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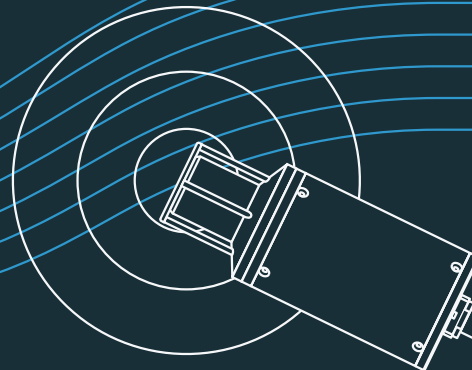
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FEATURING:

Water Quality Monitoring

Electric Evolution of Vehicles

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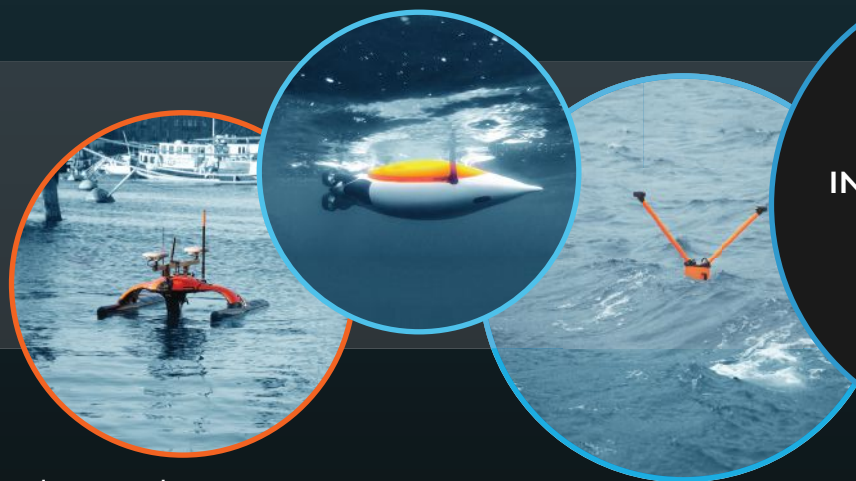
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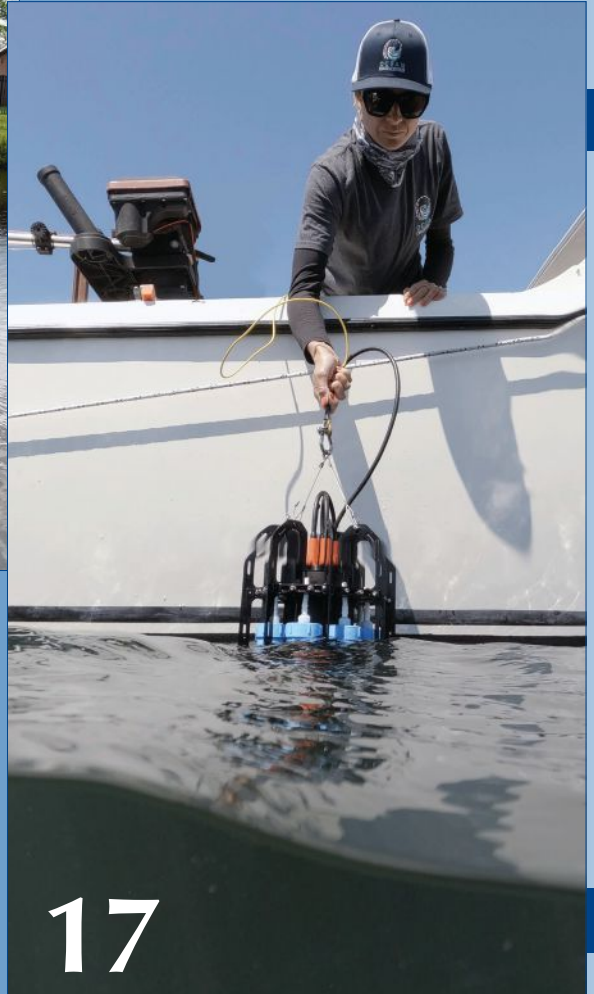


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The Teledyne Slocum Glider being deployed from the air. (Credit: Teledyne Webb Research)

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)) Industry Struggles with Pace of Digitalization. Kongsberg Digital's latest market research report, "The State of Digital Technology & Efficiency Across Industrial Sectors," has analyzed the digital challenges and growth opportunities in energy, utilities, renewables, and maritime industries. Concerns are growing among executives about the pace of digital transformation and the potential of falling behind. The report highlights a fear of talent shortage, particularly in the renewables sector, which puts additional strain on meeting the current demands of digitalization and sustainability. Moreover, there is a notable struggle with organizational silos that are limiting collaboration and innovation across industries. The report was produced in partnership with market research firm NewtonX. It surveyed 300 specialists, managers and C-level leaders in multiple countries in August 2023. The report reveals the three main challenges in their roles: 41 percent say they lack access to all real-time data in one place to take action or make decisions; 39 percent say they don't have enough skilled personnel to handle the current workload; and 37 percent say work silos prevent collaboration and innovation.

)) Micro-AUV Imaging Collaboration. In a collaboration among NOAA's National Centers for Coastal Ocean Science (NCCOS), AUV manufacturer RTsys and subsea imaging technology manufacturer Arctic Rays, the NemoSens SwordFish has been designed to revolutionize ocean exploration and research by enhancing NOAA's efforts to study and understand the seabed. NCCOS will use these vehicles to collect high-resolution digital images of the seabed as deep as 300 m inside the United States Exclusive Economic Zone. These unique vehicles fill a technological gap and a growing need to provide sufficient images cost-effectively to characterize ecosystems and inform decisions about offshore energy development, sustainable fisheries, and protecting special places in the ocean. The NemoSens micro-AUV, developed by RTsys, will be equipped with SwordFish, an imaging payload developed by Arctic Rays. A fully integrated camera and lighting solution, SwordFish enables turnkey imaging acquisition for seafloor survey. The imaging payload features georeferenced digital capture of 4K UHD video and still images with high-output, dual-mode lighting and an onboard CPU and SSD storage. NemoSens utilizes sustainable energy sources, minimizing its environmental footprint and allowing for extended mission durations. Three primary units of the NemoSens SwordFish are scheduled for delivery to NOAA's lab in Beaufort, North Carolina, early 2024.

)) Advanced Onboard Carbon Capture Pilot Project. Crowley and Carbon Ridge Inc., a developer of modular on-board carbon capture and storage solutions (OCCS), with support from the U.S. Maritime Administration (MARAD) Maritime Environmental and Technical Assistance (META) program, have initiated an advanced pilot project to reduce emissions impacts using Crowley's *Storm* international container ship. Using Carbon Ridge's patent-pending, second-generation carbon capture technology, the companies and MARAD have executed a cooperative agreement for the pilot program to operate, measure, and optimize the technology's effectiveness in actual maritime environments at port and, ultimately, at sea. The collaboration includes the engineering, manufacturing and integration of a small-capacity version of Carbon Ridge's full-scale carbon capture system. Crowley's engineering services group, which provides vessel design and engineering, project management, and waterfront engineering by leveraging its research and development team for internal and external customers, is leading the integration of the pilot system on the *Storm*, which serves the U.S. and Caribbean Basin. The carbon capture system will be housed in two 40-ft. container units on the vessel's main deck and have an additional 20-ft., ISO-certified tank for storing the captured liquid CO₂. The pilot project is expected to capture 1 metric ton per day from the vessel's main engine. Installation of the pilot unit on the vessel is expected in 2024 after completing onshore testing.

)) First North Americans Could Have Arrived via Sea Ice Highway. The prevailing archaeological theory of the arrival of the first people in North America is that they walked through an ice-free corridor that briefly opened between ice sheets an estimated 13,000 years ago. But more archaeological and genetic finds—including human footprints in New Mexico dated to around 23,000 years old—suggest a much earlier date, AGU has reported. These early Americans likely traveled along the Pacific coastline from Beringia, the land bridge between Asia and North America that emerged during the last glacial maximum when ice sheets bound up large amounts of water, causing sea levels to fall. Paleoclimate reconstructions of the Pacific Northwest hint that sea ice may have been one way for people to move farther south. Arctic people today travel along sea ice on dog sleds and snow mobiles. Early Americans may also have used the "sea ice highway" to get around and hunt marine mammals, slowly making their way into North America in the process. The climate data suggest conditions along the coastal route may have been conducive to migration between 24,500 to 22,000 years ago and 16,400 to 14,800 years ago, possibly aided by the presence of winter sea ice. While proving that people were using sea ice to travel will be tricky because most of the archaeological sites are underwater, the idea provides a new framework for understanding how humans may have arrived in North America without a land bridge or easy ocean travel. And the sea ice highway isn't mutually exclusive with other human migrations, the research team said. The team's models show the Alaskan current had calmed down by 14,000 years ago, which would have made it easier for people to travel by boat along the coast. **ST**

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EU Proposal to End Plastic Pellet Pollution

Plastic pellets are lentil-size pieces that form the building blocks of all plastic items in existence, from food packaging to fridges. They are spilled on land and at sea in the billions every year, with catastrophic environmental and social consequences. Plastic pellets are directly handled by many different actors across their life cycle, but to date, voluntary efforts to prevent losses from plastics supply chains have not been effective.

In October 2023, the European Commission published a long-awaited legislative proposal to prevent plastic pellet losses to reduce microplastic pollution. Fauna & Flora's marine plastics team has been working to address pellet loss for many years, advocating for strong regulation based on a supply chain approach and has been following the development of this proposal closely. While some parts of it are promising, the lighter requirements offered for a significant number of handlers across the supply chain are likely to significantly reduce overall impact of the policy.

