-ion (Li-ion) batteries have been the standard for UUVs of all sizes (as well as some crewed submarines and submersibles). Their high energy density, scalability, low maintenance, and relative safety make them attractive to defense and commercial customers alike. But Li-ion dominance may be peaking, as hydrogen fuel cell power has been making steady gains. Fuel cells, which generate electricity by combining hydrogen and oxygen through an electro chemical reaction, have for many years enabled conventional (non-nuclear) crewed submarines to operate for weeks at a time without surfacing. In addition to having a higher energy density than Li-ion batteries, fuel cells do not self-discharge during periods of inactivity, which could greatly extend uncrewed underwater operations and enable missions involving prepositioned systems in forward areas. The **Teledyne Seabed Supercharger** and the Solus family of UUVs from **Cellula Robotics** are examples of systems utilizing fuel cell power. And recently, Connecticut-based Infinity Fuel Cell and Hydrogen was awarded a contract to provide the U.S. Navy with UUV fuel cell technology, possibly for use in the Navy's prototype Snakehead large-displacement UUV (LDUUV).

Nuclear-powered underwater systems are also on the drawing boards of several navies.

Last year, North Korea unveiled what it claims is a nuclear-powered torpedo, Haeil (Tsunami), capable of standoff deployment against surface or coastal targets. In 2022, scientists with the **China Institute of Atomic Energy** published a paper outlining a concept for a nuclear-powered heavyweight torpedo. Perhaps the most sensational use case of underwater nuclear power is Russia's nuclear-powered, nuclear-armed Poseidon, an intercontinental, autonomous torpedo capable of striking coastal cities or aircraft carrier strike groups. While the viability of nuclear-powered underwater systems is up for debate, these concepts underscore the broader recognition of endurance as a critical factor in uncrewed underwater operations. For UUVs, higher endurance means longer range, and the capability to patrol larger regions of water space. Lower endurance could mean dangerous gaps in sensor coverage or combat capability, imposing higher procurement costs in the form of additional vehicles or other platforms to ensure persistent, wide area operations.

A current example of this is Australia. For nearly thirty years, the **Royal Australian Navy (RAN)** has relied on a fleet of six Collins-class diesel-electric submarines to patrol its EEZ - the third largest EEZ in the world at 3,146,060 square miles (8,148,250 square kilometers). The aging Collins boats are currently undergoing emergency maintenance to extend their lives into the next decade, as **AUKUS** Virginia-class boats are not set to arrive until the 2030s. Meanwhile, to augment their submarine coverage, the RAN is investing heavily in uncrewed systems, most notably Ghost Shark, an XL-AUV from **Anduril Industries**. It is widely understood that Ghost Sharks are intended to deter Chinese maritime aggression, including submarine incursions, and possibly assist in defending subsea infrastructure. (Australia is connected to some two dozen subsea cables.)

A large number of vehicles will be needed to provide the RAN with persistent, wide area anti-submarine and seabed defense operations. The Ghost Shark power system has not been disclosed, but it will come with energy constraints that limit its range and endurance, influencing the scope and scale of its missions and, in turn, the number of Ghost Sharks required to successfully carry them out. AUKUS Pillar two calls for the transfer of "advanced undersea capabilities," which could be used to augment submarine/XL-AUV coverage. For example, resident UUV systems could provide ongoing surveillance of cables, pipelines, and other infrastructure. Vehicles such as the **Saab Sabertooth**, or the **Oceaneering Freedom**, which was recently selected by the U.S. Navy in its search for a seabed warfare UUV, can recharge independently while operating at considerable depths.

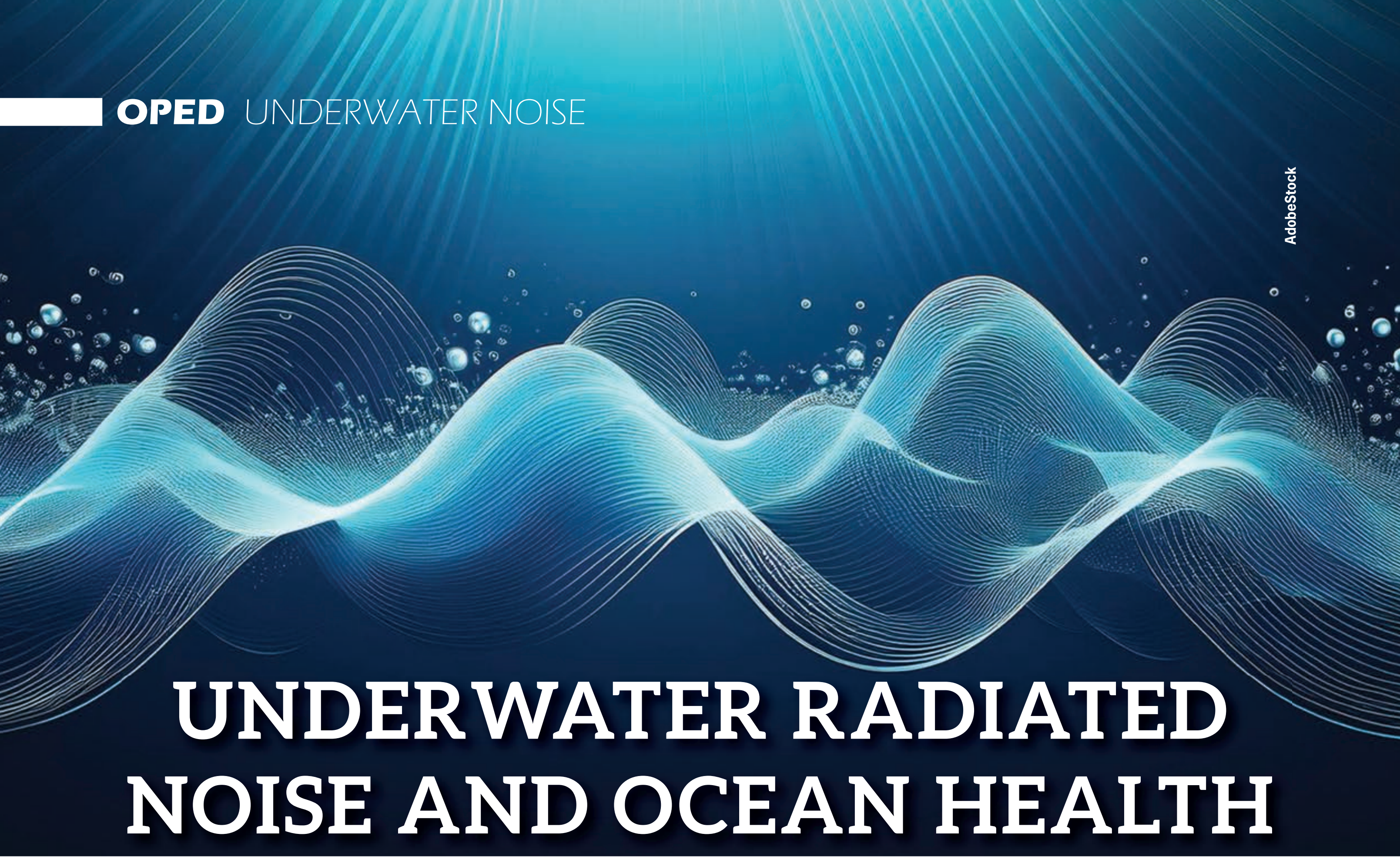
What about sustained uncrewed underwater operations in contested waters? A concept put forth by the U.S. Navy and DARPA, the **Forward Deployed Energy and Communications Outpost (FDECO)**, would enable sustained UUV operations using a network of seabed charging stations. Networks like FDECO would likely be deployed clandestinely by XL-AUVs, such as the U.S. Navy's Orca, or by special purpose crewed submarines like the USS Jimmy Carter, or the forthcoming Block VI Virginia-class seabed warfare variant.

Another option would be torpedo tube launch and recovery (TTLR) of UUVs, with crewed submarines acting as forward deployed charging stations. Torpedo tube equipped XL-AUVs could potentially also be fitted with this capability, enabling a lower-cost fleet of mobile charging stations capable of launching and recovering UUVs from within the water column.

But even with fully functioning systems in place, friction, as Clausewitz reminds us, is inevitable.

High sea states, strong underwater currents, depth changes, and complex maneuvering will place greater demands on thrusters and navigation sensors, causing them to consume more energy. Artificial intelligence will generate high computational loads due to complex algorithms and real-time data processing, placing a higher demand on onboard energy, as will malfunctioning sensors, software glitches, or malware infected computers. Surface UUV recovery, recharging, and redeployment takes time, effort, infrastructure, and manpower, and can be impacted by all manner of adverse maritime conditions. All of these small things will pose dilemmas for commanders in the field, and conspire to undermine mission success.

While logistics may win wars, endurance is a key enabler of victory. Managing the energy demands of underwater systems in the face of complex mission sets and operational friction will be one of the greatest challenges in the coming era of uncrewed underwater operations. As another 19th century strategist, Napoleon, is said to have quipped: Armies march on their stomachs. In the modern age of uncrewed systems, underwater armies will march on their batteries, fuel cells, and nuclear reactors.



AdobeStock

UNDERWATER RADIATED NOISE AND OCEAN HEALTH

By Chris Waddington, Technical Director at International Chamber of Shipping

The maritime industry's push toward decarbonization brings an unexpected benefit: the reduction of underwater radiated noise (URN). While the sector focuses intensively on emissions reduction and fuel efficiency, these same measures are quietly contributing to a healthier acoustic environment in our oceans. For ship owners and operators already investing in green technologies, addressing URN can be a natural extension of existing environmental initiatives, offering a dual benefit for both emissions and marine life.

Energy Efficiency and Noise Reduction

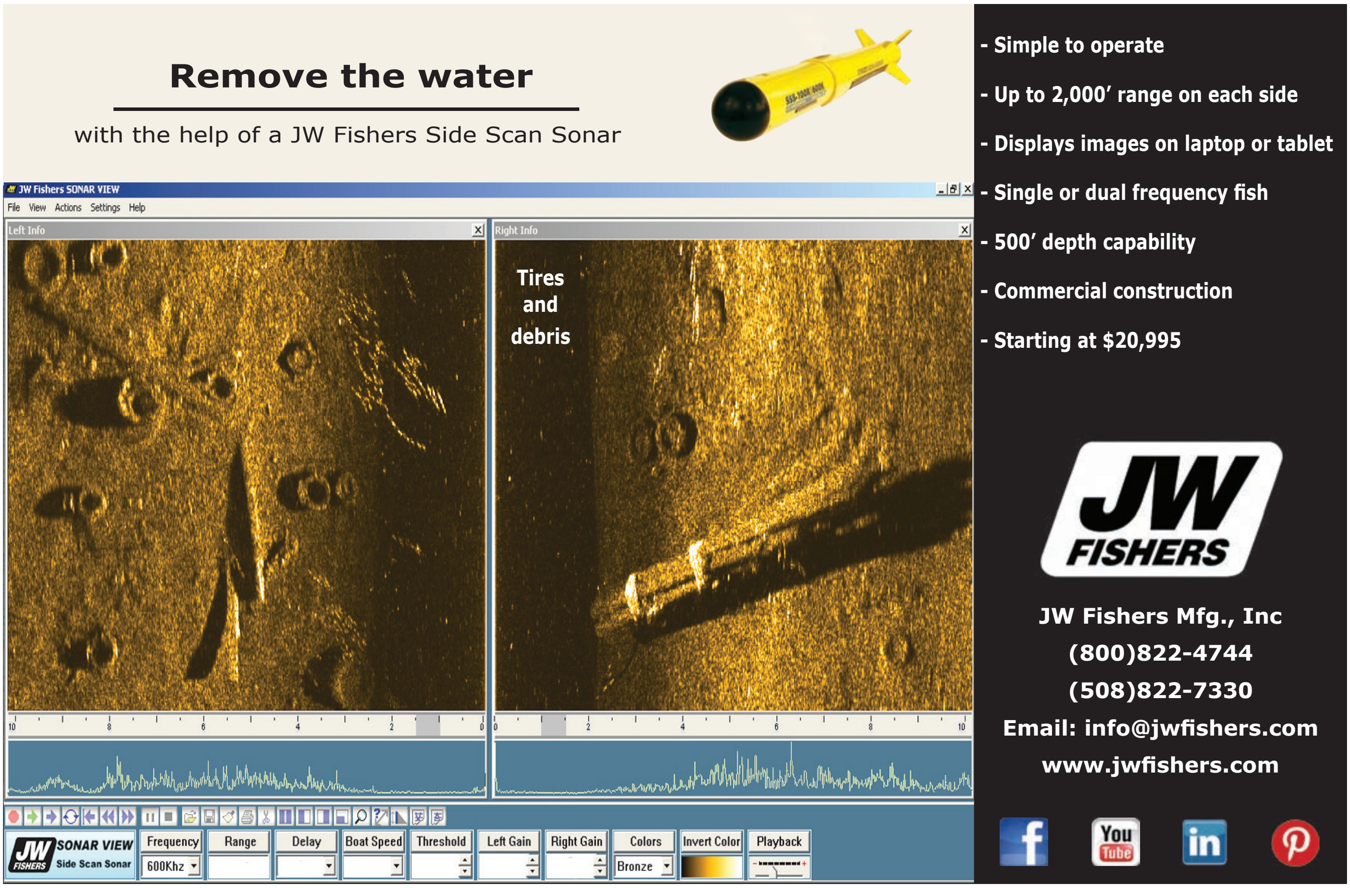
One of the key insights from recent research is the natural alignment between energy efficiency measures and noise reduction. Most interventions aimed at improving a vessel's fuel efficiency also contribute to reducing its URN output. Speed limitation, a fundamental tactic for lowering fuel consumption, simultaneously reduces propeller cavitation and, consequently, URN. Technologies like air lubrication systems, which reduce friction between a ship's hull and the water, not only improve energy efficiency but also help in minimizing noise pollution.

The IMO's Energy Efficiency Existing Ship Index (EEXI), effective from January 2023, limits the power output of ship engines, indirectly contributing to URN reduction. More advanced technologies, such as wind-assisted propulsion and techniques to ensure Just-in Time Arrival, hold promise for further mitigating both emissions and noise pollution.

Understanding URN

Underwater radiated noise refers to the sound energy emitted from ships into the ocean. This noise originates from various sources, with cavitation from propellers being the most significant contributor. Cavitation occurs when water vapor bubbles form and collapse near the propeller blades due to pressure changes, releasing energy in the form of sound. This constant hum of cavitation and other machinery adds to the ambient noise in the ocean, contributing to a long-term increase in sound levels.