One positive is that the proposed regulation targets pellet loss across the whole supply chain; an essential measure to bring about a systemic change in the way pellets are produced, manufactured, handled, and transported on land and at sea. To date, there have been no mandatory requirements for plastic pellets handlers to demonstrate that they are actively preventing, monitoring or reporting pellet pollution.

Going forward, all pellet handlers and carriers operating in the EU will be obliged to implement loss prevention measures and monitor and report any losses to the relevant authorities. Crucially, the regulation would require companies handling larger volumes of plastic pellets to provide independent third-party verification that loss prevention measures have been implemented. If done well, this could increase transparency and accountability.

The proposal, however, has shortcomings. It is not clear whether the regulation covers all forms of plastic feedstock: Flakes and powders, even though they present the same risk as pellets, are not clearly mentioned.

Another concern is that the proposal does not go far enough to address conditions across the whole supply chain, despite the high risk of loss every time pellets are (mis)handled across their life cycle. As the proposal stands, only sites handling in excess of 1,000 tonnes of plastic pellets will be required to provide independent verification of compliance with monitoring and loss prevention measures. All other installations and carriers handling less than 1,000 tonnes per calendar year—the vast majority of stakeholders—will be allowed to self-declare compliance, and those handling less than five tonnes of plastic pellets per year are exempt from all aspects of the proposal, supposedly to protect small and micro-enterprises. These lighter requirements, as they have been framed, do not establish the level of assurances needed to build confidence that there is a break in the status quo. This runs the risk of undermining the overall impact that this world-leading legislation could have.

To tackle pellet pollution effectively, all handlers, regardless of size, must be held accountable by providing independent verification that pellet loss prevention measures are implemented, maintained and monitored at all stages of the supply chain.

The transition time is also crucial. While all sites and carriers will be expected to ensure that losses are avoided when the regulation enters into force, we urge the European Parliament and Council to support an expedited timeline for independent verification of compliance. Without this assurance, we will likely continue seeing the devastating impacts of this pollution. **ST**

SEA TECHNOLOGY® 2024

JANUARY

Annual Review & Forecast

****EUROMARITIME 2024**, January 30-February 1, Marseille, France

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

****Oceanology International 2024**, March 12-14, ExCel, London, U.K.

MARCH

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

****UDT 2024**, April 9-11, ExCel, London, U.K.

****OCEANS 2024 Singapore**, April 14-18, Singapore

****XPONENTIAL 2024**, April 22-25, San Diego, CA

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

****Offshore Technology Conference**, May 6-9, Houston, TX

MAY

Communications, Telemetry, Data Processing

JUNE

Seafloor Mapping/Sonar Systems/Vessels

****Sea Technology supports these shows**

BONUS INFORMATION

- | | | |
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| • Capital Report | • Marine Renewables | • Ocean Engineering |
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| • Contracts | • Meetings | • People |
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4 EDITORIAL CALENDAR

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JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

****IMAGE 2024**, August 25-30, Houston, TX

AUGUST

Ocean Resources Development & Coastal Zone Management

****OCEANS 2024 Halifax**, September 23-26, Halifax, Canada

SEPTEMBER

Geophysical Exploration/Seafloor Engineering

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

****EURONAVAL 2024**, November 4-7, Paris, France

****CLEAN GULF**, November 18-20, San Antonio, TX

****MAST Australia 2024**, November 19-21, Adelaide, Australia

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Continuous Water Quality Data

Real-Time Information Facilitates Coastal Monitoring Projects

By Annmarie Delfino

When it comes to water quality data, how much is enough? What parameters do you need to measure? And what temporal and spatial coverage will provide a full understanding of what's happening in the water and inform modeling for effective water quality management?

Occasional sampling doesn't capture real-time developments that can influence water quality, and continuous monitoring without a robust software platform to view and manage data can be a wasted effort. Three recent projects—a coastal dredging operation off the Alabama Gulf Coast, a student research project tracking Florida sea levels during hurricanes, and a monitoring

program investigating oyster growth and mortality in California—owe a measure of their success to continuous data collection and user-friendly data services platforms.

In all three cases, real-time updates on changing conditions helped scientists understand and preserve water quality, offered surprising insights into the needs of aquatic life and coastal communities, and provided essential information for making proactive decisions to protect these environments.

Compliance Keeps Dredging Operations on Track

For international engineering firm Moffatt & Nichol, two recent projects along the heavily developed and



In Graveline Bay, near Dauphin Island, newly constructed marsh habitat offers added protection from intense weather for homes along the coast. (Credit: Google Earth)



A Stetson University student gathers water quality data from a stormwater pond for research with the Institute for Water and Environmental Resilience (IWER). (Credit: Stetson University)

ecologically fragile Alabama Gulf Coast required continuous water quality data collection in order to meet regulatory requirements and avoid costly project delays.

Dr. Don Blancher, supervisory coastal scientist with Moffatt & Nichol, led monitoring efforts for Alabama's Lightning Point and Graveline shoreline restoration projects.

The Lightning Point project in Bayou La Batre, a boat-building hub and the state's seafood capital, entailed construction of a living shoreline with about 42 acres of new marsh, tidal creeks, and upland habitat to support a wide variety of fish, shellfish, and birds, including an oyster nursery. The project required them to keep total suspended solids levels within prescribed limits and minimize damage to aquatic life within the dredge zone.

To monitor turbidity, temperature and salinity, Blancher and his team deployed In-Situ's Aqua TROLL 500 multiparameter sonde and VuLink telemetry device on a well-positioned piling just outside the project's mixing zone. For the better part of a year, the team used In-Situ's HydroVu data services to access water quality data in real time.

"State requirements are that during dredging operations you can't be more than 50 NTU above background," said Blancher. "We had the continuous data

from the Aqua TROLL and VuLink, a local university had a unit some distance away that we used for background, and we used a roving unit to monitor the plume by boat. That gave us everything we needed to make sure we were in compliance."

A second shoreline project in the Gulf was in Graveline Bay, near Dauphin Island. There, Moffatt & Nichol replaced eroded marsh with a cluster of sandy mounds. The newly constructed marshland restores habitat and helps protect the homes behind it from northwest winds that eat away at the shoreline.

"We've already heard from some homeowners that this was the first year they haven't had to bring in fill to replace what was lost," said Blancher.

For this project, Blancher and his team installed an Aqua TROLL 500 and a VuLink on a residential pier just west of the turbidity curtain and east of a nearby oyster farm. VuLink transmitted data from the sonde back to Blancher's office through HydroVu, making it easy to correlate with grab samples in the lab, satellite images and other data to make sure they have a good handle on suspended solids content.

"The system has worked well," said Blancher, adding that fouling is always the biggest challenge with long deployments. "We had the sonde with the wiper and the



copper restrictor. But at Lightning Point we had a colony of barnacles that grew right over the sensors. Fortunately, with the data coming in through HydroVu, we could see that the signal was getting degraded, so we went out there and took care of it.”

Dredging to reshape and restore shorelines and rebuild lost or degraded coastal habitat delivers significant benefit, but not without environmental risk. Blancher said that with good data at their fingertips, the firm was able to maintain compliance through both projects. As these projects become more common and funding for them increases, effective water quality monitoring during dredging operations will be essential.

Level Data During Hurricane Confirms Theory

The Institute for Water and Environmental Resilience (IWER), founded at Stetson University in 2015, provides undergraduate students with opportunities for interdisciplinary research in water monitoring projects across central Florida.

In one such project, IWER’s Executive Director Dr. Jason Evans and instructor Andrew Joesoef helped students install five In-Situ Level TROLLs in the area: three at Cape Canaveral, one 20 mi. south at Satellite Beach and one in Edgewater.

They were afforded a unique opportunity to watch continuous data come in during hurricanes Ian and Nicole and were surprised by their findings.

“During Hurricane Nicole, we recorded something



(Left to right) The Aqua TROLL 500 deployed with VuLink telemetry delivers real-time updates on water quality at Hog Island Oyster Co. growing leases. (Credit: Hog Island Oyster Co.) Eli Kersh of LakeTech prepares to deploy a multiparameter instrument inside In-Situ’s Rugged Buoy to collect continuous, real-time water quality data. (Credit: LakeTech) Press just one button and VuLink telemetry is ready to transmit continuous data. (Credit: In-Situ)

coastal engineers had thought would happen for years,” reported Evans. Engineers had predicted that the water level at Cape Canaveral would drop during the storm because of the strong winds coming from the northeast. Expecting the same principle to hold true at Satellite Beach, Evans was shocked when the Level TROLL, located on the eastern side of the lagoon, indicated water levels rose during the storm.

Puzzled, Evans shared the data with everyone he could. He connected with Dr. John Fergus, a retired coastal geologist and former Air Force member who lives in Satellite Beach. Fergus was excited by the data.

“Apparently coastal engineers and scientists in the area had thought this would happen because there’s a little pinch at the bottom of that lagoon, and they predict-



ed the water would pile up there,” Evans explained. Now they have the data to prove it.

Projects like this are a critical part of planning for and addressing flood risks in the area. Thanks to IWER’s data, local authorities know that the storm surge Hurricane Nicole caused at Satellite Beach was considerably higher than at Cape Canaveral. Referring back to that data helps allocate resources for storm preparation and make proactive flood management plans.

“We have actual data that’s immediately helpful for flood plain managers, emergency management officials, hydrologists and others,” said Evans.

Evans reported an increase in interest when locals hear about IWER’s data from Ian and Nicole. “Without baseline monitoring, there’s been this knowledge gap,”

Evans said, “and when people see what we’re doing, it’s really compelling.”

He underscores the importance of understanding the behavior of coastal systems not just from an environmental standpoint, but from an economic one as well. Many Florida buildings are 40 to 60 years old or more and struggle to withstand rising sea levels. Designing resilient and long-lasting coastal infrastructure starts with data that can describe the problems currently facing these communities.

“You need the best information possible to make the best designs,” Evans said. “Data helps inform. We can use it to adjust and adapt.”

Last fall, IWER received a Stage 2 CIVIC award from the National Science Foundation to build and monitor a



In-Situ instrumentation and telemetry fit easily into a 2-in. pipe, for simple deployment from a pier or dock. (Credit: In-Situ)

bioswale drainage system in Cape Canaveral to assess its effectiveness as a nature-based method of flood management.

Continuous Data Offer Clues to Oyster Mortality

In late 2022, Max Rintoul of Hog Island Oyster Co. (HIOC), the largest oyster grower in California, reached out to Eli Kersh, president of LakeTech, a water quality consulting company based in the Bay Area, to establish a continuous monitoring program.

Oyster growers in the area receive leases from the state to grow in specific sections of Tomales Bay. Through many years of experience, workers at HIOC recognized that the productivity and mortality at their dozens of sites varied throughout the year, but they didn't know why. Rintoul hoped continuous monitoring would allow HIOC to understand what was influencing the sites and develop growing strategies based on quantitative evidence.

LakeTech supplied three Aqua TROLL 500s equipped with temperature, salinity, chlorophyll a and FDOM sensors. Kersh deployed each sonde at a different lease, securing them in the baskets with the oysters to get the closest representation of their growing conditions. Each sonde connected to VuLink telemetry for real-time access to continuous data.

In mid-June of 2023, HIOC started noticing an increase in adult oyster mortality. Every aquaculture op-

eration experiences occasional mortality events, but this was the first time HIOC had access to continuous data during one such die-off.

Oysters usually die in late summer/early fall, after they spawn and complete their reproductive cycle; a mortality event early in the summer was unusual. In the winter and early spring, the area around Tomales Bay experiences above average rainfall, causing rainwater from surrounding watersheds to rush into Tomales Bay. This brought with it dissolved organic matter and nutrient runoff from farms in the area, causing FDOM to spike.

Then, a month later, chlorophyll a followed. Rintoul speculates that the influx of organic matter in the spring led to algae growth earlier in the year than expected.

"We usually see oysters start spawning in mid-July, as a response to rising water temps in late June," he said, "but the spike in chlorophyll a, combined with increasing temperatures in May, created the perfect conditions for the oysters to spawn early."

Continuous data allowed Rintoul and others at HIOC to track these changes and better understand how conditions evolved.

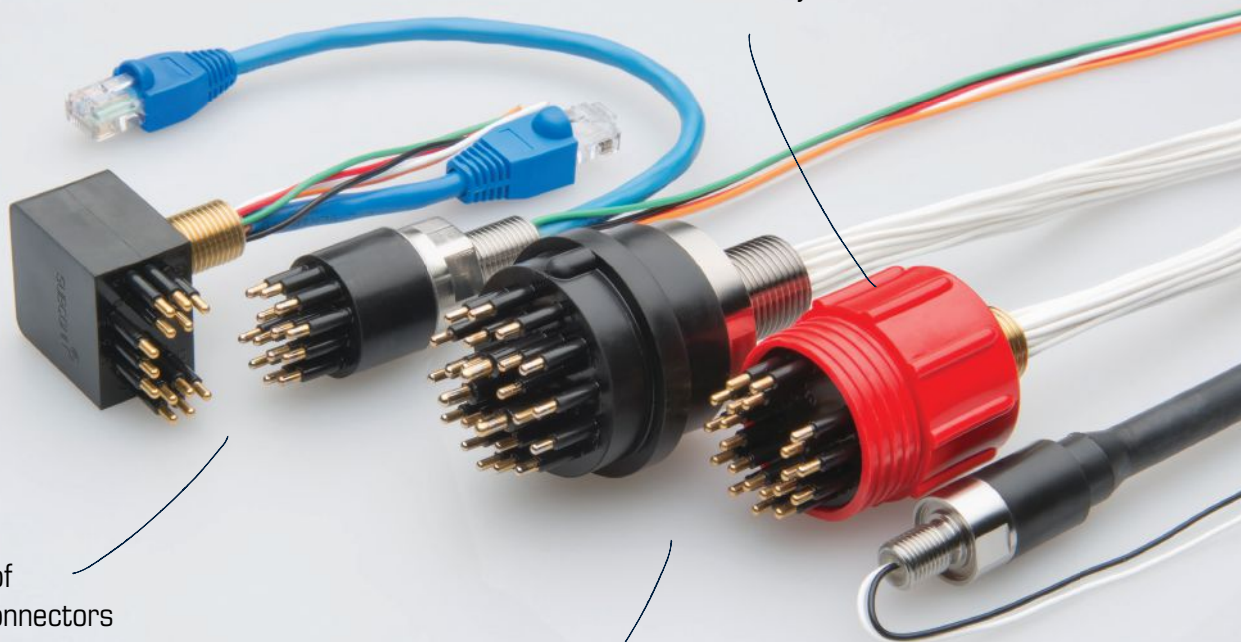
HIOC is working with LakeTech to refine and expand their monitoring program for next year. Baseline data is the first step; decision making will come later, when long-term monitoring begins to reveal trends.

"While we couldn't immediately make the real-time management decisions we originally planned on," Rin-



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“In all three cases, real-time updates on changing conditions helped scientists understand and preserve water quality, offered surprising insights into the needs of aquatic life and coastal communities, and provided essential information for making proactive decisions to protect these environments.”

toul said, “the sensor data provided valuable context for the June mortality event.”

Though their monitoring program is relatively new, there’s huge value in collecting this information. HIOC didn’t know there would be a mortality event this past June, but having captured the data, the company can start to evaluate why it happened. And as HIOC gathers more data on fluctuations at its leases over time, the company can respond with confidence to changing conditions, knowing it has the data to support informed decisions.

Reliable Measurements Tell the Whole Story

Instrumentation, telemetry and software that are designed to work together and simple to set up make it easier to collect actionable, real-time data on critical locations and parameters.

“Continuous monitoring technology has reached a point where it’s more cost effective than physically going to your sites. That wasn’t true even five years ago,” said Eli Kersh of LakeTech. “The ability to overlay data and see how these things add up makes it easier to identify potential correlations.”

Getting the long view of patterns and trends lays the groundwork for better business decisions, understanding effects on environments over time, and developing more effective disaster management plans and greener infrastructure. With all that continuous data provide, it’s worth the effort to establish a strong continuous monitoring program. **ST**

Annmarie Delfino is a marketing writer for In-Situ Inc.

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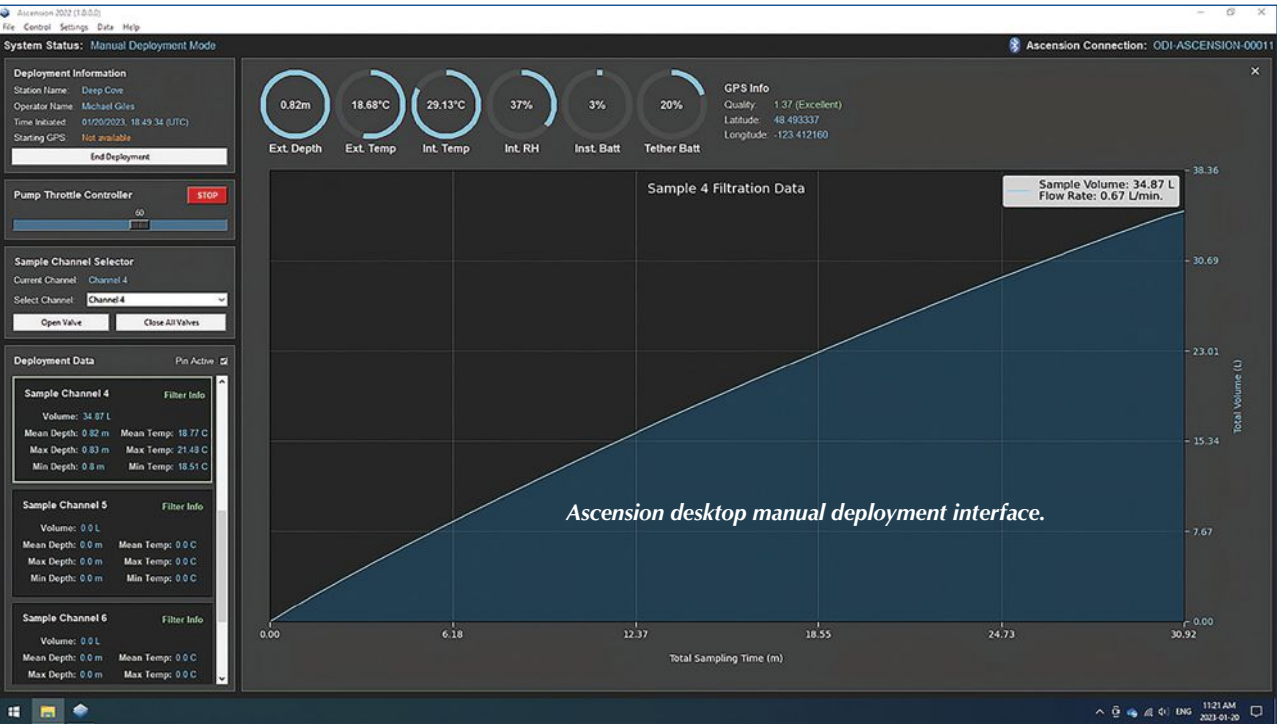
Filtering Water In Situ to Measure Industry’s Environmental Impact

By Karly McMullen

Marine transport, offshore wind, fisheries and other industries increasingly look to monitor their environmental impact. Governments are expanding marine protected areas, and marine scientists are actively seeking technology to monitor aquatic environments and measure protection success. Yet, current sampling techniques are inefficient, cost-prohibitive and lack contamination mitigation. To address these demands, a Canadian company recently introduced specialized technology for effective in-situ water filtration, facilitating monitoring and environmental sample collection with minimal contamination risk.