Since the 1930s, studies have indicated that URN levels have risen by an average of three decibels per decade, largely driven by shipping activities. This steady increase disrupts the natural acoustic environment, posing challenges for marine life that rely on sound for navigation,


Remove the water
with the help of a JW Fishers Side Scan Sonar
Tires
and
debris
- Simple to operate
- Up to 2,000' range on each side
- Displays images on laptop or tablet
- Single or dual frequency fish
- 500' depth capability
- Commercial construction
- Starting at $20,995
JW FISHERS
JW Fishers Mfg., Inc
(800)822-4744
(508)822-7330
Email: info@jwfishers.com
www.jwfishers.com


SBG SYSTEMS
Motion & Navigation you can trust
Navsight Marine
All-in-one Motion & Navigation Solution
Qinertia Software
Next Generation INS/GNSS Post-processing Software
www.sbg-systems.com
MADE IN FRANCE

communication, and reproduction. While recent studies show some variation in trends across different regions, the overall impact of shipping on the underwater soundscape remains a cause for concern.

URN & Marine Life

For marine species, especially those that depend on echolocation and sound-based communication, URN is akin to human exposure to constant noise pollution. The continuous noise can interfere with essential behaviors, such as hunting, mating, and social interaction, leading to a cascade of negative effects on marine ecosystems. Species like whales and dolphins are particularly vulnerable, as they rely on sound for long-distance communication and navigation. Coastal waters, where marine biodiversity is often concentrated, are especially sensitive to URN.

Regulatory bodies such as the International Maritime Organization (IMO) have begun addressing this issue. The IMO's URN guidelines encourage stakeholders to adopt noise reduction measures, and national and regional measures are providing focused protection for particularly sensitive coastal areas, e.g. through mandatory or voluntary slow down zones.

Reducing URN

Achieving significant reductions in URN requires a multifaceted approach. Beyond technological innovations, there is a need for stronger incentives. Ports and harbor authorities, as highlighted by the IMO, can play a crucial role in encouraging ship owners to adopt quieter technologies. The International Association of Ports and Harbors (IAPH) is already taking steps to include URN reduction in its Environmental Ship Index (ESI), rewarding vessels that minimize their environmental footprint.

Local initiatives, such as Vancouver's proactive noise-reduction schemes, demonstrate the potential for regional action to address this global issue. Expanding these efforts to a broader scale, with the support of international bodies like the IMO, could create a framework for URN management across the maritime industry. Instruments such as Particularly Sensitive Sea Areas (PSSAs) offer a way to protect critical local habitats by imposing stricter controls in designated regions.

A Sustainable Maritime Future

Looking ahead, the goal set by the Okeanos Foundation to reduce ambient deep ocean URN by three decibels per decade over the next 30 years is ambitious but achievable. Existing energy efficiency technologies, which also reduce noise, can help the industry meet these targets. The challenge lies in encouraging ship owners to choose the right technologies, scaling these solutions and ensuring that the incentives and guidance align with environmental objectives.

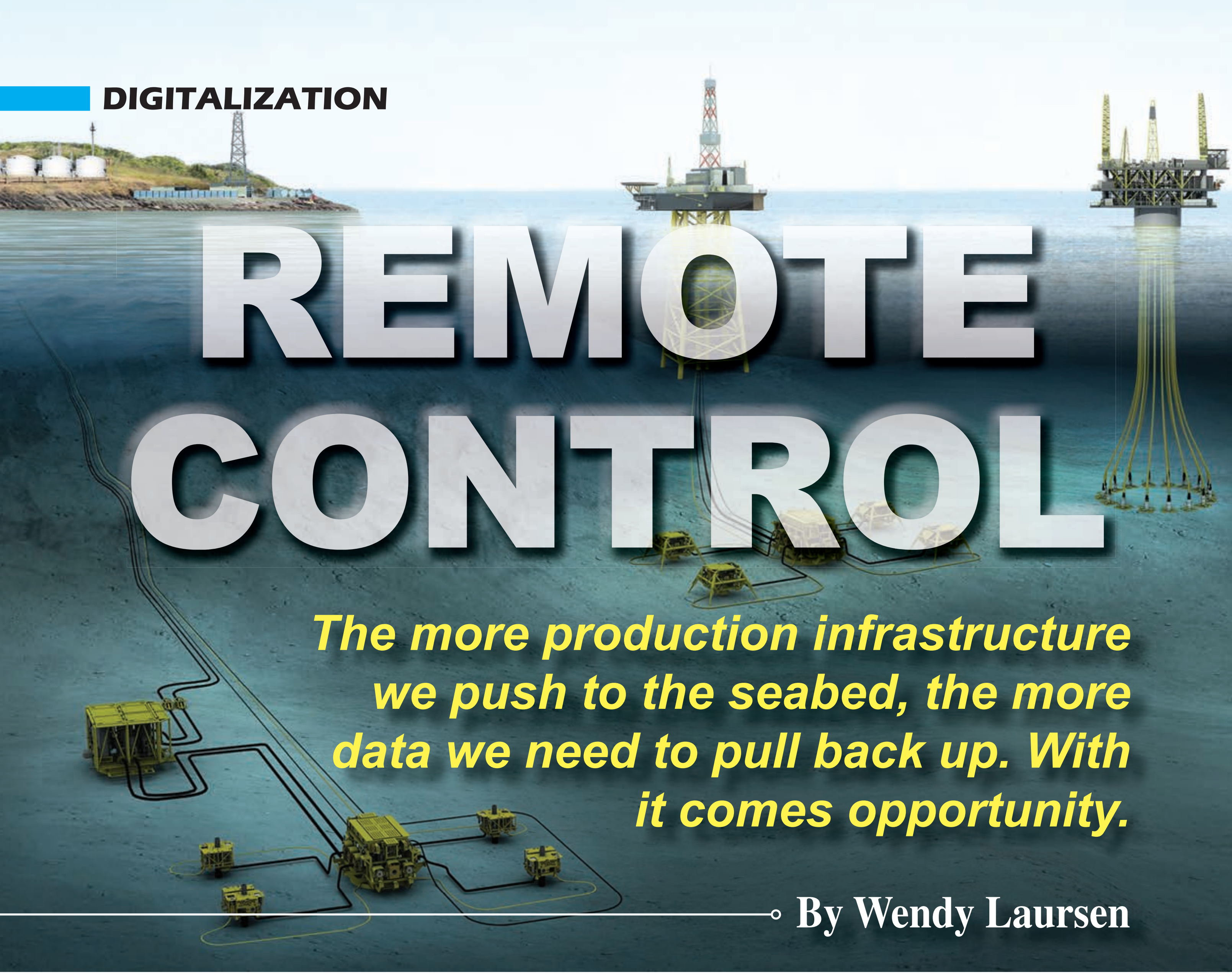
As the maritime industry continues its journey towards decarbonization, addressing URN must remain a priority. The environmental and economic benefits of noise reduction are clear. By embracing energy-efficient practices which give the co-benefit of noise reduction, ship owners and operators can play a pivotal role in safeguarding the oceans for future generations. The conversation on URN has begun, but the real work lies ahead in transforming this awareness into action.

ICS and BIMCO's commitment to reducing URN: A practical guide for the industry

Recognizing the growing concerns around underwater radiated noise, the International Chamber of Shipping (ICS), in collaboration with BIMCO, has taken a proactive step by releasing the Underwater Radiated Noise Guide. This guide provides shipping companies with a comprehensive toolkit to address and mitigate noise pollution across their fleets. It details the primary sources of URN, emphasizing the strong synergies between noise reduction and energy efficiency, offering opportunities for significant co-benefits. The guide outlines practical design and operational measures that are proven to reduce noise levels, helping companies develop and implement effective noise management plans.

For more information and to order the Underwater Radiated Noise Guide please visit: ***https://www.ics-shipping.org/publications/underwater-radiated-noise-guide-first-edition***

About the Author
Chris Waddington is Technical Director at the International Chamber of Shipping (ICS). He is responsible for the development and implementation of ICS policy on technical, operational and environmental regulatory risks affecting international shipping. He actively participates in IMO Committees and industry associations, to represent the interests of ICS Members, shipowners and operators.



REMOTE CONTROL

The more production infrastructure we push to the seabed, the more data we need to pull back up. With it comes opportunity.

By Wendy Laursen

Chevron's landmark 6,500 tons of subsea gas compression infrastructure for Jansz-Io demonstrates the scale of what is being put on the seabed, but there's a diversity of other infrastructure under development that will operate alongside traditional production systems.

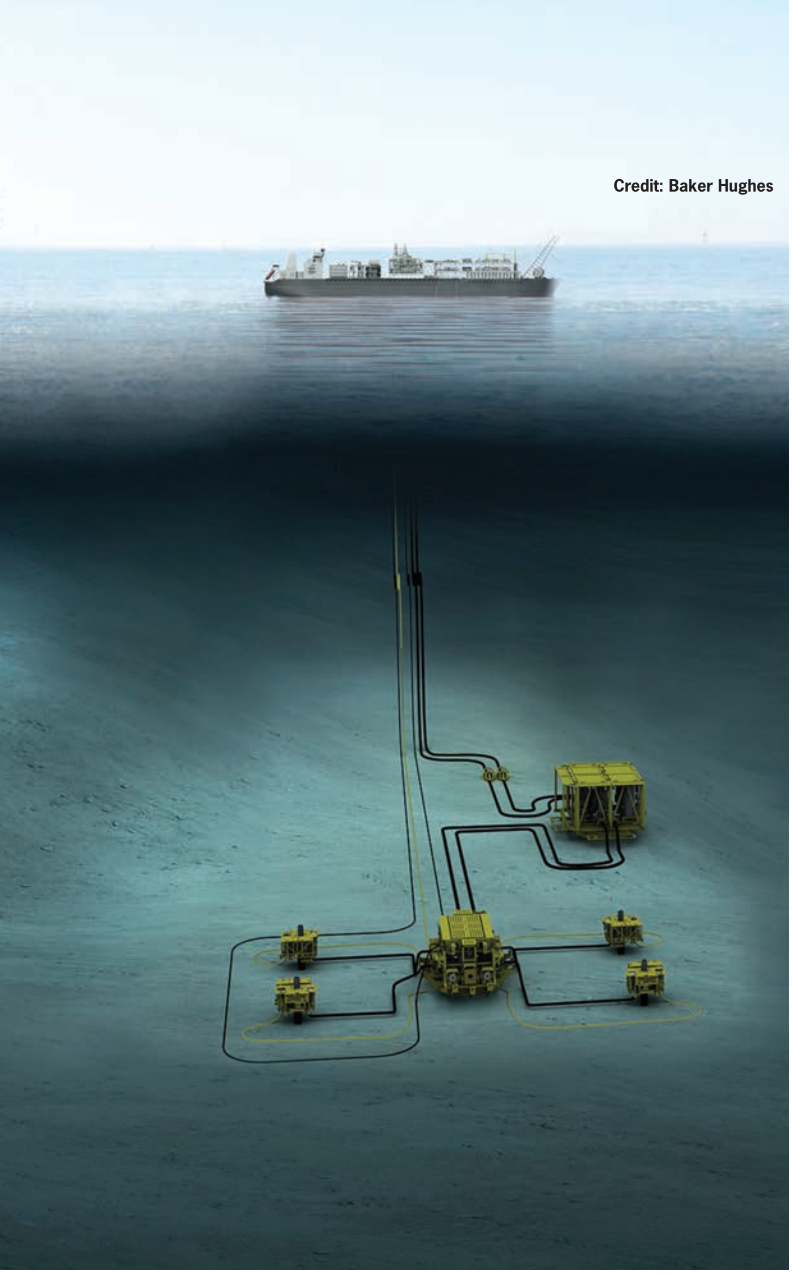
This includes subsea fluid storage technology from NOV Subsea Production Systems, and **TechnipFMC** and **Sulzer Flow Equipment's** subsea CO2 pumps for new high pressure separation technology from Petrobras.

The growing number of new technologies are expected to play a pivotal role in the future of oil and gas production, advancing efficiency and environmental performance. Their digitalization will further these goals by providing remote control, optimized operations and enhanced decision-making capabilities.

Enabling technology for that digitalization, such as subsea power and communications, continue to evolve, says **Miguel Hernandez**, Senior Vice President of Global Offshore at ABS, even though the subsea environment poses significant challenges. "Maintaining reliable communication links between subsea assets and onshore or offshore control systems is crucial, but connectivity issues such as bandwidth limitations and signal interference can pose challenges," says Hernandez. "Transmitting data through water, especially at great depths, is challenging due to the attenuation of signals."

The introduction of 5G technology aims to overcome these challenges and is already being developed for production systems. In July, **ADNOC** and **e&** announced a project to build a 5G network that will relay information from sensors embedded in more than 12,000 wells and pipelines to autonomous control rooms. It is due to be completed in 2025 and expected to generate $1.5 billion in value during its first five years of operation.

Also in July, ADNOC announced the deployment of RoboWell, AIQ's autonomous well-control solution into its NASR field operations. RoboWell uses cloud-based AI algorithms to autonomously operate wells that self-adjust according to



Credit: Baker Hughes

changing conditions to enhance safety and efficiency and reduce the need for travel and physical interventions.

A 12-month trial project wrapped up in March that aims to support the electrification of subsea power and communications by combining wave power with subsea energy storage. The Renewables for Subsea Power project connected **Mocean Energy's** Blue X wave energy converter with a Halo underwater battery storage system developed by Verlume. The trial off the Scottish coast demonstrated how green technologies can be combined to provide reliable and continuous low-carbon power and communications to subsea equipment as a future alternative to umbilicals. TotalEnergies and Shell Technology recently joined the initiative to now deploy the system on live assets.

Siemens Energy is working on new concepts to make subsea digital systems smarter using its Subsea DigiGRIDTM control, safety and digital twin systems. Endre Brekke, Product Lifecycle Manager for Subsea Automation and Control, explains: "We are designing systems to be able to perform well under significant uncertainties in the system and environment for extended periods of time and without external intervention, that is, operator monitoring and control. We are also working on edge analytics and storage, building in abilities to perform analytics close to the source of the data and to store both raw data and results for an extended period of time."

Brekke says industry-standard based integration with topside systems is very important. This enables interoperability between systems from different vendors and enables use of automation standards on the seabed. "This saves CAPEX and OPEX," he says.

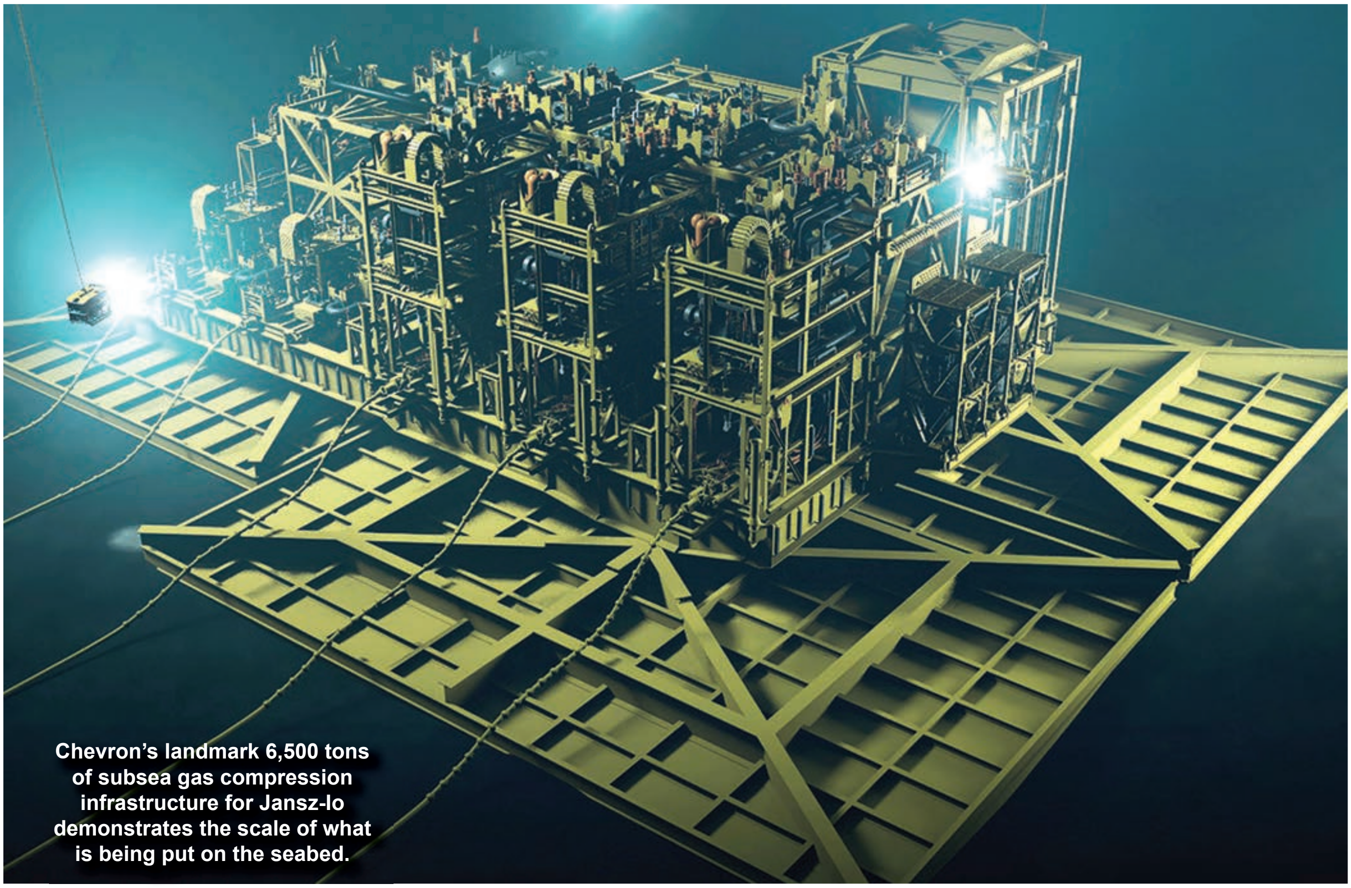
"This approach also enhances liberation of data for optimization of production and maintenance. This is growing even more important, and our Subsea DigiGRID system is designed to do this very efficiently. The Subsea DigiGRID can interface a topside controller on a hard real-time standard automation protocol and, at the same time, from the same hardware, stream data to a topside cloud-based digital twin using a digital twin protocol like MQTT."

OneSubsea, an **SLB** joint venture, is pushing ahead with subsea electrification, a move that has the potential to increase the amount and quality of data returned topside. The company has been awarded the FEED of a 12-well, all-electric subsea production system with an IoT for the subsea trees at Equinor's Fram Sør field, offshore Norway. As part of the agreement, future engineering, procurement and construction will be directly awarded to SLB OneSubsea conditional on a final investment decision. The IoT includes three key digitalization efforts: intelligent sensors and actuators on the equipment (rather than spring-operated on/off systems), connectivity through a secure digital platform and the ability to turn data into decisions via analytics and diagnostics.

"With all these pieces now in place, we have enabled intelligent asset lifecycle performance management for our subsea production systems, including for the trees," says **John Macleod**, vice president of technology and strategy, SLB OneSubsea. "Looking forward, the industry needs more data to develop a deeper contextual understanding of equipment performance to safely extend the productive life of offshore assets and to enable circularity."

For Fouzi Bouillouta, Global Program Manager – EngageSubsea at Baker Hughes, maintaining equipment up-time is critical. With the growing digitalization of a growing number of subsea assets, his aim, using tools such as the company's modular engageSubsea platform, is to break down data silos, consolidate multiple data streams and bring end-to-end operational visibility and analytics. The system provides a real-time, 360-degree view of installed equipment, preventative maintenance forecasts and critical alarms.

Bouillouta doesn't see digital technology as a black-box approach to problem solving. Rather, the engageSubsea platform is a visualization tool that helps optimize how people



Credit: Chevron

Chevron's landmark 6,500 tons of subsea gas compression infrastructure for Jansz-Io demonstrates the scale of what is being put on the seabed.

communicate and collaborate on the processes that will maximize up-time. One standout feature is engageSubsea Remote, a module enabling remote operations for both Baker Hughes users and customer operations. With it, Baker Hughes has the capability to provide remote technical support via the use of augmented reality tools located on a platform. "This creates a lot of value, instead of sending someone offshore or having to keep someone offshore to look at problems if something happens," says Bouillouta.

"Today's business complexity necessitates a shift from a reporting culture to true transparency and collaboration in the energy industry. With asset integrity management still representing a significant portion of OPEX, the market needs a solution that leverages data and expertise to proactively manage assets and reduce costs.

"When we speak about digital technology, it sometimes sounds very complex, and expensive, but really it's all about providing a competitive view of the subsea ecosystem."

Fram Sør Will be the Tipping Point for Subsea Electrification

OneSubsea, an SLB joint venture, recently announced a contract award for its all-electric subsea production system, and John Macleod, vice president of technology and strategy at SLB OneSubsea, sees it as the onset of a tipping point.

"Large investments have been made across the industry to make this capability a reality, and we now see several projects on the horizon that use all-electric as their base case."

The first project is the recent contract award from Equinor for the front-end engineering design (FEED) of a 12-well, all-electric subsea production systems project in the Fram Sør field, offshore Norway. The solution will use SLB OneSubsea's standard subsea tree design, upgraded with a fully electrified power, control and actuation system.

"You can only go so far by optimizing component-level performance," says Macleod. "As we add to our electric capabilities toward a complete pore-to-grid solution, this will trigger further step changes in performance, enabling greater and greater system-level optimization capabilities and cost efficiencies.

"Additionally, an all-electric approach can help to overcome some of the limitations associated with legacy offshore power and control systems. Some of the cases we have looked at for tiebacks into mature infrastructure show an all-electric approach can help to enable the viability of these tiebacks.

"It will also enable the remote control of such assets during the operational phase. The resulting reduction in project cycle time and costs and the ability to produce previously inaccessible reserves can redefine an asset's net present value for the better."

All-electric systems are well suited to local energy generation and storage which can be an additional enabler to project viability. Also, electrification leads to reduction of surface infrastructure at the host facility, coupled with the reduction of hydraulics eliminating hydraulic power units and large topside reservoir.

In the future the integration with autonomous underwater vehicles, subsea wireless and subsea power solutions will support even more reduction of infrastructure topside.

"Electrification at a system level will drive simplification of integration with existing infrastructure, moving more to a plug-and-play model for infrastructure led (ILX) resources, for example," says Macleod.

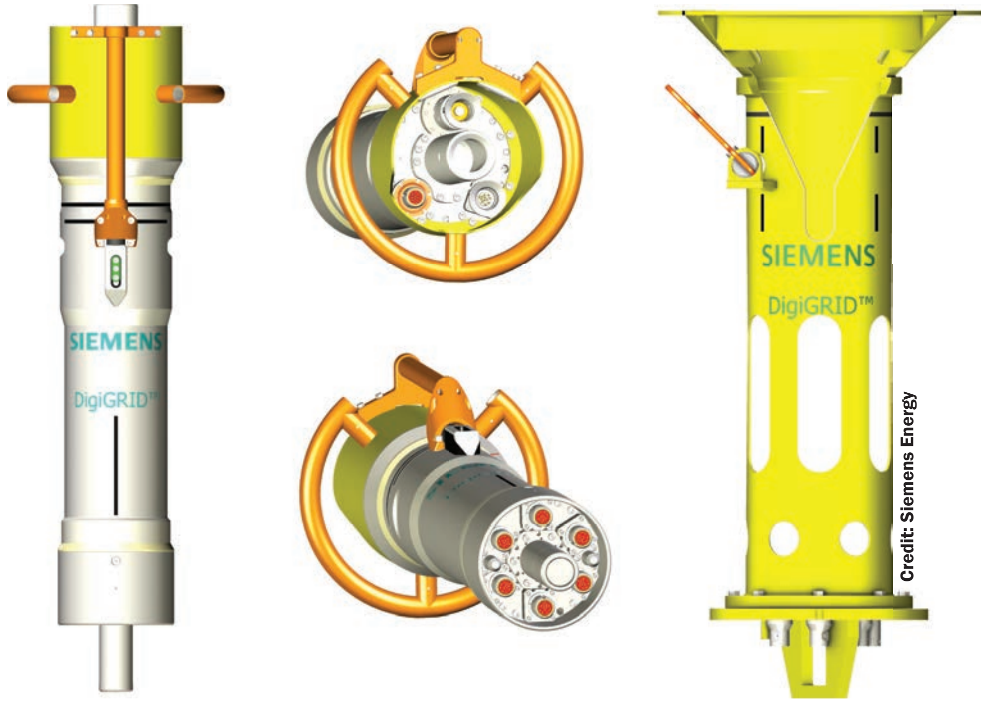
This is especially important for tiebacks into busy facilities, where plug-and-play power and communications result in much simpler topside modifications, much lower cost and much smaller environmental footprint rebuilding topsides.

The elimination of high-pressure hydraulic systems is expected to enable operators to go further and deeper, improving production and making even marginal fields more viable.

"Electrification is in some cases the only solution to achieve technical, commercial and operationally viable solutions for long distance developments. Using traditional systems, it will be much harder and costly to achieve both acceptable safety and operational performance compared with hydraulic systems during, for instance, shutdown and pressurization of the system. Digitalization of subsea assets facilitates more opportunities for conditioning monitoring, which allows for predictive maintenance and planned interventions or the potential to avoid equipment failure altogether."

One of the key changes SLB has made is to go from a spring-operated on/off system to a battery-operated and motor controlled one, facilitating much better positional control.

"Ultimately, more control and more data enables realization of optimization that in time may lead toward more



Mechanical solution for stab-plate based control canister with six electrical stab-plate connectors in the bottom and two electrical and one fibre optic ROV connectors in the top. This mechanical solution can be used for all standard assemblies in the Subsea DigiGRID portfolio.

Credit: Siemens Energy

"We are designing systems to be able to perform well under significant uncertainties in the system and environment for extended periods of time and without external intervention, that is, operator monitoring and control."

– Endre Brekke,
Product Lifecycle Manager for Subsea Automation and Control, Siemens Energy

Credit: OneSubsea

"The industry needs more data to develop a deeper contextual understanding of equipment performance to safely extend the productive life of offshore assets and to enable circularity."

– John Macleod,
Vice President of Technology and Strategy, SLB OneSubsea

Credit: Baker Hughes

"When we speak about digital technology, it sometimes sounds very complex, and expensive, but really it's all about providing a competitive view of the subsea ecosystem."

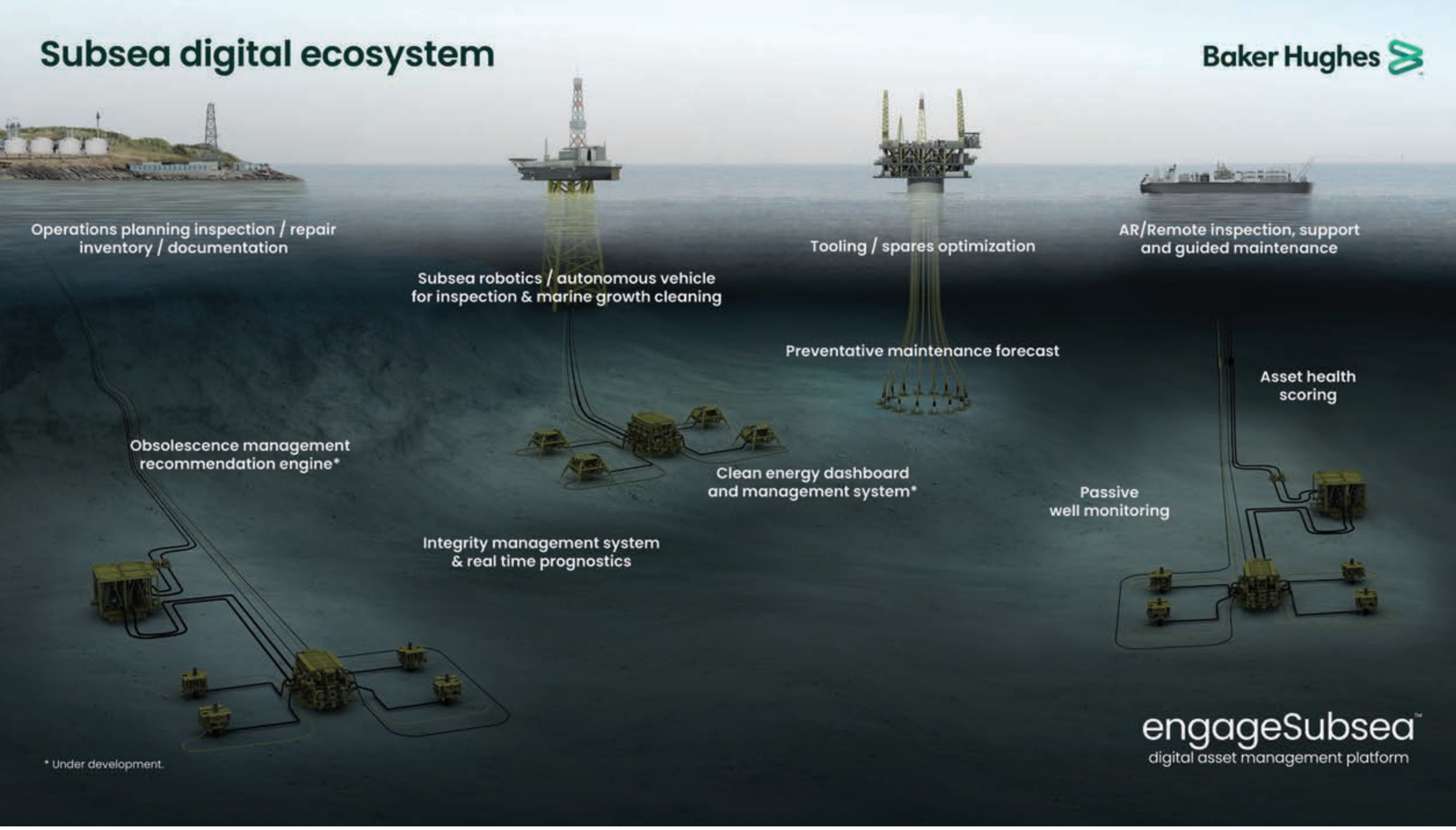
– Fouzi Bouillouta,
Global Program Manager - EngageSubsea at Baker Hughes

closed loop automation, as well as more cognitive workflows. This is becoming an extremely interesting area."