Designed by marine scientists and engineers to over-

come microplastic and environmental DNA (eDNA) sampling challenges, Ocean Diagnostics’ portable depth sampler, Ascension, is a 22-lb. instrument that filters water directly in situ down to 400 m from any size vessel or fixed installation. By filtering in the water column, Ascension eliminates the need for heavy and expensive equipment, saves hours of sampling time and significantly reduces contamination. This innovative technology is being deployed around the globe in biodiversity assessments using eDNA, microplastic pollution surveys and other water sampling initiatives. No matter the industry, Ascension is revolutionizing how organizations extract key information from the water column.





Ascension manually deployed from a small pleasure craft vessel.

Design

The instrument collects filtered samples in the water column through seven intake channels and comes equipped with a full CTD sensor to precisely measure depth, temperature, salinity, flow rate and total volume, filtered in real time for highly targeted samples. Each channel contains a sealed 47-mm-diameter filter housing, which is prepared in a clean lab. When ready, the filter housings click into place and seal on the instrument through a modular quick-connect design. They can be swapped out in the field or the lab, depending on how many samples are needed per deployment.

When the filter housings are in place, Ascension can either be lowered through the water column by hand using a communication tether (manual mode) or attached to a fixed installation, such as a buoy or dock, and set for

automatic time series sampling (automated mode).

In a manual deployment, the tether connects to a Windows interface via high-speed Bluetooth, and the user controls filtration flow rates and sample selection in real time. Data are logged on board the instrument but also saved locally on the computer. All data are saved at 1-sec. intervals, where each instrument power cycle activates a new system “session.”

In an automated deployment, the user programs Ascension through a mission planner software before a deployment and has full control over when the instrument wakes up to start sampling and the channels through which the samples are collected.

Ascension’s rechargeable 266 watt-hour battery pack allows users to easily recharge between deployments with a simple cable connector and wall charger. When set up for a time series deployment, Ascension will sit in a low-power standby state, using the battery during sampling times. The instrument typically requires 1 to 2 hr. to swap filters and fully recharge from a low-battery state.

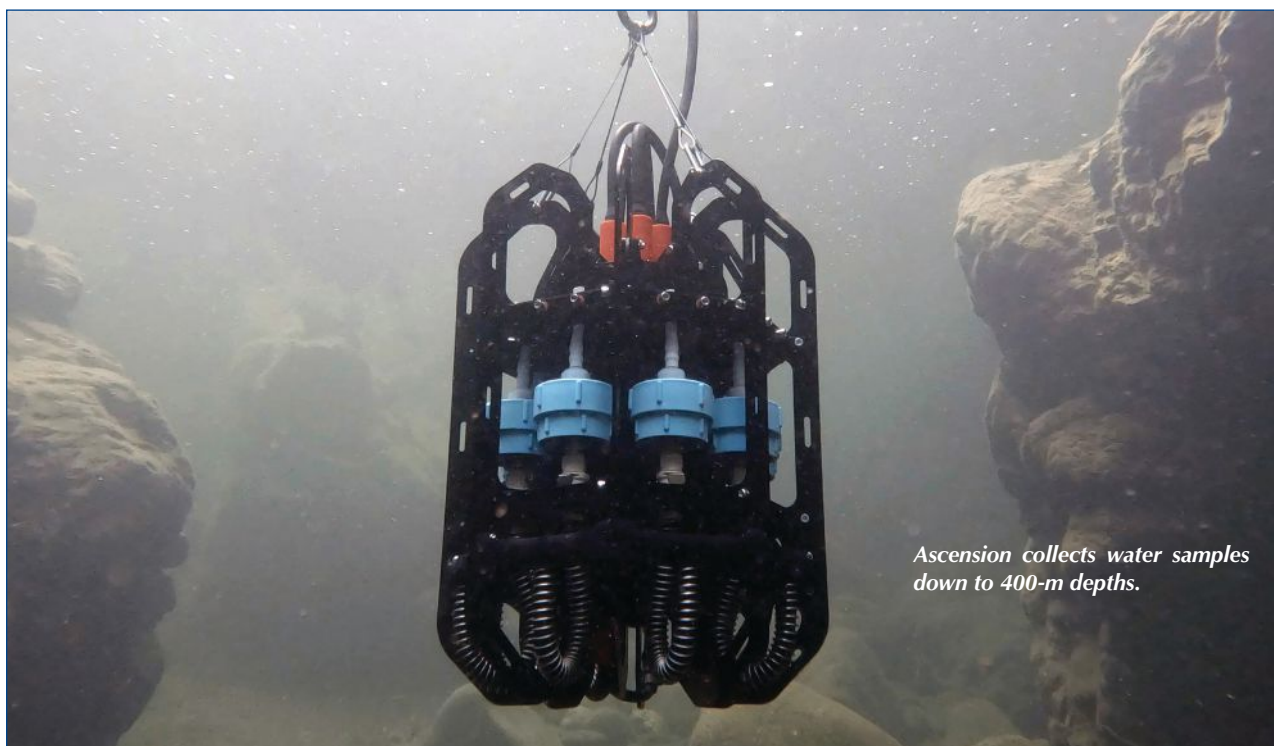
The flexibility of Ascension allows it to be customized with two different sampling pump options, depending on the research application, designed for either high pressure and low flow rates or lower pressure and high flow rates. The instrument is also designed with modular components, allowing for individual parts to be replaced easily with a few fasteners by a user in the field, if necessary.

Reduced Contamination

Legacy water filtration methods require a considerable amount of time, large vessels and equipment, including winches. Transporting heavy water to a contamination-free filtration location also proves challenging. Contamination jeopardizes sample and data reliability, and organizations want to be certain that they have an accurate picture of reality.

Filtering water on a ship or at the bench risks contamination that could negatively skew results in eDNA or microplastics applications. Airborne clothing fibers, for instance, could impact microplastics data and provide a false sense of microplastic concentration in a sample. In eDNA applications, airborne and surrounding environmental DNA may introduce contamination to samples and lead to distorted sequencing results. Ascension is a cost-effective instrument that offers completely sealed collection housings to collect filtered water samples in a standardized and efficient manner, without the risk of airborne contamination.

While cleanrooms equipped with high-grade HEPA filters can provide a contamination solution, the chal-



Ascension collects water samples down to 400-m depths.

challenge lies in transporting the water to these controlled environments. Every time a water sample is exposed to the air, contamination risks persist. To mitigate contamination and ensure sample integrity, water typically is transported to a cleanroom, where it is filtered and analyzed. Unfortunately, not all researchers have access to a cleanroom conducive to microplastics or eDNA research, and water can be heavy and logistically difficult to transport from the sea to suitable laboratories.

Ascension filters water directly in the water column, eliminating the need to transport water and risk contamination. The quick disconnect filter housings can be primed in a clean laboratory and then easily loaded into the instrument, either in the field or laboratory. The instrument's robust pinch valve design with modular quick connect fittings ensures that filter housings and seals are completely isolated from the environment and the other sampling channels, mitigating potential small leaks and cross-contamination that otherwise could occur over time. The instrument is constructed of primarily lightweight anodized aluminum and stainless steel to further reduce instrument-derived plastic contamination.

Real-Time CTD Integration

Ascension features a fully integrated CTD sensor, developed for NASA by Star-Oddi. The integrated CTD provides the user with real-time water column profile information directly in the Ascension control interface, reducing the need for an additional CTD instrument to be deployed during a cast.

The water temperature detection range for Ascension instruments is -1° to $+40^{\circ}$ C (30.2° to 104° F), with a temperature accuracy of 0.1° C (32.18° F). The depth accuracy is 0.6 percent of the depth range, providing precise depth measurements. Different depth ranges can

be configured depending on the user's requirements, but typically a 5-to-500-m depth sensor is provided as the stock option. The salinity range is 3 to 68 millisiemens per centimeter, with salinity accuracy at ± 1 practical salinity unit (PSU), ensuring accurate readings in a diverse range of aquatic environments.

In addition to CTD data, users can capture real-time flow rate and total volume data for each of the seven sampling channels during water filtration. This flexibility allows for on-the-fly deployment adjustments to align with specific research objectives and ensures quick and accurate data collection. After deployment, users can view their data in the interactive Data Viewer software module or seamlessly export their deployment data to a standard .CSV file for further processing.

Worldwide Case Studies

Ascension is making waves across continents. To address the planet's biodiversity loss crisis, Ocean Diagnostics is working with an Australian foundation to rigorously test the efficacy of eDNA in assessing biodiversity in Australia's marine parks. Research suggests eDNA is a powerful method to monitor ocean and freshwater biodiversity, given that it can non-intrusively identify which species and organisms have been in that environment, including invasive species, without having to catch or directly observe or disturb them. Ascension for eDNA can monitor biodiversity down to 400 m from any size boat or fixed platform and performs the filtration in situ, so contamination concerns are minimized.