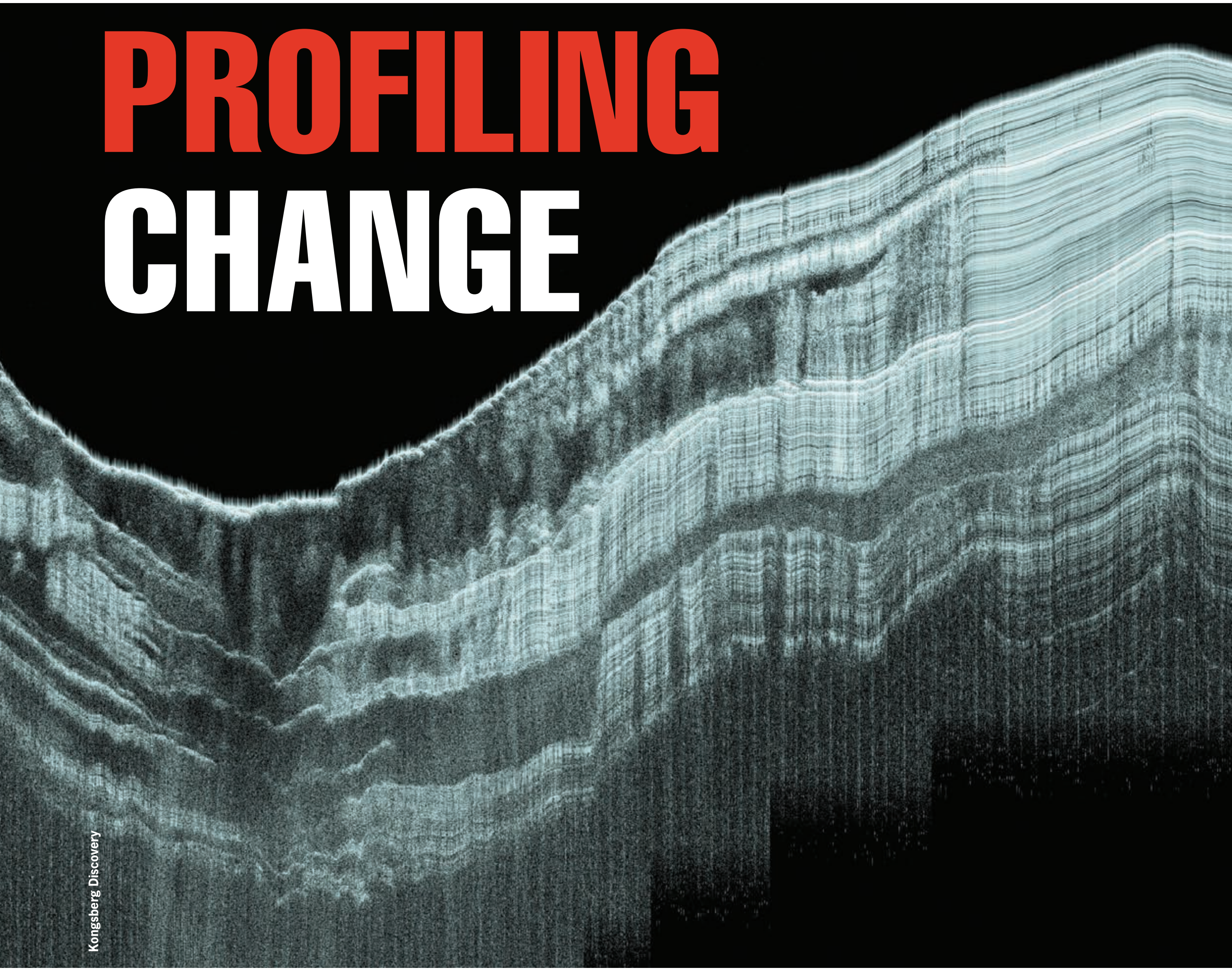
Macleod points out that the benefits of increased electrification and instrumentation have been recognized across many industries, and history shows that once the benefits are demonstrated at scale, adoption accelerates. "That's why we believe that the Fram Sør project could pave the way for accelerated industry-wide adoption of all-electric subsea technology, as it offers that industrial, scalable solution. It is built on a solid, proven technology platform, while offering lower cost, smaller footprint and simplified architecture. It is also a necessary piece in the overall digitalization effort of our industry."

SLB has been awarded the FEED of a 12-well, all-electric subsea production system with an IoT for the subsea trees at Equinor's Fram Sør field, offshore Norway.

Credit: OneSubsea


Subsea digital ecosystem
Baker Hughes
Operations planning inspection / repair inventory / documentation
Subsea robotics / autonomous vehicle for inspection & marine growth cleaning
Tooling / spares optimization
AR/Remote inspection, support and guided maintenance
Preventative maintenance forecast
Asset health scoring
Obsolescence management recommendation engine*
Clean energy dashboard and management system*
Passive well monitoring
Integrity management system & real time prognostics
engageSubsea
digital asset management platform
* Under development.

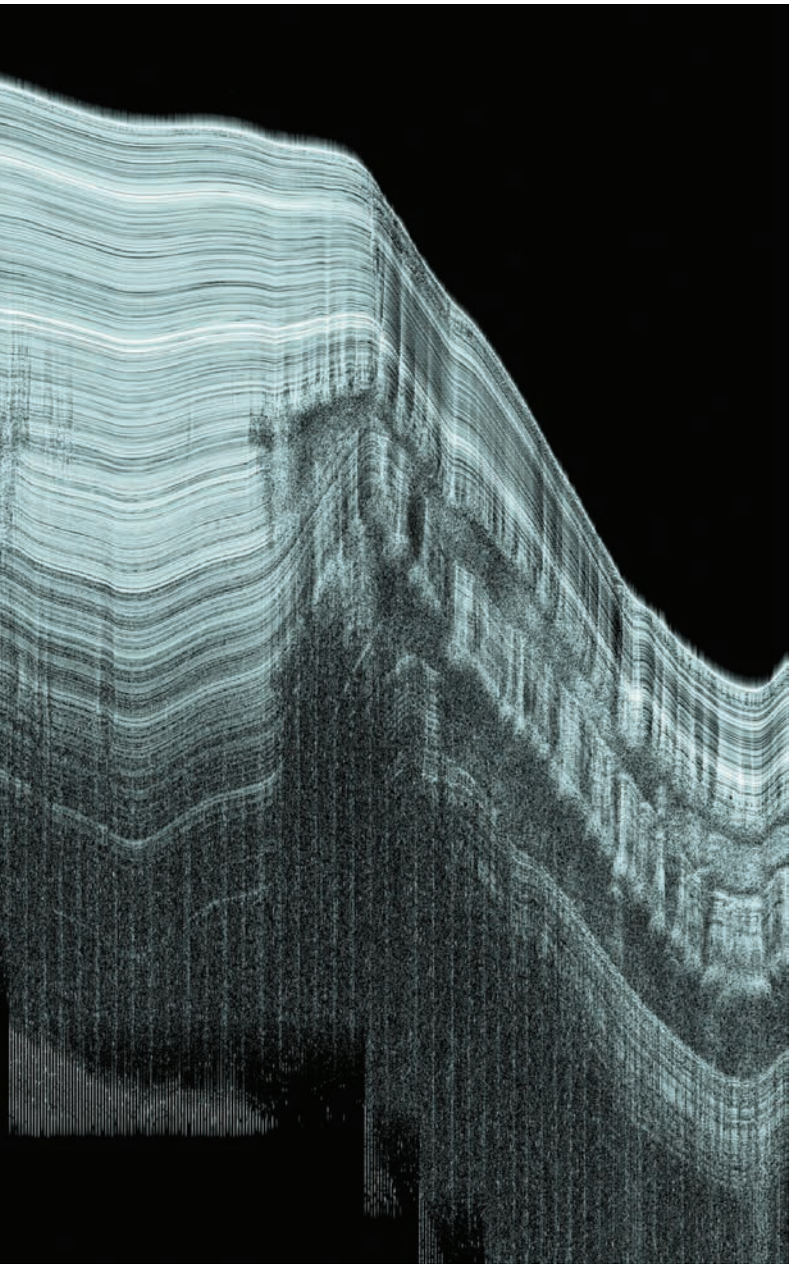
PROFILING CHANGE



Kongsberg Discovery

SUB-BOTTOM PROFILERS ARE TRACKING OFFSHORE WIND INTO DEEPER WATER, BUT THERE'S OTHER OPPORTUNITIES TOO THAT ARE DRIVING THE LATEST DEVELOPMENTS.

By Wendy Laursen



Kongsberg Discovery

"The need for automated solutions to ensure data quality is becoming more important."

– Therese Mathisen,
Product Manager for Sub-bottom Profilers, Kongsberg Discovery

Bahrain's coastline has expanded significantly in the past 30 years, while Abu Dhabi actively pursues new land development through the creation of massive artificial islands.

Sub-bottom profilers have and will be crucial in projects like these, says R**ichard Dowdeswell, CCO at GeoAcoustics**. "Offshore construction, particularly for land reclamation projects like ports and harbors, is a growing market. Before any construction begins, it's essential to understand the area's geology, which feeds into the civil and marine engineering plans. Most of this activity happens in shallow coastal waters."

The growing demand for geophysical surveys, particularly for wind farm development, is another key driver, says Dowdeswell, and this is increasingly encompassing deeper waters. "Wind farms require knowledge of subsurface conditions, especially for laying interconnecting and export cables. When operating cable trenching machines, it's critical to identify potential obstacles like large boulders that could damage the expensive equipment. This is where more powerful sub-bottom profilers, along with traditional seismic boomers and sparkers, come into play. These tools, which operate at lower frequencies with more power, help detect deeper subsurface features and harder surfaces, such as compacted sand, revealing objects and the geology of the strata."

The company's latest development extends depth range. "The GeoPulse Compact is an excellent tool for shallow water

GeoAcoustics

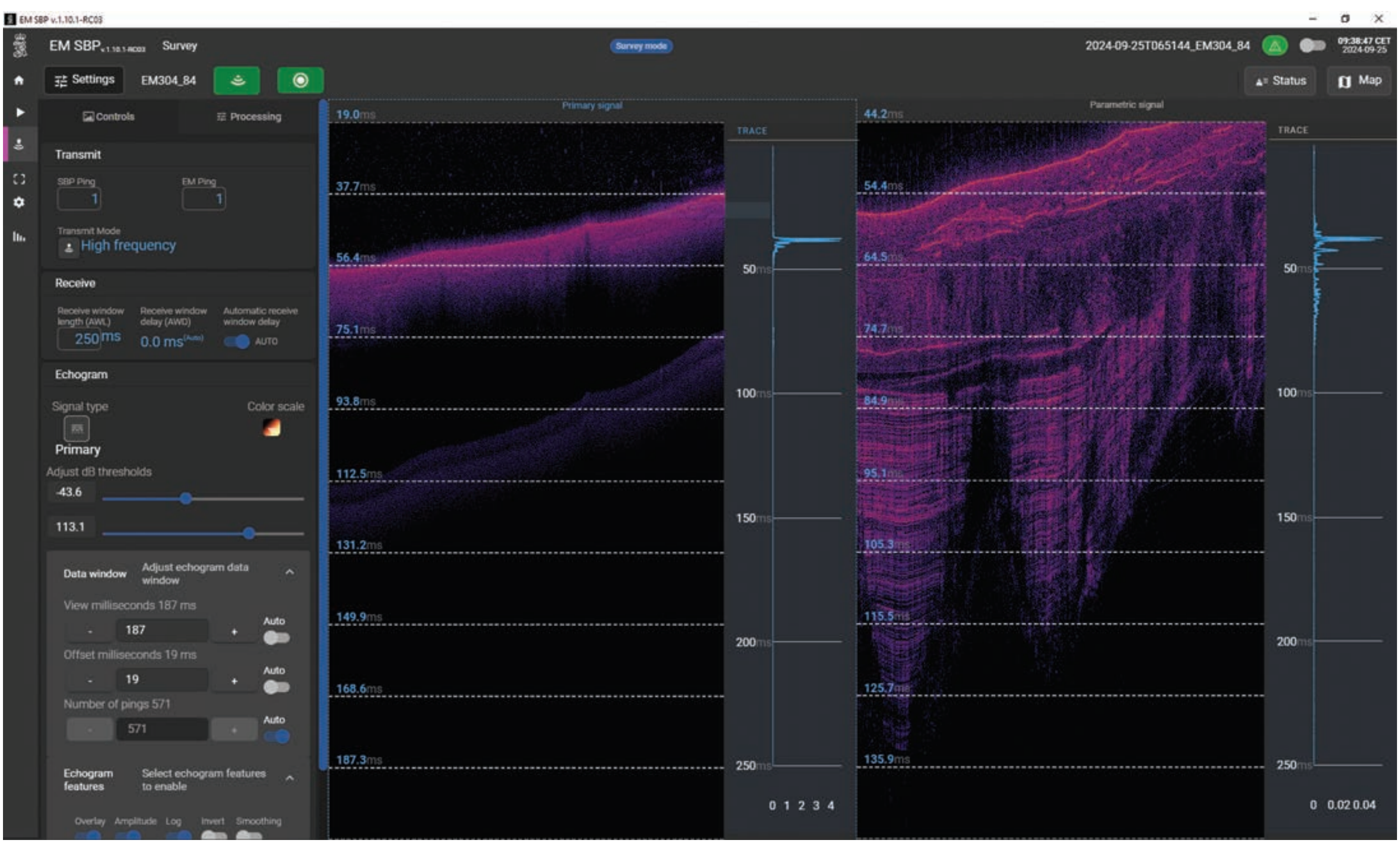
GeoPulse 2 from GeoAcoustics replaces the older analogue systems and operates at depths of up to 5,000 meters.

and small boat exploration. In contrast, the GeoPulse 2 replaces the older analogue systems and operates at depths of up to 5,000 meters. It has significantly more power, making it better suited for penetrating harder sediments and reaching greater depths."

GeoPulse 2 offers digital Chirp and Ricker waveforms, in addition to pinger functionality. These new waveforms offer enhanced resolution and advantages depending on the geological conditions and water depth. Despite these upgrades, GeoPulse 2 is designed to be a simple drop-in replacement – users don't need to replace their existing GeoPulse cabling or transducer, and it's compatible with systems like **Chesapeake Technology's SonarWiz**, **Xylem Water Solutions' Hypack**, and **GeoMarine's Geo All Suite.**

Therese Mathisen, product manager for sub-bottom profilers at Kongsberg Discovery, points to the trend towards smaller vessels and automated survey platforms. Saving space and power consumption are important factors. Contradicting these needs, operation at deep water requires providing greater penetration and resolution through a low and wide frequency range, high source level and narrow beams - which typically involve physically larger installations.

"The need for automated solutions to ensure data quality is becoming more important. Aided and automated survey settings are important to avoid making costly mistakes that re-



Kongsberg Discovery

Kongsberg Discovery's EM SBP sub-bottom by primary EM304 frequencies (left) and EM304 parametric low frequencies (right).

EdgeTech's 3400 systems now have PVDF receivers and "pipeline mode."

EdgeTech

EdgeTech's 3400-OTS transmits wide band frequency modulated pulses utilizing the company's proprietary full spectrum CHIRP technology.

Jonathan Morvan, Commercial manager at Hydroconsult and Benoît Fraleu, CEO at Hydroconsult, with Guillaume Jouve and Calixte Genin from Exail.

Exail

quires re-runs, or even revisiting a survey area. The user may want data in near real time for their decisions makings. Cloud based solutions giving the user necessary information is certainly an important means to allow for sharing the data in an efficient manner," says Mathisen.

"The need for meeting practical solutions such as installation space, power requirements, remote operations, as well as robustness against user mistakes at the same time as providing expert users with high flexibility, is technologically challenging, but yet interesting and very understandable."

Kongsberg Discovery's sub-bottom profiling systems include the SBP29, a high power, narrow beam sub-bottom system that operates together with the deepwater Kongsberg multibeam systems. It operates at 2-9 kHz and can acquire several simultaneous narrow beam sub-bottom observations in a fan across the vessel. In real-time it will pick the strongest reflection and generate a multibeam sub-bottom image from several high resolution, narrow beams.

The TOPAS is a family of parametric sub-bottom profiling systems available in configurations from shallow waters to full ocean depths. The benefit of the parametric principle is that it can acquire high quality sub-bottom data with smaller transducer arrays.

EM SBP is **Kongsberg Discovery's** newest sub-bottom profiling solution. EM SBP uses the EM 124 or the EM 304 multibeam echo sounder hardware which for many larger survey vessels already are available on board for bathymetry purposes. "EM®SBP allows you to use your multibeam system for sub-bottom data acquisition and by that adding information and value to your seabed survey at low cost, low space and low power consumption," says Mathisen.

EdgeTech's 3400 systems now have PVDF receivers and "pipeline mode." The 3400-OTS transmits wide band frequency modulated pulses utilizing the company's proprietary full spectrum CHIRP technology. The system uses flat multi-channel hydrophone array to generate high resolution images of the sub-bottom stratigraphy in oceans, lakes and rivers and provides excellent penetration in various bottom types, says **Doug McGowen**, Director, Sales and Marketing at **EdgeTech**.

The 3400-OTS receiver array is segmented for standard sub-bottom profiling operations or "pipeline" mode for optimal location and imaging of buried pipelines or cables. The system offers real-time reflection coefficient measurements. "This unique ability of the EdgeTech sub-bottom profiler system allows users the ability to collect complex analytic data using linear system architecture to measure sediment reflection and analyze sediment type determination," says McGowen. Additionally, the system has discrete transmit and receive channels allowing for continuous data collection resulting in a high ping rate, particularly important for construction and pipeline surveys.

At the high end of the market, EdgeTech has just started to deploy the buried object sonar system (eBOSS) which is capable of penetrating the seabed to accurately detect, locate, classify and identify buried and partially proud objects. This low-frequency acoustic imaging system can be operated in real-time for general survey purposes such as cable and pipe tracking and route surveys or have the data post processed utilizing synthetic aperture sonar processing to render 3-dimensional images of buried objects.

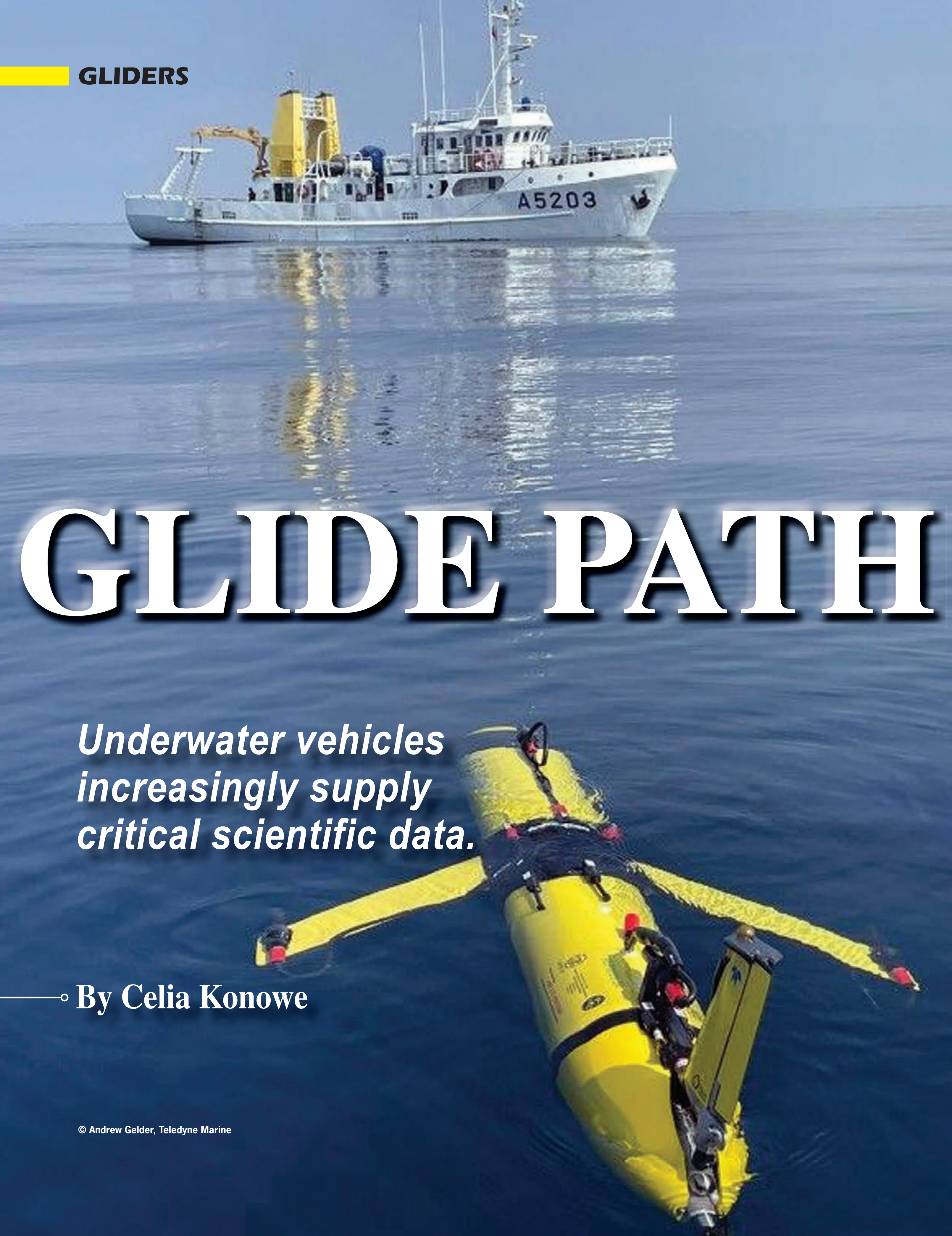
Exail's new Echoes Compact provides high-resolution images of sedimentary deposits and buried objects across a depth range from very shallow waters to 400m. The system is specifically designed for USVs and small vessels as it features low power consumption and compact dimensions. It is a portable solution suited to river, lake and ocean surveys, whatever the seabed topography. Exail says it offers good penetration of clays and sands due to its powerful low-frequency signal, together with 7.5cm vertical resolution thanks to a wide bandwidth from 5 to 15kHz.

Exail sold its first Echoes Compact to Hydroconsult. The company is serving as a consultant and personnel provider to a major multi-energy firm in Africa which is analyzing the sub-bottom before the installation of telecommunication cables and pipelines in West Africa.

GLIDE PATH

Underwater vehicles increasingly supply critical scientific data.

By Celia Konowe



© Andrew Gelder, Teledyne Marine

Underwater ocean gliders, autonomous and unmanned, are critical for gathering data and providing insight into climate change, marine biodiversity, infrastructure and other applications. Gliders are one of many tools utilized across the maritime industry, occupying a unique role thanks to their ability to explore remote and often extreme locations. This versatility allows for the monitoring of different trends and conditions, some of which are difficult to identify from larger vehicles or satellites. To fulfill such an important mission, gliders are continuously evolving and advancing to better suit the requirements of the multifaceted ocean industry.

SENTINEL ON DUTY

Teledyne Marine, specializing in digital instrumentation and imaging services, boasts the Slocum glider, with academic, military and commercial applications and web-based piloting. About a year ago, the company delivered the first ultra-high displacement (UHD) buoyancy engine for the Slocum, moving a total of 1.8L (1800 cc), or +/- 900cc, and allowing for faster movement through the water and larger hardware payloads.

Building on the Slocum glider is the **Slocum Sentinel,** with an increased size of 13 inches in diameter and more than eight feet of length, allowing for over 3.5 times as many lithium primary batteries and up to eight sensors or hardware integrations. The Sentinel will be driven by a buoyancy engine with a volumetric capacity of four liters, maintaining a standard glide speed of 0.75 knots. As a result, explained **Shea Quinn,** Slocum Glider product line manager, "Sentinel Glider users will be able to monitor and collect ocean data while operating with higher-energy and greater quantities of hardware/sensors, over greater distances and more diverse operational areas, and for longer operational periods."

In terms of sensor integrations, Teledyne introduced the **Kongsberg WBT Mini EK80 Echosounder** as commercially available option on the gliders. "This technology uses active acoustics to identify and quantify a wide range of targets, including fish/plankton, bubbles, oil droplets, and physical oceanographic features such as turbulence," said Quinn. "We also collaborated with J**ASCO Applied Sciences** and **Blue Ocean Marine Tech Systems** at the REPMUS unmanned maritime systems naval exercise to demonstrate near-real-time passive acoustic detection and localization of underwater targets using three Slocum gliders equipped with four-hydrophone arrays."

"Compared to most other autonomous ocean vehicles, gliders have a distinctive advantage in terms of both mission endurance and targeted data," observed Quinn. Traditional autonomous underwater vehicles (AUVs) and unmanned surface vehicles (USVs) measure mission lengths in hours, days and weeks, whereas glider missions can be measure in months or even years. "And rather than measure surface ocean conditions or mapping the seafloor, the glider is uniquely suited to measure oceanographic and environmental conditions of the water column itself, given the sawtooth pattern of its flight."

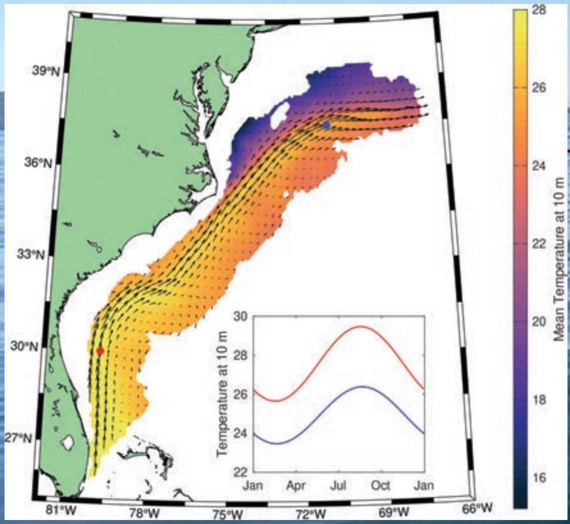
Upcoming projects include the Sentinel Mission, a collaboration between **Teledyne Webb Research** and **Rutgers University** and supported by the UN Ocean Decade. It aims to send a Slocum Sentinel Glider on the first-ever worldwide circumnavigation by an autonomous underwater vehicle. The mission will commence in the coming year, bringing together a global community for unity, collaboration and discovery, as well as inspiring the next generation of ocean scientists, added Quinn.

DATA AT HAND

Spray, a robotic underwater glider, is fulfilling the need for publicly available data. Developed by the Instrument Development Group at **Scripps Institution of Oceanography,** Sprays can operate for several months at sea, typically in depths up to 1000 meters and travelling 15 miles a day. They surface around every six hours, transmitting via satellite the information it collected underwater.

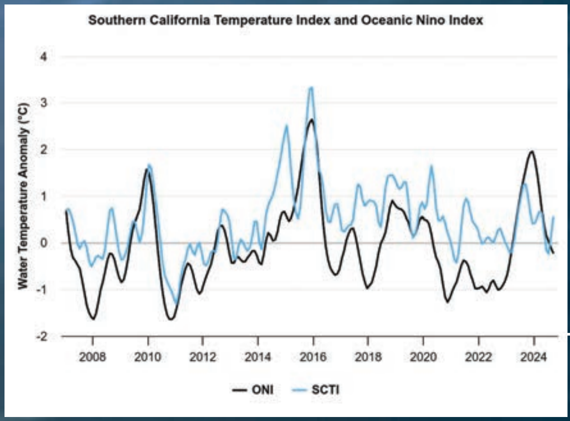
The Slocum Glider with the EK80 sensor integration.

© Kimberlee McHugh



A new climatology from Spray underwater glider measurements provides insights into how the Gulf Stream is changing over time. This graphic shows average temperature, location and strength of the Gulf Stream near the ocean surface from 2015-2023.

Generation 2 Spray glider



Water temperature anomalies off Southern California and in the east-central tropical Pacific Ocean.

Images this page: © Daniel Rudnick, Scripps Institute of Oceanography

The Spray Data website provides public access to observations from Spray projects globally spanning the last 20 years. "Real-time observations are distributed for inclusion in weather forecasts and science quality data are available to enable integrated ocean research," said **Daniel Rudnick,** principal investigator and director of the Instrument Development Group at Scripps Institution of Oceanography and **Jennifer Sevadjian**, Spray Glider data manager. "Products like climatologies, anomalies and indices are available for sustained projects like our longest running project the California Underwater Glider Network."

Spray's work has been fundamental in ocean observations, especially in Southern California. "We noticed strong coupling between ocean temperature at the equator and our glider measurements of the California Current System," Rudnick and Sevadjian explained, "So we created the Southern California Temperature Index (SCTI) as a way to easily track the two." The indices depict the deviation of ocean temperature from normal for that time of year and have become a standard measure in the region. New climatology from Spray underwater glider measurements has also provided insights into how the Gulf Stream, which plays a key role in global ocean dynamic, has changed during the past 13 years. More than 25,000 temperatures and salinity profiles collected by Sprays helped identify that the Gulf Stream now has a surface layer of warmer and lighter water, contributing to increased upper ocean stratification.