To filter for eDNA, Ascension is configured with a specialized peristaltic pump to generate the high pressure needed to filter 1 to 2 liters of water through 47-mm-diameter filters with pore sizes greater than 0.45 microns. Best suited for flow rates between 0.03 to 0.5 liters

per minute, eDNA samples are generally collected on 0.45-micron Mixed Cellulose Ester (MCE) filters. This configuration typically allows Ascension to filter 2 liters in 8 to 10 min., providing seven samples within 1 hr. of sampling time on station.

The impact of Ascension is not confined to eDNA nor to the Southern Hemisphere. Canadian Fisheries research organizations and National Research Institutes in France and Australia are deploying Ascension to accelerate the pace of marine pollution research. Anticipating plastic pollution legislation changes and coastal monitoring needs, especially considering the impending UN Global Plastics Treaty, these organizations are one step ahead, using Ascension to effectively monitor both microplastic abundance and the effectiveness of mitigation strategies.

For microplastics applications, Ascension offers seven 47-mm-diameter filter housings for filters with pore sizes greater than 10 microns. The pump type employed is a high-flow impeller pump designed specifically for microplastics sampling, with flow rates ranging from 0.2 to 4.5 liters per minute. At this flow rate, Ascension can handle larger water volumes ranging from tens to hundreds of liters, at a rate of about 2 to 4 liters per minute. This configuration ensures efficient and precise microplastic sample collection, making Ascension an ideal choice for researchers focused on microplastic studies in aquatic environments.

Serendipitously, Ascension's journey has extended further to Ascension Island, the island it was named af-

ter. It is being deployed to steer groundbreaking studies on eDNA and microplastics. Ascension Island is a living laboratory, offering valuable insights into the intricate dynamics of marine environments. Fortunately, the design of Ocean Diagnostics' instrument is modular, which facilitates simple part replacement and lightweight construction, enabling it to reach even the most remote islands.

Conclusion

Ascension is a groundbreaking solution to the challenges associated with water sampling and in-situ filtration in marine and freshwater research and monitoring programs. This Canadian innovation stands at the forefront of advancing environmental research. Designed by marine scientists and engineers, Ascension eliminates the need for heavy and expensive equipment, revolutionizing water sampling efficiency. The instrument's portability, modular design and real-time CTD integration contribute to its adaptability and reliability in diverse aquatic environments. As global efforts intensify to protect water, Ascension provides a critical tool to ensure the accuracy and effectiveness of impact assessments and conservation initiatives. **ST**

Karly McMullen is a marine scientist who helps advance the Ocean Diagnostics Inc. (ODI) mission to diagnose and protect the planet from pollution and biodiversity loss. Leveraging her background in communications and science, she shares news about ODI's innovative tools, technology, and collaborations with researchers, marine organizations, and the public.

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Electric Evolution

New Vehicles, Tooling Advance Efficiency, Sustainability at Depth

By Jon Robertson

In the depths of our oceans, a technological revolution among work-class ROVs is underway, driven by an imperative for sustainability in the realm of underwater robotics. Saab UK, a pioneering force in subsea innovation, stands at the forefront of this evolution with its latest groundbreaking creations: Seaeye eWROV and Seaeye eM1-7 Electric Manipulator (eManip).

With a heightened global focus on environmental impact, industries working subsea face increased scrutiny regarding their ecological footprint. The recognition of the fragile nature of underwater ecosystems has sparked a collective effort to minimize disturbance and preserve these delicate environments. This is alongside the drive for preservation of human life. Subsea environments pose

a myriad of challenges and dangers for human operations. The remoteness of these environments compounds the risks, and the hostile and unpredictable nature of the ocean and tides creates treacherous conditions. Finding a solution that keeps safe both ecosystems and human life is paramount.

This has been made clear with international organizations amplifying their emphasis on eco-friendly practices, urging companies to adopt sustainable approaches in their subsea endeavors. The drive toward sustainability is no longer an option but a necessity, as operators recognize that responsible practices not only safeguard the environment but also contribute to operational efficiency, safety and long-term viability.





The eM1-7 Electric Manipulator.

Saab UK's latest offerings represent a paradigm shift, ushering in an era when electric-powered underwater work-class robots not only meet but surpass traditional hydraulic work systems. Innovative, eco-responsible products such as eWROV and eManip represent an evolutionary leap in this pursuit of balance between progress and planetary stewardship. These innovations embody a commitment to ecological responsibility, redefining the possibilities of subsea exploration and operations.

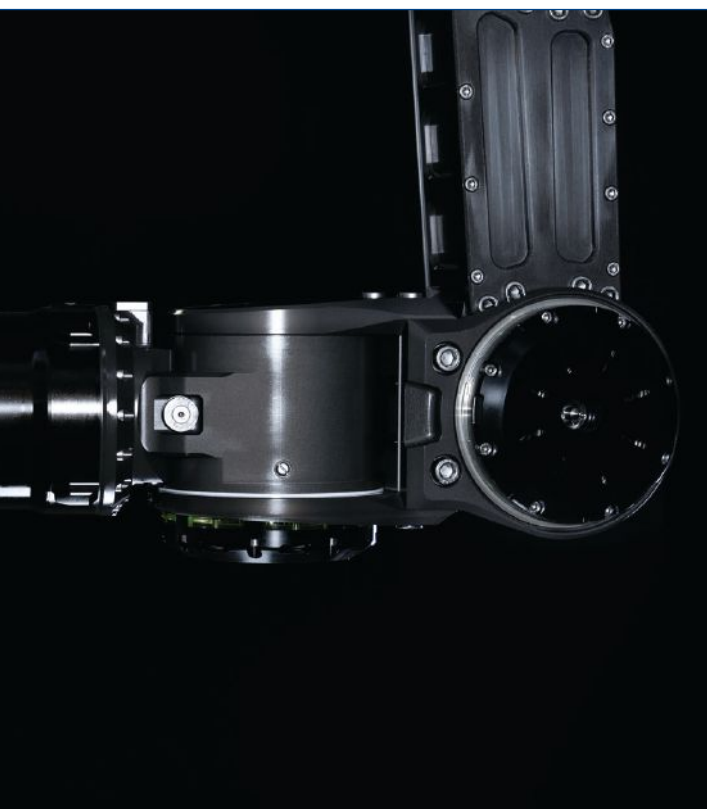
eWROV: Pioneering Eco-Responsibility

An electric work-class ROV offers significant benefits over a traditional hydraulic vehicle. One of these benefits is efficiency. When comparing electric thrusters with hydraulic thrusters, electric is 48 percent more efficient. eWROV consistently proves this statistic, generating 560 kgf from 32 kW of power. eWROV also boasts an impressive depth rating of 3 km, with a 6-km option.

The vehicle has a robust DC power system, reducing size and weight while maintaining high-performance power subsystems, meaning less CO₂ output compared to its hydraulic counterparts. Saab UK's DC power system is extremely efficient and maintains a constant sub-sea voltage level. By utilizing a DC power system that is more efficient in delivering power to the ROV's components, it requires less energy overall from the surface power systems. Reduced energy demands translate to lower CO₂ emissions, as the surface power systems generate less carbon dioxide while providing the necessary power to operate the ROV. The improved efficiency minimizes wasted energy, resulting in a more environmentally friendly operation with reduced carbon emissions.

The utilization of hydraulics in ROVs poses a threat to the marine environment with various forms of oil pollution throughout operational cycles. Underwater operations involving hydraulic systems often lead to their leaking, both from routine activities and inherent "natural leakage" arising from moving seals within thrusters, hydraulic power units (HPUs), manipulators, and other components. Accidental discharge resulting from failed hoses, fittings, seals or compensators further exacerbates the issue.

Beyond operational concerns, routine servicing generates waste oil and contaminated hydraulic consumables, such as filters, filter elements and hoses, contributing to the environmental burden. For a 200-hp hydraulic ROV, there can be around 500 liters of oil waste from routine servicing over the course of a year. Disposal of oil-contaminated waste materials, such as rags, matting and containers, adds to the cumulative impact. In comparison, eWROV, with its environmentally conscious



design, yields an annual oil waste from servicing, with minimal HPU usage, of around 25 liters.

Perhaps the most significant benefit of the vehicle lies in its ability to deploy and operate from compact, minimally crewed vessels by controlling the robot from shore, resulting in a substantial reduction in CO₂ emissions, more safety with fewer offshore operators, and lowered operational expenses.

For conventional ROV operations, large offshore vessels are needed. The fuel consumption necessary to sustain 150 individuals for four to six weeks during subsea operations encompasses a complex array of factors. It involves the energy required for heating, cooking, and powering various systems essential for maintaining comfortable living conditions and operational functionalities. This includes not only the fuel needed for generators providing electricity but also the energy demands for heating the facilities, preparing meals, and supporting the infrastructure required for daily operations. On average, such operations might require anywhere from 5,000 to 10,000 gallons of diesel or equivalent fuel sources, at high cost. These figures can fluctuate significantly based on the various factors listed.

In comparison, electric work-class vehicles such as eWROV have the processing power in the vehicle, which enables supervised autonomy, and in time, fully autonomous functionality. This setup favors low-bandwidth, high-latency communication links for remotely controlling robots from shore.

In short, the benefits of an electric work-class ROV lie in its inherent autonomy, reliability, minimal maintenance, extended deployments and lower operational costs.