New advancements and projects for the gliders will be exciting, noted Rudnick and Sevadjian. The second-generation Sprays will have twice the battery power and be designed to support new sensors to measure pH, nitrate, optical backscatter and downwelling irradiance in addition to the current suite. Applications for the new Spray include monitoring the effects of El Niño and the effects that warm water (including marine heatwaves) have on ecosystems and fisheries, monitoring harmful algal bloom initiation in offshore environments, monitoring ocean acidification and hypoxia, and providing critical data to resource managers.

EARS AT SEA

ALSEAMAR also boasts several gliders for ocean exploration. The SeaExplorer X3 is its latest generation of underwater glider, incorporating improvements in power efficiency, acoustic noise reduction and data-reading reliability. Appli-

© Alseamar

cations range from environmental and marine assessments to industrial, government studies and offshore oil and gas. The SeaExplorer Shallow is well suited for coastal exploration, navigating in shallow water efficiently and collecting chemical and physical data, as well as that on marine life.

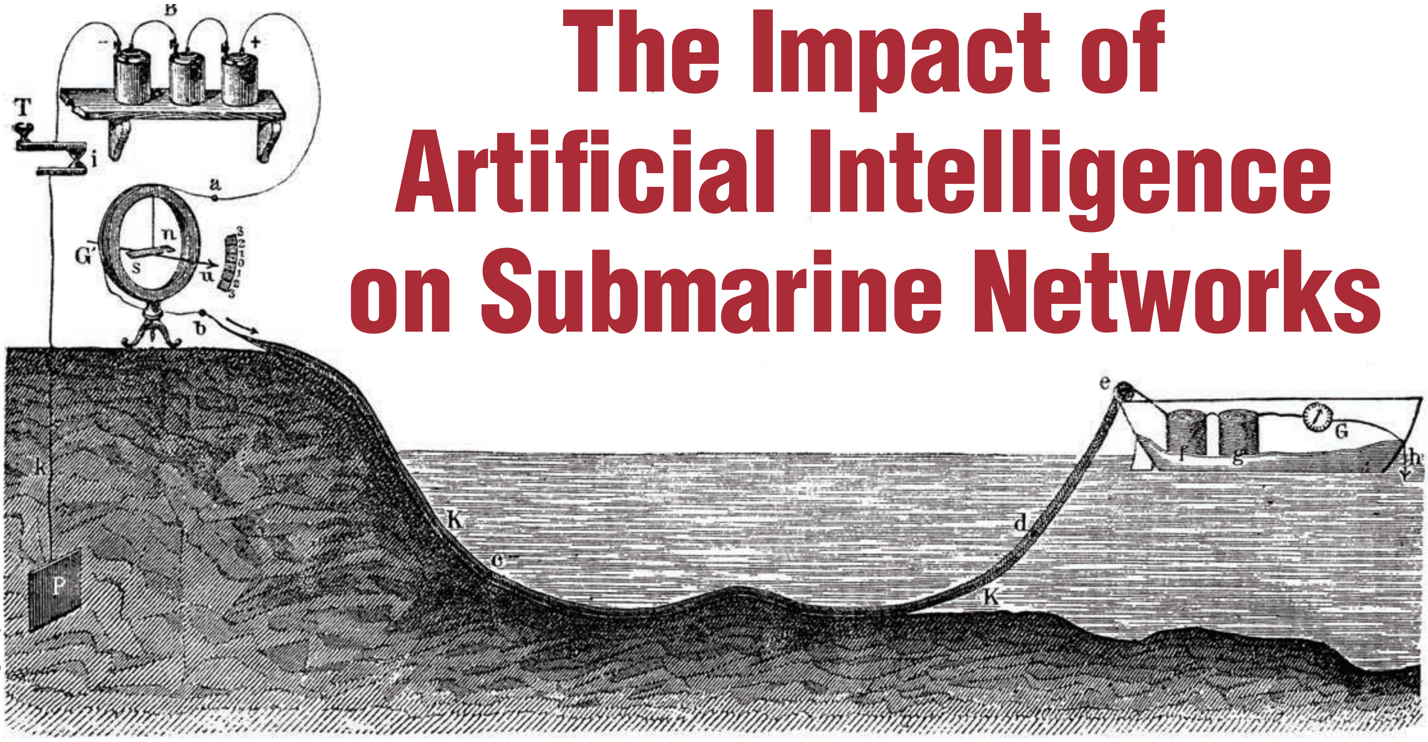
A new dual-thruster option further enhances maneuverability beyond shallow areas, enabling operation in strong currents. Additionally, the AURIS passive acoustic sensor features four hydrophones and an open-system design that allows for onboard processing of acoustic data using a Jetson Nano computer. Full integration into the SeaExplorer glider allows for user access in near real time and it can collect ambient noise, as well as detect and classify specified sound sources.

ROBOTS TO THE RESCUE

Rudnick and Sevadjian remarked that the future of ocean observation and exploration is robotic. Quinn agreed, adding, "I expect we'll see more and more oceanographic survey and data gathering work rely on autonomous systems to gather, process and dispense information across several fields. An increase in persistent, uncrewed oceanographic monitoring in remote areas will have a profound impact on how we understand the oceans, weather, climate and more—and I believe gliders have an important role to play in that data ecosystem."

As the need for ocean data intensifies in the face of climate change, gliders present a unique solution amongst other marine vehicles. Their versatility, long range, and autonomy allow for conditions and trends to be identified in even the most remote, extreme, or difficult to navigate environments. With new projects and advancements on the horizon, ocean gliders have only begun to fulfill their mission.

The Impact of Artificial Intelligence on Submarine Networks



Submarine communication cables – almost 560 of them deployed to date – crisscross our oceans, interconnecting continents and carrying over 99% of intercontinental data traffic. This article looks at how the emergence of artificial intelligence (AI) will affect these cables in terms of traffic demand as well as in terms of how we design and operate the key equipment that feeds data into these cables.

By Geoff Bennett, Director, Solutions and Technology, Infinera

AI and Network Traffic Volumes

There are several reports that predict a huge increase in the processing power required for AI applications as well as the electrical power consumed by future AI workloads. Indeed, power consumption is already reaching critical levels in countries such as Singapore and Ireland, where data center projects have been put on pause by government intervention because of concerns over insufficient capacity on their power grids. But there is very little published data at the moment on the likely workload that AI will place on transport networks – be they metro, long-haul terrestrial, or even submarine links.

Is there a lesson to be learned from cloud computing?

As shown in Figure 1, two distinct types of traffic emerged in cloud computing 10 years ago.

North-South: User to Network Traffic

First was "user-to-network" traffic. Because of the way PowerPoint diagrams tend to be drawn, this is usually portrayed as running up and down, or north-south.

North-south traffic was originally thought to be the main contributor in a cloud architecture because users would need to move information back and forth to the cloud applications in the data center instead of running the applications locally.

East-West: intra- and inter-data Center Traffic

The other type of traffic – east-west – is the local (intra-data center) and long-distance (inter-data center) traffic between servers. Initially, this was assumed to be just occasional updates, with most of the real traffic staying inside the data center, travelling between servers in the same rack or racks in the same building.

Traffic Evolution

As time evolved, however, an odd thing happened, as highlighted in Figure 2.

The volume of north-south traffic grew steadily as companies migrated to cloud applications, but the volume of east-west traffic grew at an even faster rate – and soon dwarfed north-south traffic levels. The east-west growth arose from virtualization, cloud computing, and the intensive use of databases and internal applications that require constant server-to-server communication. For example, your Facebook page may look like a single pane of information, but it's actually a collage of multiple information streams that come from different parts of the virtualized cloud of storage. And this east-west growth can happen over long distances.

To explain why, let's look at the Facebook model, which is driven by advertising revenue. As a U.K. resident, I spend most of my money here, so if I travel to the U.S. or around Asia, there's no point in serving me U.S. or Asia ads – the Facebook data center in Singapore, for example, has to synchronize with one of their three data centers in Europe to retrieve the appropriate advertising and deliver it with low latency so I don't scroll past it before it's delivered, because then Facebook would not get paid for my "eyeballs." East-west traffic also means that data centers can load-balance and act as resilient backup.

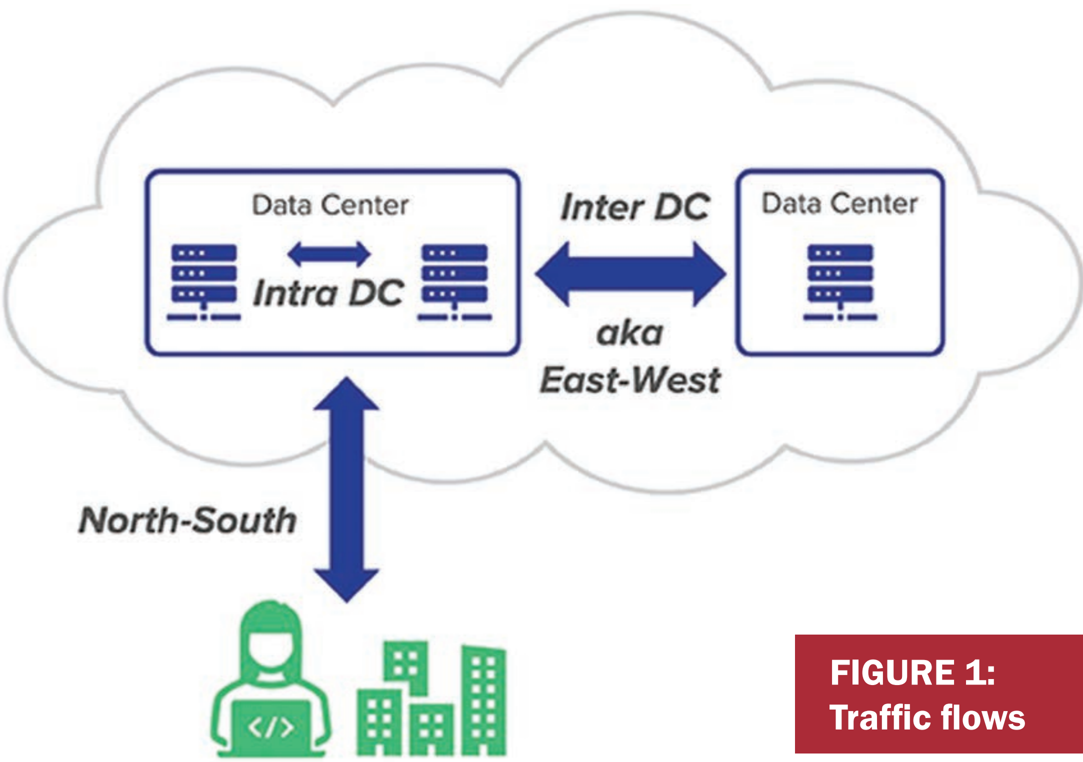


FIGURE 1: Traffic flows

From Conventional Cloud to AI Data Centers

The biggest question mark over AI data centers is what effect AI processes such as training vs. inference will have on traffic patterns. The initial observations are that the move to AI data centers for training large neural network models is boosting east-west growth because, for one thing, these models are exceeding the scale that can easily be trained inside using the capacity that can be rented at any one time in a single data center. I've shown this speculative growth prediction with the shaded section in Figure 2.

Inference requires low latency, whereas training is regarded as being less latency-sensitive for the simple reason that it usually happens within a single data center. In the inference phase, in terms of network traffic, a pre-trained model is queried using relatively short text prompts, and the responses sent back are also short text documents or still images. North-south traffic per user will obviously increase as AI moves from text responses to still images and then to ever-increasing quality of video.

AI's Impact on Submarine Network Technology

Once a submarine cable is deployed, it has an engineering life of 25 years, but the only thing we can upgrade during that lifetime is the submarine line-terminating equipment (SLTE), and there may be multiple opportunities to enhance cable performance by taking advantage of the latest transponder and SLTE terminal technology. AI can play a part in this enhancement in two different ways: operational and network-based functionality.

Operational Use of AI

There are three main operational areas where AI can be used to enhance SLTE capability, and all of these functions tend to be housed within the management and automation software of the network.

Automating Network Planning and Capacity Optimization

In a modern open cable system, it's essential to characterize each fiber pair to ensure that the cable operator got what they paid for in terms of wet plant performance. Characterization using a range of parameters has been well defined by the SubOptic Open Cable Working Group. But the process of taking these measurements can be labor intensive, and AI can certainly play its part in reducing the manual work required.

The next step for operators is spectrum planning and allocation. That can include the need to support spectrum sharing on a given fiber pair. This stage is performed knowing the exact type of transponders that will be deployed, and these performance parameters can be plugged into an AI model that can

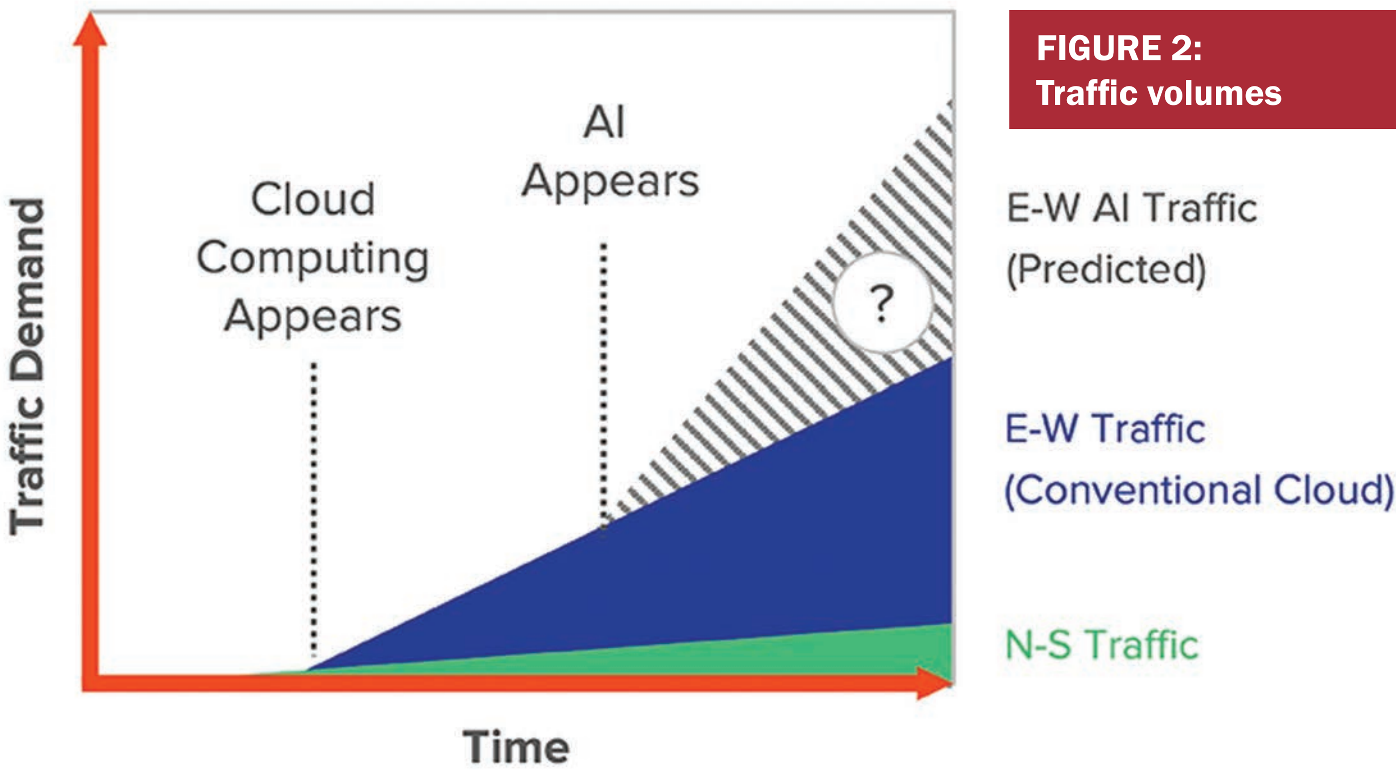


FIGURE 2: Traffic volumes

help optimize the available spectrum.

Finally, optical power planning is an ongoing aspect of fiber pair operation, and it's essential that this is carefully designed in order to ensure stable service levels.

Enhanced Network Monitoring

Coherent transponders and, to a lesser extent, the transport platforms they are housed in offer a veritable fire hydrant flow of telemetry, with the latest transponders having hundreds of information points in their published data models. Dealing with this flood of information over the data communication network has always been a challenge, but this is exactly the kind of problem that AI can help with by extracting correlations and patterns that the human eye alone cannot recognize.

Predictive Maintenance

Hand in hand with enhanced monitoring is the ability to use the processed telemetry from the transponder, transport platform, SLTE terminal, and repeater chain to detect potential operational issues and to deal with them before they become a problem.

Network-based Use of AI

Network-based features generally run in AI-enhanced transponders, and at least two different features have seen active development.

Threat Monitoring and Proactive Protection

For several years, Infinera has been involved in the development of techniques for seismic anomaly detection – basically using existing submarine cables to enhance tsunami warning systems. Cable operators have shown interest in this capability, but they have also thrown down the challenge of enhancing sensitivity in order to detect threats such as seabed trawling or dragging anchors in the vicinity of the cable.

Advanced Nonlinear Compensation

The limiting impairments for modern coherent transponders are nonlinear effects caused by high optical power levels in the fiber. Using fully effective, algorithmic nonlinear compensation (NLC) techniques is extremely computationally intensive – well beyond the immediate roadmap for ASIC processing power. Limited NLC does deliver useful additional performance, but one direction of research is looking at the use of a neural network approach for NLC that uses far less processing power yet delivers a significant performance improvement.

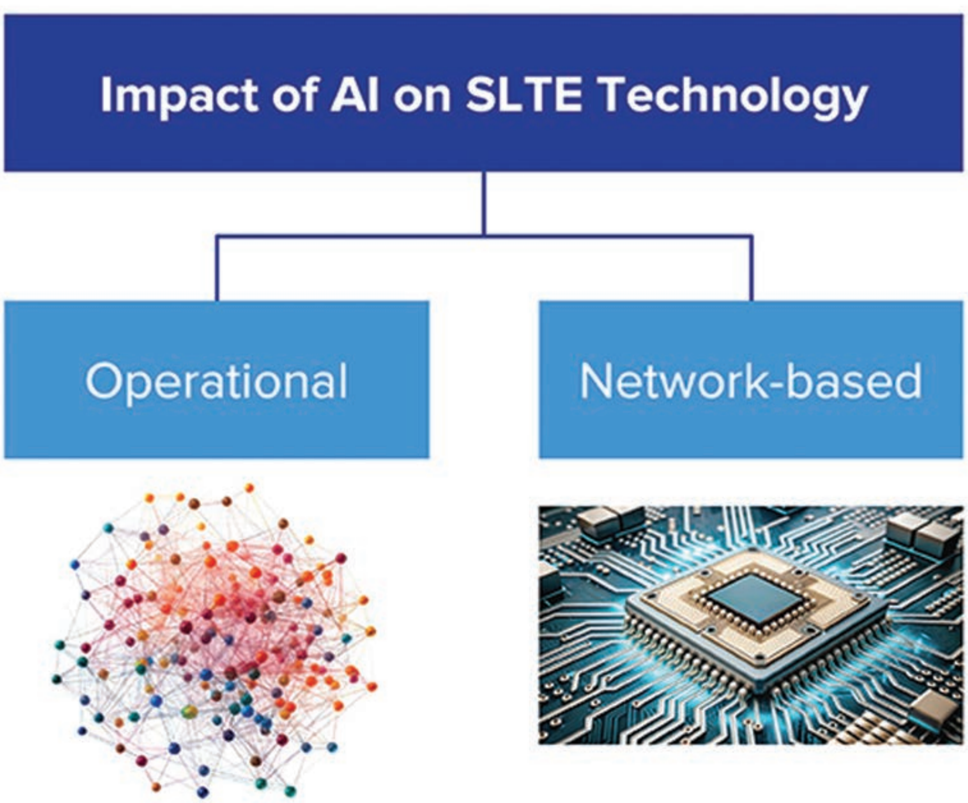


FIGURE 3:
The operational and network-based impact of AI in SLTE technology

Figure 1

A ferrocement anchor is heavy enough to do the job, and cheap enough to not strain the budget.

HOW TO MAKE FERROCEMENT ANCHORS

By Kevin Hardy, Global Ocean Design LLC, MTR columnist

Expendable anchors should be dense, cheap, biodegradable, readily available and scalable.

Iron barbells weights are dense, specific gravity of 8, are biodegradable, iron is a key nutrient in primary productivity, but not so cheap, about $2/pound. They are readily available and can be stacked, making them scalable.

Concrete is cheap, environmentally neutral, but with a low specific gravity of about 2.7. When submerged in seawater, buoyant force subtracts 1 from the 2.7, making the water weight of the anchors only 63% of their air weight. To bump the water weight up to 100% of the original target weight, the air weight has to be increased 37%. That's a lot of extra mass to have to deal with on the deck of a ship or hanging over the side.

In Lander Lab 1 (January/February 2022) we mentioned a hybrid solution, the "Ferrocement Anchor." Since then, I've shared this approach with colleagues in the Landerean community, here and abroad.

Concrete is a composite material made of three things: Portland cement, a material that that is mixed with water to create a slurry that hardens and binds the other ingredients, called aggregates, such as sand, gravel, or crushed stone together. An unforeseen shortage of bar bell weights for an upcoming lander deployment made a new aggregate material seem reasonable: steel stampings.

Necessity being the mother of invention, we hit pretty fast on a new idea: Concrete doesn't have the density we prefer, but what if we substitute iron stampings for gravel in the mix, while keeping the sand and Portland cement as the binder. We'll use rebar to tie a chain to, and a 5-gallon plastic bucket as our mold.

We checked and found scrap iron stampings are available from a number of sheet metal shops around town. We were happy to find the scrap value is only 3-5 cents a pound. We also found that stainless steel stampings were segregated from the common steel because they were worth 6-8 cents a pound. Stainless steel is non-magnetic, which may be a useful property to have. Ferrocement anchors breakdown faster than common concrete. We're talking a couple of years. Seawater seeps

Figure 2

Steel stampings replace gravel in ferrocement anchors.

Figure 3

The rebar is inserted into the last link of the chain and fixed by baling wire to hold the pieces together.

Figure 4

Mortar mix is Portland cement and sand. Ferrocement replaces the gravel with steel stampings.

Figure 5

Using a ladder as an A-frame, we weighed 15-pounds of dry mortar, then 25-pounds of steel stampings. This is enough to make a 30-pound water weight ferrocement anchor.

Figure 6

In this view, we shovel mortar with steel stampings to fill the first 1” of the bottom of the bucket. The rebar and chain are then set in place. Note the rope that holds the chain vertical. We then shovel in more ferrocement. The blue tarp will help with clean-up later.

into the cement, the steel rusts, expands, and breaks down the anchor. We were looking for a specific gravity of around 5, double that of concrete.

We first picked up the scrap steel stampings, since that was the critical item. We were not disappointed. The steel stampings were in various shapes and sizes. Some were too large, while most were about the size of gravel. (**See Figure 2**)

Then it was off to Home Depot for steel wire mesh, rebar, baling wire, chain, mortar, hoe, a mixing tray, and 5-gallon plastic buckets.

The steel rebar, steel wire mesh, chain and baling wire provide the skeletal structure of the ferrocement anchor. (**See Figure 3**)

Mortar mix is Portland cement and sand, just what we need for the binder. (**See Figure 4**) We found the mortar adheres well to the steel stampings.

We worked out the ratio of 25-lbs steel stampings with 15-lbs of dry mortar mix. We used a folding ladder for an A-frame as we had a hanging scale. A floor scale would have been just fine, too. (**See Figure 5**)

Using a hoe, we mix the steel stampings and mortar in a mixing tray (See top portion of **Figure 6**) A concrete mixer would be very helpful if you want to make a much larger anchor, or several at one time.

Once cast, the anchor has to harden and dry for a couple of days. Don’t be too anxious to pull the anchor out of the mold, as uncured concrete will crack. **(See Figure 7)**

The ferrocement should be cured enough to pull it from the mold after 48 hours. It takes up to a week to reach about 70% of full strength. After 28 days, the concrete is considered fully hardened. **(See Figure 8)**

In 3 or 4 days we measure the water weight of the anchors. **(See Figure 9)**

One variation we haven’t tried yet is to cast a ferrocement anchor with a center hole for stacking on top of an anchor with a chain. **(See Figure 10).** If anyone tries this, please send us a photo to share.

Landereans might consider the many shapes syntactic foam can be cast in for buoyancy. Similarly, Ferrocement lends itself to unique anchor shapes to better suit a design.

An environmentally friendly ferrocement anchor does the job while lowering the cost of the expendable weight.

A 43-page PDF with additional details on making ferrocement anchors is available free to readers by contacting me at Kevin Hardy on email @: **khardy@marinelink.com**

Reader Feedback: *Comments on this article, abstracts of stories of interest to the wider Landerean community, or suggestions for future topics are all welcome.* ***MTR*** *invites you write to Kevin Hardy* <**khardy@marinelink.com**>.

Figure 7

The ferrocement anchor is cast. The top is tamped down, pushing any steel below the surface. Some water will pool on the surface as the ferrocement settles. Let cure 48 hours.

Figure 8

When the ferrocement has set, flip over the bucket and give the bottom a tap. The ferrocement anchor will release and drop right out.

Figure 9

Ferrocement anchors can be made in different sizes. Weigh the ferrocement anchors in water to determine their water weight.

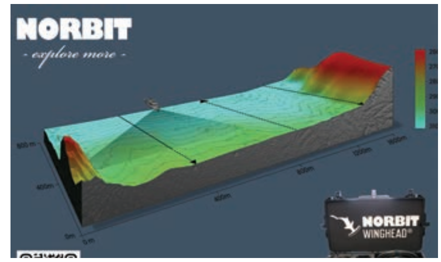
Figure 10

Barbell weights could be added to adjust the overall weight conveniently. Try casting a smaller ferrocement anchor with a through hole in the center. The center hole can be made by using a PVC pipe fixed to the bottom center of the pail.

Blueprint Subsea

Tritech

Norbit



Blueprint Subsea

Blueprint Subsea offers the StarFish sidescan systems which are used in hydrographic surveys, underwater inspection, and search and rescue operations. Another product range is the SeaTrac USBL acoustic tracking systems, which offer real-time tracking and positioning of underwater vehicles and divers, providing critical support for complex underwater applications. Blueprint also manufactures Oculus multibeam imaging sonar, designed to deliver high-definition imaging for a variety of applications. Oculus' dual frequency capability enables operators to optimize performance by seamlessly switching between frequency modes to suit their task.

Tritech

Tritech International Limited launched in March 2024, the Precision Altimeter MKII sensor is one of the first products to utilize our newly derived 'text based' programmable command interface for simple reconfiguration, whilst retaining full backwards compatibility with the previous generation of Precision Altimeter sensors.

EdgeTech

EdgeTech continues to see a strong demand for offshore, mid-to-deep water survey systems including the 4205 side scan sonar system and 3400 sub-bottom profiler. The 4205 continues to be the side scan sonar of choice for offshore windfarm surveys. Additionally, the 2050 remains popular because of its unique ability to collect side scan and sub-bottom data from one towed platform. Closer to shore, EdgeTech's pole mount systems such as the 6205 combined side scan sonar and bathymetry system, and the 3400-OTS (over the side) sub-bottom profiler are playing an important role. A rising star this year for the company is the eBOSS. EdgeTech's innovative Buried Object Sonar System (eBOSS) is an advanced sub-bottom sonar system capable of penetrating the seabed to accurately detect, locate, classify, and identify buried and partially proud objects. This low-frequency acoustic imaging system can be operated in real-time for general survey purposes such as cable & pipe tracking and route surveys or have the data post processed utilizing synthetic aperture sonar (SAS) processing to render 3D images of buried objects.

GeoAcoustics

GeoAcoustics is a pioneer in interferometric sonar for bathymetry and a leading supplier of Sub-Bottom Profilers and Side Scan Sonars.

• **Bathymetric Sonar** – An interferometric system with accurate, efficient simultaneous swath bathymetry and side scan sonar mapping for shallow water environments. GeoSwath provides ultra-high-resolution swath bathymetry with up to 12 times water depth seabed coverage and a 240° field of view.

• **Side Scan Sonar** – The Pulsar operates within a 550KHz to 1MHz frequency with selectable FM and CW pulses, allowing the user to optimize the configuration to the survey task.

The company's latest product is a new version of its shallow water Sub-Bottom Profiler, GeoPulse. GeoPulse 2 updates the system and gives the user the opportunity to experience the same operation in deeper water.

Massa Products

Massa Products Corporation is a sonar and ultrasonic product manufacturer. Founded in 1945 by Frank Massa, the man who pioneered the electroacoustic industry through his career at Victor talking Machine/RCA and Brush Development as the Industry POC for Sonar Advancement and Production for the US Navy during WWII. Massa remains an industry leader and under family ownership, currently run by third-generation Dawn Stancavish. With a presence in both government and commercial markets, Massa offers a full line of solutions for both underwater and in-air applications such as Sub-bottom profiling, underwater communication, UUV/AUV sensors, connectors, level measurement, and proximity detection to name a few. Massa also develops custom solutions for uniquely challenging applications, environments, and use cases where sound has not previously been considered.