Electric vs. Hydraulic Manipulators

A significant roadblock to the adoption of electric vehicles has been the challenges of producing an electric manipulator and tooling. If you need hydraulics for manipulators and tools, you may as well have hydraulic propulsion, or so it was thought. Electric tooling has also faced limitations in power density compared to their hydraulic counterparts. This is primarily due to the high cost to create solutions and the technology available.

eManip addresses these problems with advanced fea-

tures meticulously engineered to redefine the capabilities of electric manipulators. Through the integration of compact, modular electric joints, this innovative device revolutionizes arm control, enabling impressive lifting capacities ranging from 122 kg at 2-m full extension to 454 kg at minimum extension. Crafted from sturdy yet lightweight aluminum, this manipulator has both durability and agility. With a weight of 116 kg in air and 84 kg underwater, it operates at depths with ease, reaching down to 4,000 m, with options for 7,000 m.

Notably, eManip's intelligent power management system efficiently regulates power consumption, capably handling regenerative power during free-fall loads. Its versatile functionality, including 6° of freedom and jaws, bestows exceptional dexterity.

Beyond its technical specifications, eManip embodies a forward-thinking approach. Its sophisticated control system lays the groundwork for increased automation, diminishing the reliance on operator expertise while ensuring consistent and reliable task execution. The necessity for human intervention in hazardous underwater environments is drastically reduced, minimizing the exposure of human operators to potential risks.

The manipulator's precision in position and force feedback, coupled with its consistent performance and intelligence, hints at a future of advanced manipulator arm control. Saab UK's forward-looking approach involves integrating subsea exchangeable end effectors and force sensing ability, empowering the manipulator with en-

hanced adaptability and responsiveness to varying tasks and environments. The incorporation of advanced object detection systems signifies a potential shift from manual control and supervised autonomy to fully autonomous maneuvers. This adaptability and readiness for future upgrades underscores Saab UK's steadfast commitment to continuous innovation and preservation for human safety, heralding a new era for electric manipulators in the ever-evolving landscape of underwater robotics.

Moving Toward Autonomy

The future of ROVs holds the potential for more autonomous operations in underwater robotics, with significant promise for various industries. Advancements in artificial intelligence, machine learning, and sensor technologies enable the development of underwater robots capable of executing complex tasks with minimal human intervention. These robots could autonomously navigate, perform inspections, conduct maintenance, and even make decisions based on real-time data, enhancing operational efficiency.

Continued advancements in eco-friendly underwater robotics focus on enhancing sustainability in subsea operations. Technologies that reduce environmental impact, such as electric propulsion, efficient power management and autonomy, are increasingly integrated into underwater robots. These advancements not only improve performance but also align with global sustainability goals by reducing reliance on fossil fuels, minimizing pollution, and promoting environmentally conscious practices in subsea exploration and operations.

The evolution toward more autonomous, resident and eco-friendly underwater robotics is poised to revolutionize various industries, such as offshore energy production. As technology continues to advance, these innovations will play a pivotal role in enabling safer, more efficient and environmentally responsible practices.

Saab UK is at the forefront of this transformation in underwater robotics, driven by the urgent need for sustainability, drive for cost savings and preservation of human life. The latest innovations, eM1-7 Electric Manipulator and eWROV, embrace the push for more environmentally responsible practices while being cost effective and increasing safety.

The increased global emphasis on reducing environmental impact has led to heightened scrutiny and a collective effort to preserve delicate underwater ecosystems. Sustainability has evolved beyond a passing trend; it has become an integral aspect shaping the future of industries. **ST**

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Jon Robertson has 26+ years' experience in engineering and marine robotics. He is currently managing director of Saab Seaeye, having joined the company in 1998, rising from special projects engineer to engineering manager to engineering director. He has a track record of bringing smarter underwater robotics to the market, with significant technological advances and product design achievements.



Smaller Sensors, UUVs

Sensors and UUVs Coevolve with Rising Demand for Data

By Jake Frith

Moore's Law highlights that the number of transistors in an integrated circuit doubles about every two years. This, combined with advancements in critical technologies such as battery storage, partially explains why subsea vehicles have become more effective over the past decade in a more compact platform. A smaller size results in less carbon footprint for the data gathered, lower cost per vehicle and increased/faster subsea coverage.

Simultaneously, the integration of AI (artificial intelligence) and ML (machine learning) technology is rapidly advancing in UUVs. This progress, coupled with

supporting technologies such as enhanced bandwidth connections, onboard edge processing, improved object recognition, and more sophisticated interconnectivity among vehicles deployed in a fleet, signals a fast-moving

NBOSI has supplied hundreds of CTD sensors for Huntington Ingalls Industries' REMUS vehicles, including the new modular REMUS 300 vehicle, shown here with a custom sensor nearly flush-mounted in a wet volume near the nose.





These L3Harris OceanServer Iver vehicles were equipped with ruggedized NBOSI CTD sensors with custom through-hull penetrators. The large aperture conductivity cells (starboard side, aft) enabled extremely fast sensor response during a NASA investigation of upper ocean salinity in the tropical Atlantic.

evolution in the industry. We are swiftly headed toward once-fictional scenarios, such as subsea robotic fleets collaborating intelligently and executing swarm deployments.

According to market research by Fortune Business Insights, the global unmanned underwater vehicles market size is projected to grow from \$3.34 billion in 2023 to \$8.14 billion by 2030, at a compound annual growth rate of 13.5 percent.

Straits Research, forecasting for the period 2023 to 2031, has stated that demand for “small and medium underwater drones is expected to grow significantly during the forecast period. Small and medium underwater drones are propelled by electric motors, and, hence, the demand for battery-powered small and medium underwater drones is expected to grow considerably over the years.”

One reason for this strong growth forecast is the high, and rising, demand for accurate underwater data, driven by growing sectors such as offshore wind, oil and gas, scientific research, and defense. Consider the tasks of surveying the deepwater seabed prior to the installation of a floating offshore wind farm mooring system, or monitoring and protecting vital infrastructure such as subsea data cables. Today, these tasks constitute a substantial portion of global subsea data collection efforts. Obtaining data in deepwater over wide areas will require efficient, fast-moving, battery-powered vehicles operating close to the seabed in fleet formations.

Compact CTD

Neil Brown Ocean Sensors Inc. (NBOSI), a U.S.-headquartered manufacturer of CTD sensors for mobile marine platforms, is one of the companies that supports the growing market for data gathering via smaller subsea vehicles. CEO Dr. Dave Fratantoni reported a three-fold increase in demand for NBOSI’s compact, hydrodynamically efficient sensors from 2022 to 2023. “We expect to sell our 1,000th sensor in the first half of 2024, which, for a company of our size producing a custom or semi-custom product, is a significant milestone,” he said.

“There are both push and pull factors influencing the industry’s move toward smaller, more numerous, but

“One of the drivers for the growth in the small and micro-AUV markets is the lower cost of entry.”

vastly more capable vehicles,” he continued. “Technologies such as our sensors allow more to be achieved with a smaller hull, while the requirement to map and collect data for so much of our ocean bed for environmental reasons, and recent increases in geopolitical instability driving defense procurements, act as major pull factors.”

NBOSI’s enclosed-field, electrode-based conductivity cells have always been reliable, accurate, and easy to integrate. NBOSI is set to introduce its newest product to the sector: an integrated CTD sensor for temperature, salinity, depth and sound speed measurements in a palm-size, rugged, easy-to-integrate package. Anticipated for launch in the first quarter of 2024, this innovation removes the requirement for installation of control electronics within a vehicle’s pressure hull, thus simplifying installation, calibration and field maintenance of a mission-critical sensor. The new sensor also incorporates a precision pressure sensor and provides real-time output of ocean density and sound speed, further reducing the payload and data processing burdens on small platforms.

Benefits

There are several benefits of the new integrated sensor approach for smaller vehicles and large fleets, including ease of maintenance. Typically, occasional sensor calibration requires opening up the vehicle’s pressure hull, removing the sensor’s internal electronics and subsequently resealing it. While this can be a relatively straightforward task on many vehicles, it is a task that has to be multiplied by the number of vehicles an operator needs to maintain at any one time, and it can be a very challenging task to undertake in the field. In contrast, servicing the new integrated sensor is a much more straightforward proposition of unplugging the fully external sensor and either returning it to NBOSI for rapid, low-cost calibration, or swapping it out with a ready-calibrated standby spare. The end result is a faster turnaround supporting more frequent recalibration and better-quality data.

Integrating the electronics and sensing elements into a plug-and-play externally mounted single unit will significantly streamline servicing and calibration. Additionally, eliminating the need to carry the electronics board within the pressure hull frees up valuable in-vehicle real estate. As vehicles become smaller, this in-hull volume becomes ever more precious. Even in larger vehicles, for which NBOSI still offers the option of a separate internal

board, the new board is only a quarter of the size of the previous one.

One of the drivers for the growth in the small and micro-AUV markets is the lower cost of entry. On the defense side, this is allowing ever smaller nation states to defend their critical subsea infrastructure by deploying fleets of subsea vehicles in previously inaccessible areas. The lower platform costs are also allowing investigators, both young and experienced, to add innovative autonomous observing capabilities to their research portfolios.

The new integrated CTD will continue NBOSI’s high standards for reliability and accuracy at a price point consistent with smaller vehicle applications. This will be achieved primarily through greater standardization and more efficient production. A slightly more streamlined manufacturing process can only be good news for the scalability of the NBOSI business; an important consideration as the UUV industry mushrooms in the coming decade.

That said, all NBOSI sensors are customized to precisely suit the end-user’s particular application. Over the past year, the company has supplied custom sensors for an innovative mine-hunting vehicle built by Mitsubishi Heavy Industries in Japan. A collaboration with Cornell University has involved providing a specially configured and calibrated sensor for the remote study of a deep brine pool in the Gulf of Mexico. Perhaps most notably, the NBOSI technology is included on the cutting-edge HII REMUS 300, the foundational vehicle for the U.S. Navy’s extensive Lionfish SUUV program.

Throughout these projects, the company has actively engaged with customers during the early stages of their design process, always combining the well-tested sensor technology with tailored engineering support. The outcomes have been exceptionally positive across the board. NBOSI is currently in ongoing discussions with potential new clients, some in completely new sectors, and eagerly anticipates exciting collaborations in the coming year.

Conclusion

NBOSI has seen these successes by focusing on the development of low-power, low-cost, robust sensors specifically for mobile platforms. The design of the sensors minimizes hydrodynamic drag and potential for biofouling while maximizing accuracy of measurements in the varied environments where these autonomous platforms operate.

“How, precisely, data demands for activities such as subsea warfare, scientific research and the energy industry will evolve over the next decades is impossible to predict with much accuracy,” said Fratanтони. “But, based on the feedback and requests from customers, we can be confident that the trend toward vehicle miniaturization and proliferation is likely to persist. From a business perspective, this is encouraging for us, because the smaller these vehicles get, the greater the opportunity for our compact sensors.” **ST**

Jake Frith is a commercial marine journalist who covers maritime innovation, particularly in robotics, hull design and electrification.

Arm for ORCA ROV

Students Develop Manipulator for Underwater Inspection, Exploration

By Karthik Raja Anandan • Anirudh Anand • Dr. Sakthivel Murugan Santhanam

ORCA is an inspection-class ROV designed in the Underwater Acoustic Research Lab at the Sri Sivasubramaniya Nadar College of Engineering in Chennai, India, by an undergraduate team.

The ROV measures 500 by 350 by 210 mm, uses six thrusters and weighs approximately 10 kg. Sensors include an IMU and a camera to enable underwater inspection and exploration.

The open-frame design of high-density polyethylene ensures water flow while maintaining stability by positioning the center of buoyancy above the center of gravity. The acrylic electronic enclosure features adjustable

horizontal plates housing the thrusters, and a Logitech joystick allows laptop-piloted control.

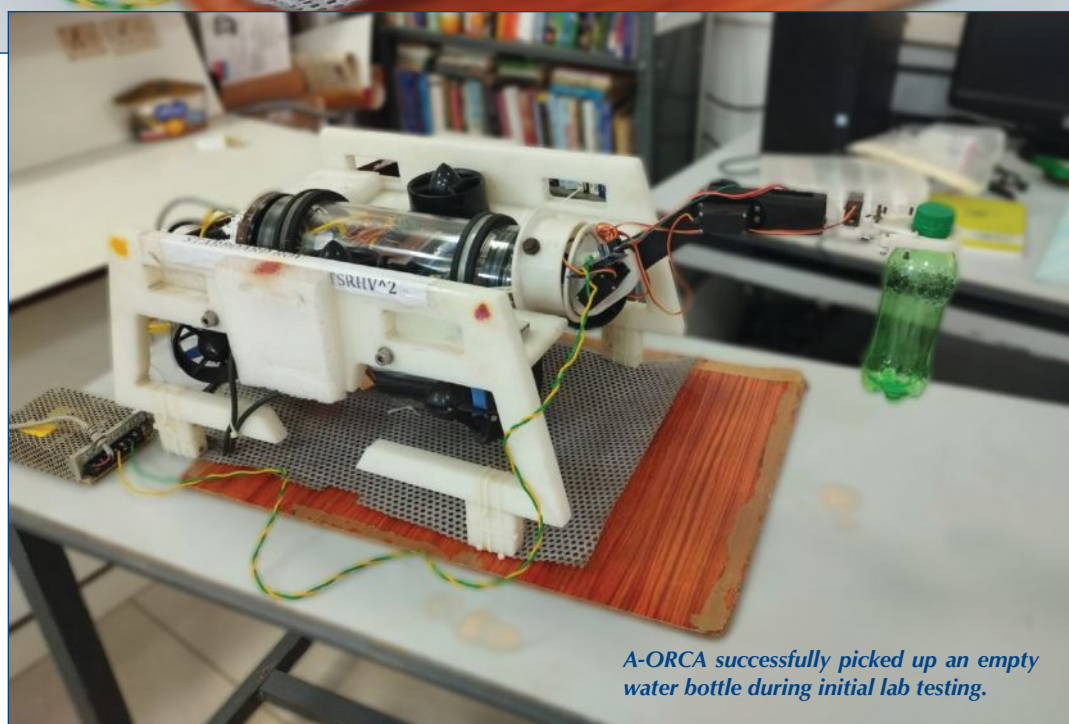
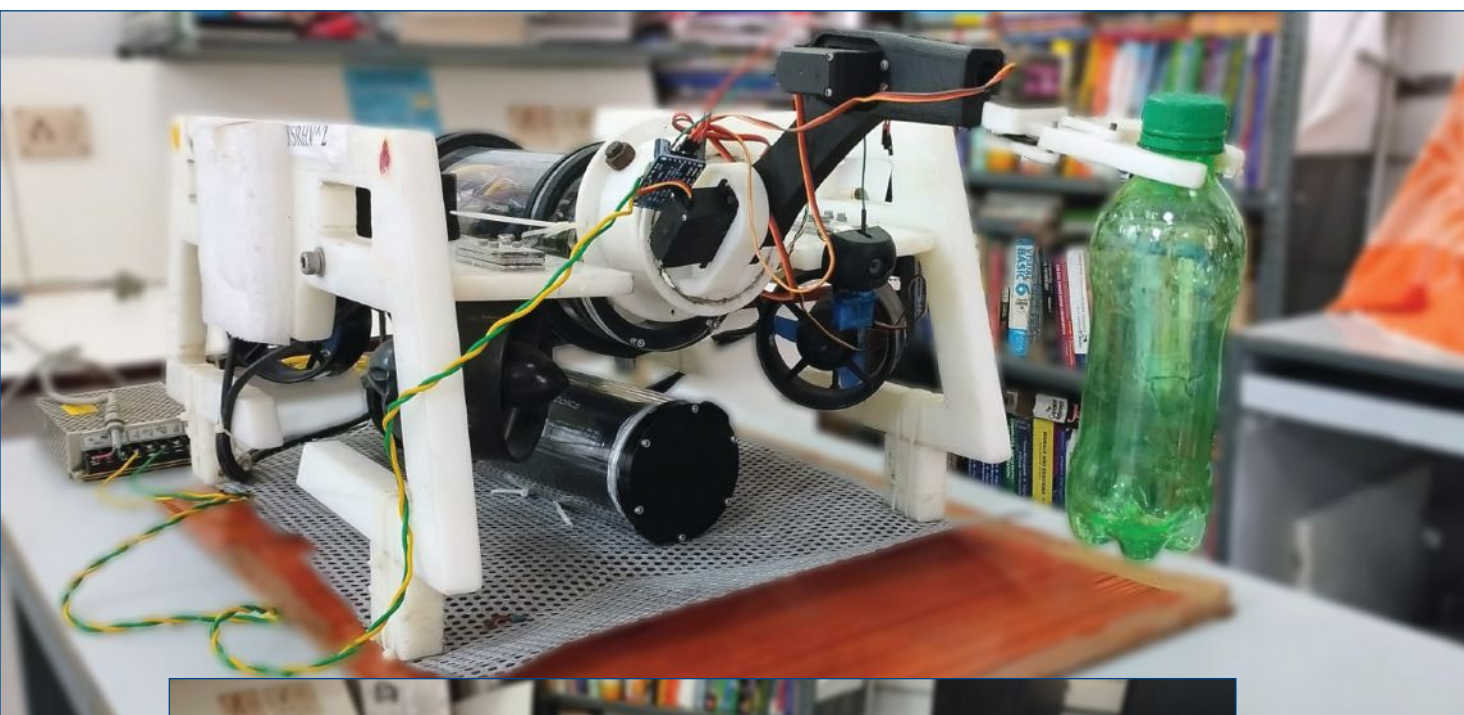
Sensors and electronic circuitry are secured within the enclosure, which uses a Raspberry Pi Model B+, Arduino Uno R3 microcontroller, and electronic speed control via a Cat 5 Ethernet tether. Software integration includes MOOS-IvP for navigation. The IMU, HD USB camera, and sensors aid in navigation and data acquisition. ORCA's thrusters enable horizontal and vertical movement.

Manipulator Arm

The latest development for the ORCA is a manipu-

A modular manipulator arm has been developed for the student-created ORCA ROV.





A-ORCA successfully picked up an empty water bottle during initial lab testing.

lator, called A-ORCA. The robotic arm incorporates various elements to ensure durability and functionality. Constructed through 3D printing using a robust plastic, the arm can withstand up to 500-m depth of underwater pressure.

The skid pad devised for attachment to the ROV is constructed from acrylic, the same material as the ROV's structural components.

The robotic arm is engineered using a 4° of freedom (4-DOF) model, encompassing rotational motion at the base, a shoulder joint, an articulated joint and a gripper mechanism. These articulations collectively grant the arm versatility in movement and interaction within its operational environment. The model can accurately

predict the angles required for the robotic arm to perform specific tasks, such as grabbing an object.

For motorization, a combination of MG996 and MG90S servos is employed. The MG996 servos are primarily utilized in the arm's joints due to their robust torque capabilities, while the lighter MG90S servo is used in the gripper. The arm demonstrated the ability to handle tasks that require lifting objects weighing around 1 kg (for example, a water bottle).