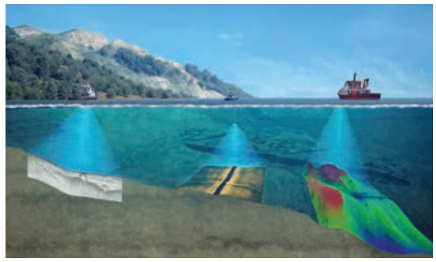
Norbit

In the world of underwater surveying, the introduction of the NORBIT WINGHEAD i80S Long Range multibeam sonar marks a milestone. This high-performance, high-resolution integrated 3D & 4D motion-stabilized bathymetric system is designed to deliver accuracy and reliability in deeper water areas even in the most challenging operational environments. In high sea states or mounted on vessels with challenging dynamic motion, the WINGHEAD i80S Long Range has full motion stabilization capabilities.

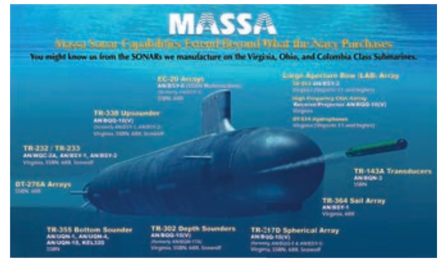
Whether dealing with roll, pitch, or yaw, the technology ensures that bathy-

EdgeTech

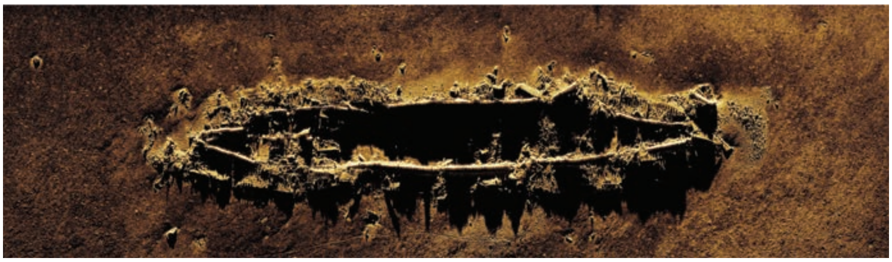
GeoAcoustics



Massa Products



Kraken Robotics



Impact Subsea

metric data remains precise and consistent.

Surveyors further benefit from NORBIT multiple imagery and backscatter outputs as standard, enhancing high data quality throughout the wide swath coverage for deliverables. The WINGHEAD i80S Long Range stands out with its compact curved array design. Its small form factor, combined with low power consumption and tight integration, makes it an ideal choice for a wide range of survey platforms. With a depth range of up to 650 meters and a resolution of 0.5 x 0.5 degrees at 400kHz the WINGHEAD i80S Long Range has a level of precision and capability proven to deliver for various applications, including: offshore operations, harbor and bridge inspections; maintenance tasks; wreck and seabed searches; coastal surveys and renewable energy.

Kraken Robotics

Kraken tech includes

• **MINSAS** is Kraken's off-the-shelf Miniature Interferometric Synthetic Aperture Sonar, billed as a replacement for sidescan systems with improved resolution, range, 3D bathymetry, and delivering the industry's best Area Coverage Rates (ACR). It offers 3.3 cm x 3.0 cm (2.1 cm x 1.9 cm with post-processing) ultra high definition constant resolution up to 200 meters per side, with simultaneous 6 cm x 6 cm bathymetry.

• **Man-Portable SAS payload** uses its new MINSAS 60 Light Weight arrays and is designed to retrofit existing Man-Portable UUVs with diameters from 7.5 to 9 inches. This modular payload section can be added and removed quickly in the field without recalibration; retaining the ability to use the vehicle's existing OEM shipping containers. The MINSAS 60 LW is designed to deliver picture-perfect seabed images with unprecedented image resolution and detail in a compact, man-portable package. It provides detailed images with a resolution of 3.3 cm x 3.0 cm out to a range of 100 m from each side of a UUV (200 m swath). The MINSAS 60 LW also produces real-time bathymetric data with a resolution of 25 cm out to full range while delivering high depth accuracy.

• **Sub-Bottom Imager (SBI) Surveys:** The Sub-Bottom Imager uses beamforming SAS arrays, providing a real-time 3D view of the sub-seabed. The SBI identifies buried objects, anomalies, geohazards, and stratigraphy, acquiring data in a continuous 3D acoustic swath at a minimum of 5 meters wide (at the seabed) and penetrating to 5 meters below the seabed.

Impact Subsea

Impact Subsea introduced an open source SDK to provide users of Impact Subsea sensors with a powerful kit to develop applications. The company has strengthened its support offerings through the appointment of a service center within Guangzhou, China. By leveraging Oceasian Technology's established presence and expertise in China, Impact Subsea will be able to better serve users of their sensors in the region. Last year it launched its Profiling Sonar.

Remote Ocean Systems

Remote Ocean Systems offers SeaStar, a high-powered, compact LED light that delivers 10,000 lumens output with a full-range dimming capability and is depth rated to 6,000 meters. The Accu-positioner is a new ROS technology Pan & Tilt Positioner that features a reliable and rugged deep ocean design and computer-controlled accuracy to +/- 0.1 degree (6 arc minutes). The Accu-positioner is controlled with COTS controllers, devices and ROS GUI. It operates with zero backlash and is depth rated top 6,000 meters.

MARINE TECHNOLOGY REPORTER

2025 Editorial Calendar

01 | Jan/Feb 2025
Ad close Dec. 31, 2024

Underwater Vehicle Annual

- Subsea Defense
- Manipulator Arms & Tools
- Autonomous Navigation
- Battery Technology

Events
UDT, Oslo, Norway

DEEP DIVE
PODCAST: Underwater Vehicle Tech

02 | February 2025
Ad close Feb 4.

Oceanographic

E-Magazine Edition

Tech Focus: Sonar, Telemetry & Data Processing Software

DEEP DIVE
PODCAST: Digitalization

03 | Mar/Apr 2025
Ad close Mar. 21

Oceanographic Instrumentation & Sensors

- Offshore Energy
- Seismic & Geotechnical Surveys
- Inspection, Repair & Maintenance
- Workclass ROVs

Events
Ocean Business 2025, Southampton, UK
OTC, Houston, TX
IPF Wind Conference, New Orleans, LA
AUVSI Xponential, Houston, TX

DEEP DIVE
PODCAST: Subsea Survey Technology

05 | May/Jun 2025
Ad close May 21

Dredging Technology

- Subsea Defense
- Hydrographic Survey
- Scientific Deck Machinery
- Cables & Connectors

Events
Underwater Technology Conference, Norway
WEDA Dredging Summit & Expo, San Diego

DEEP DIVE
PODCAST: Dredging Technology

07 | Jul/Aug 2025
Ad close Jul. 21

Autonomous Vehicle Operations

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

Events
Offshore Europe, Aberdeen, Scotland
Oceans 2025, Great Lakes

DEEP DIVE
PODCAST: Subsea Defense

08 | August 2025
Ad close Aug. 1

Hydrographic

E-Magazine Edition

Tech Focus: Underwater Communications

DEEP DIVE
PODCAST: Research Vessels

09 | Sep/Oct 2025
Ad close Sep. 21

MTR 100

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

DEEP DIVE
PODCAST: Inside NOAA

11 | Nov/Dec 2025
Ad close Nov. 21

Ocean Observation: Gliders, Buoys, & Sub-Surface Networks

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

Events
Underwater Intervention, New Orleans, LA

DEEP DIVE
PODCAST: Ocean Observation

12 | December 2025
Ad close Dec. 4

Subsea Vehicles

E-Magazine Edition

Tech Focus: Underwater Imaging: Lights,

DEEP DIVE
PODCAST: Subsea Vehicle Technology

PEOPLE & COMPANY NEWS

General Oceans Acquires RS Aqua

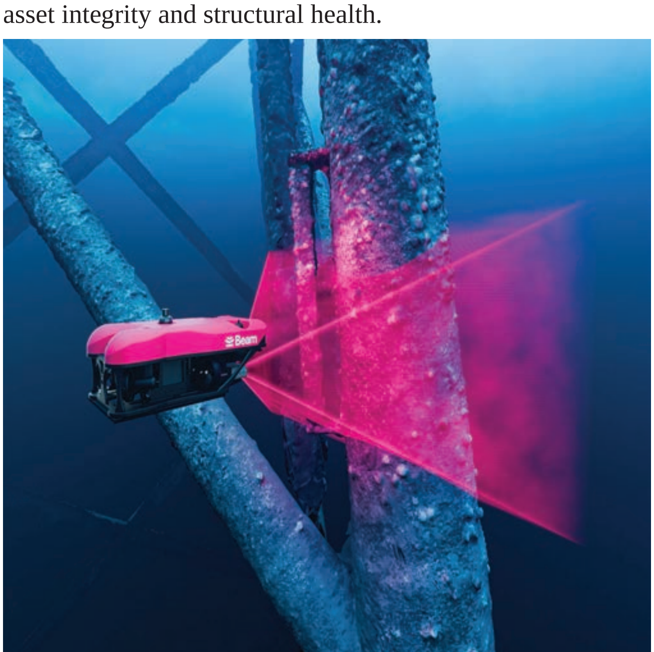
General Oceans acquired RS Aqua as of November 18, 2024. General Oceans have completed a number of recent acquisitions in the underwater technology market including Tritech International Ltd in 2022 and Klein Marine Systems in 2023. General Oceans reported revenues of GBP 62 million in 2023, an increase of 28% compared to 2022, and now consists of six operating companies including RS Aqua. General Oceans employs more than 300 people based in Europe, UK, US and Australia.

Movella Launches Xsens Flagship Sensor

Movella, a provider of full-stack solutions for digitizing 3D movement, launched its new flagship inertial sensor, the high-end industrial grade Xsens Sirius Series: the next generation of sensors succeeding the Xsens MTi 100-Series. Xsens Sirius features Inertial Measurement Unit (IMU), Vertical Reference Unit (VRU) and Attitude and Heading Reference System (AHRS) capabilities. A key feature is its advanced signal pipeline with analog filtering, ensuring high vibration resistance for precise measurements even in the most extreme-vibration environments. For the marine sector, the Xsens Sirius can be deployed on surface vessels and sub-surface robotics, such as remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) for precise navigation or stabilization, providing them with reliable heading- and roll/pitch data or support bathymetry mapping.

Beam Unveils AI Self-Driving Subsea Robot

Beam announced Scout, an autonomous underwater vehicle (AUV) driven by artificial intelligence (AI) expected to enter the market in 2025. Scout will combine advanced AI, real-time 3D reconstructions, and precise navigation to deliver inspections that are quicker and more cost-effective, as demonstrated at SSE's Seagreen Wind Farm in September 2024. Beam intends for Scout to be deployed directly by people from existing Crew Transfer Vessels (CTVs) during routine visits. Scout will enable 4K 3D reconstructions, such as year-on-year site comparisons, equipping teams with insight into asset integrity and structural health.

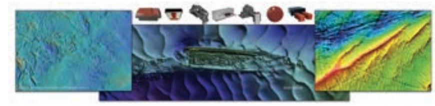


DCI Group, RTsys Partner

DCI Group, a provider of military training solutions, and RTsys, a leader in autonomous underwater vehicles, formed a partnership to integrate underwater robotic technologies into military training programs, enhancing operational readiness and effectiveness of international armed forces and security forces. "Partnering with RTsys represents a significant milestone for DCI Group," said Vice-Admiral (rtd) René-Jean Crignola, DCI Naval Department Director. "Together, we are poised to enhance military training by incorporating advanced robotic solutions that provide unparalleled realism and engagement."

NOC Appoints Chief Scientists

Two new chief scientists have been appointed to the National Oceanography Center's (NOC) Marine Autonomous Robotic Systems (MARS) Group: **Dr. Veerle Huvenne** *[above left]* and **Dr. Filipa Carvalho**. In their new roles, alongside their existing science commitments, they will work closely with the UK marine science sector to promote greater adoption and integration of MARS technology across the field. They will provide scientific insight for the advancement of MARS technologies, showcase accessibility and increase awareness of these technologies and foster a user community.



ECHO81, USME Partner

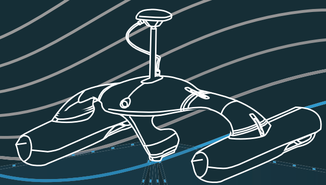
ECHO81, a provider of hydrographic solutions, and Universal Sonar Mount Equipment (USME), a specialist in sonar mounting equipment, announced a partnership to deliver Kongsberg Multibeam Technology to clients across the U.S. This collaboration brings together two companies with a shared commitment to quality, innovation, and customer satisfaction. ECHO81's expertise in hydrographic solutions combined with USME's mounting solutions will provide clients with a seamless and powerful experience when utilizing Kongsberg's advanced Multibeam Echosounders.

PRODUCT, PROFESSIONAL, VESSELS, BARGES & REAL ESTATE FOR SALE

Advertiser Index

The listings above are an editorial service provided for the convenience of our readers.
If you are an advertiser and would like to update or modify any of the above information, please contact: productionmanager@marinelink.com

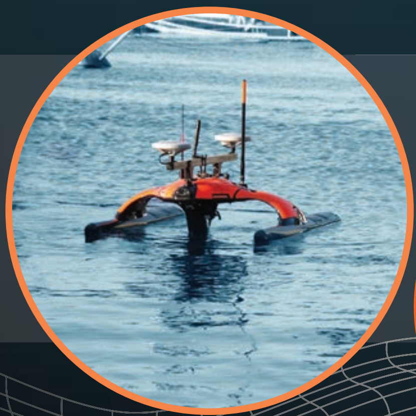
EvoLogics

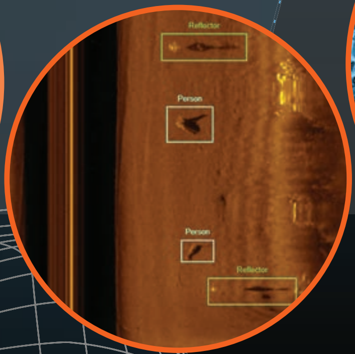


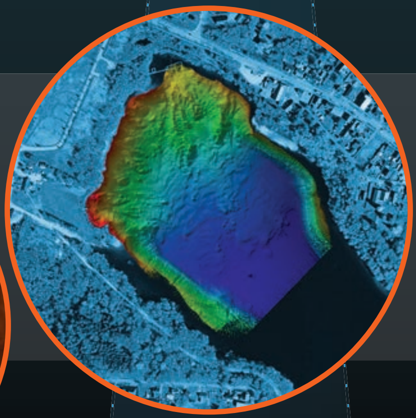
SONOBOT 5

uncrewed surface vehicle

- Accurate georeferenced bathymetry and cartography missions, search and survey in hard-to-reach areas
- Autonomous and remotely-controlled operation
- Data logging and real-time acquisition over redundant mesh network
- Exchangeable battery packs for 9+ hours of operation
- System software for planning, execution and data evaluation
- High-precision measurements and recordings, different GNSS and sonar options available
- Rapid system deployment, excellent maneuverability and area coverage with powerful and efficient drives
- AI-based object recognition for side-scan sonar: objects of interest are detected and highlighted live during the mission







sales@evologics.com
sales-us@evologics.com

EvoLogics.com


Smooth and connected.