To control the arm's movements, a Raspberry Pi serves as the central processing unit. The Raspberry Pi communicates with the arm's actuators via a PCA9685 PWM controller, offering precise control over the servos' actions. To facilitate user interaction and command ex-

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ecution, a user-friendly interface has been established. Commands are mapped to specific keys, such as W, A, S, D and the arrow keys, which correspond to the two available directions of movement enabled by the four motors present within the arm's structure.

Programming the interface between the Raspberry Pi and the motors is achieved using the Adafruit PCA9685 package within a Python programming environment. This package streamlines the process of configuring and controlling the pulse-width modulation signals, ensuring smooth and accurate motor responses according to the user's input.

The robotic arm's capabilities are augmented with the optional implementation of the YOLO (You Only Look Once) object detection framework. This integration with the ROV's camera empowers the arm to detect objects within its vicinity autonomously. A novel hierarchical model for multi-label image tagging has been introduced for object classification. Confidence values are leveraged to indicate the likelihood of new classes, objects or species, streamlining the post-processing phase.

Testing

Experimental trials have been conducted to assess the arm's ability to detect and manipulate objects. Initial tests in the Underwater Acoustic Research Lab involved the following scenarios: manual intervention to pick up detected objects (future work will automate this process); testing for 180° (vertical and horizontal) movement of the arm; placing an empty object in front of A-ORCA to identify and lift it; and placing a half-filled object (water bottle) in front of A-ORCA to identify and lift it. These initial tests were performed successfully.

Conclusion

The ORCA ROV's latest development is a modular manipulator and software suite for object detection. The attachment comprises an articulating arm and dedicated circuitry that will eventually enable the ROV to perform autonomous tasks. Further development will advance detection models and autonomous decision-making algorithms. We envision ORCA's applications with manipulator to include detecting and gathering plastic pollutants in the ocean, as well as collecting sediments of interest. Testing continues this winter in the Bay of Bengal.

Acknowledgments

The authors wish to thank the management and dean of research at Sri Sivasubramaniya Nadar College of Engineering for funding this work. **ST**

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international

JDP to Validate 3D Ship Model Approval

Bureau Veritas (BV), the Shanghai Merchant Ship Design & Research Institute (SDARI) and NAPA have completed the first phase of a joint development project (JDP) to enable 3D model-based approvals (3D MBA) for the classification of ships.

The project validated the feasibility of 3D MBA, where classification reviews are directly based on the 3D model provided by the designer, rather than requiring the traditional multiple conversions to 2D drawings.

GHG Abatement Notation

The DNV-classed rig Transocean Norge has become the first semisubmersible rig to be awarded DNV's Abate (Power+) notation, following significant upgrades designed to lower its greenhouse gas (GHG) emissions. The Abate (Power+) notation is designed to reflect the best industry practices in greenhouse gas abatement for offshore units.

While the International Maritime Organization (IMO) regulates carbon intensity for sea vessels, offshore installations do not currently fall under a similar regulatory framework, yet the industry seeks to enhance sustainability. DNV's Abate (Power+) class notation represents ambitious emission reduction targets and a comprehensive

energy and emission management system aligned with ISO 50001 standards.

GeoAcoustics Adds Partner

GeoAcoustics Ltd. has appointed its first channel partner in Singapore: Hidrokinetik Technologies Pte Ltd. A Hidrokinetik Group company, Hidrokinetik Technologies is one of Southeast Asia's primary providers of hydrographic and geophysical services and an established subsea technology rental company.

The new partner agreement brings the established bathymetric sonar, sub-bottom profiler and side scan sonar manufacturer's total number of channel partners to 57, serving a total of 68 countries.

Fugro Acquires SEA-KIT

Fugro has reached a binding agreement for the acquisition of the remaining shares in SEA-KIT International (*Sea Technology*, October 2022), a long-standing partner in the development of USVs for low-carbon-emission maritime operations and research.

SEA-KIT will continue to provide clients with high-quality USV products for cost-effective operations with enhanced safety and significantly reduced carbon emissions.

New advancements post-acquisition will include the launch of the Blue Eclipse 18-m USV specially designed for fast pipeline and deepwater asset inspection activities, as well as a zero-emission hydrogen-powered USV.

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Ashtead Acquires ACE Winches

International subsea equipment rental and solutions specialist Ashtead Technology has further expanded its mechanical solutions service offering with the acquisition of ACE Winches.

Established in 1992, ACE Winches specializes in the design, manufacture, and hire of lifting, pulling, and deployment solutions. The company's core offering supports the installation; inspection, maintenance and repair; and decommissioning of offshore energy infrastructure.

ACE Winches is Ashtead Technology's eighth acquisition in the last six years and strengthens Ashtead's product and service offering in the oil and gas and offshore wind markets.

Methanol Fuel Retrofit

Alfa Laval's fuel supply system FCM Methanol has been selected by Maersk for a pioneering methanol retrofit project to enable the container vessel *Maersk Halifax* to operate on methanol fuel. This project shows the feasibility of retrofitting ships with the necessary equipment for methanol-based propulsion.

The retrofit is scheduled by mid-2024 and will enable the vessel to sail on green methanol with dual-fuel capabilities. The project will involve adding a new fuel line for methanol alongside the traditional fuel line, respecting the existing space constraints.

Carbon Storage Tanks

Value Carbon, a sister company of Value Maritime, and Evos, an independent liquid bulk storage provider, have signed a letter of intent to build two 2,000 m³ storage tanks for absorption liquids to accommodate Value Carbon's growing CO₂ recycling business.

Value Carbon manages the whole carbon value chain, from captured carbon to utilization and/or storage, with a focus on locations where the carbon is captured and the most energy-efficient way to utilize or store it at the lowest possible cost per tonne.

Currently, the Value Group utilizes onboard ISO containers, primarily on container feeder vessels. The captured carbon is then delivered to the horticulture industry/greenhouses in the Netherlands and extracted on site.

Value Carbon chose the Evos terminal in the central location of the Port of Rotterdam, where it can receive, store, treat and redeliver carbon captured on board ships via the Filtree and Carbon Capture system.

Piping Solutions for Hospital Ship

For improved hygiene and operational safety, the international charity Mercy Ships has selected ecoFIT and INSTAFLEX by GF Piping Systems for various water applications on board the *Global Mercy*, a floating hospital that provides free medical and surgical care for people in Sub-Saharan Africa.

GF Piping Systems has provided about 13,000 piping components, including ball valves, butterfly valves and actuators. INSTAFLEX, a polybutene system designed for building technology applications, was selected for the hot and cold water installation and the onboard water

treatment system. ecoFIT, a polyethylene system for industrial applications, was installed for wastewater transportation.

New USCG Cutter

The U.S. Coast Guard's (USCG) newest *Legend*-class national security cutter (NSC), *Calhoun* (WMSL-759), has departed from Hill's Ingalls Shipbuilding division and is scheduled for commissioning in 2024. It will be homeported in Charleston, South Carolina, joining cutters *Hamilton*, *James* and *Stone*.

NSC-10 is named to honor Charles L. Calhoun, the first master chief petty officer of the U.S. Coast Guard, who served in the U.S. Navy during World War II and held leadership positions in the USCG.

Ingalls has delivered 10 *Legend*-class national security cutters to the Coast Guard and is continuing construction on the final ship in the class, *Friedman* (WMSL-760).

Danfoss Creates Marine Unit

Danfoss Drives has formed a marine business unit to provide tailored solutions for ship propulsion, control systems and electrification for customers in the marine industry. This enhanced commitment comes at a critical time for the industry as it looks to reduce environmental impact while improving efficiency and lowering operating costs.

TDI-Brooks Files Theft Claim

TDI-Brooks has filed with the Galveston Port Police Department the theft of a \$1 million GeoMil Manta-200 CPT by Mexican firms Project Development Group (PDG) and GDT Offshore S.A. de C.V. and DeepOcean Group of Norway. TDI-Brooks claims these entities conducted unauthorized transport of its equipment on board an ocean-going vessel to Mexico for a PEMEX project.

TMA BlueTech Member Makes Forbes List

Yidian Liu and Nathaniel Banks from PolyGone, a TMA BlueTech member, have been named Forbes30under30 social impact entrepreneurs. PolyGone has developed a filter material that imitates the fibrous structure of an aquatic plant root and firmly adheres to microplastics as small as 0.1 mm. PolyGone has raised \$2.8 million, partnered with the Atlantic County Utilities Authority in New Jersey to pilot the filtration system, and is working on a monitoring station on the Hudson River and a remediation system at Canada's Experimental Lake Area.

LiDAR Map of Potomac River

The U.S. Geological Survey and Dewberry have published the new topobathymetric LiDAR data set for the Potomac River. Using its Teledyne Optech CZMIL SuperNova LiDAR, Dewberry surveyed 55 mi. of river for data to help predict the presence and movement of oil spills.

Oceanbotics ROVs for Mexico Port Security

The Mexico Port Authorities have purchased nine SRV-8 ROVs from Oceanbotics Inc. for real-time hull inspections, threat detection and environmental monitoring. **ST**

Offshore Wind Cable Laying Code of Practice

With some estimates putting the cost of subsea cable failure for offshore wind at more than £500 million in 2020, the average insurance claim worth more than £3 million, and an estimated 30 percent failure rate in any given year, the International Marine Contractors Association (IMCA) has released a new Code of Practice to improve the installation of underwater power cables in offshore wind. The Code of Practice for Offshore Cable Laying in the Renewable Energy Industry (IMCA M264) addresses issues for the safe laying and terminating of offshore power cables to prevent damage.

At the point at which cables leave the laying vessel and meet the seabed, they are frequently subject to damage caused by overbending, cable pulling and inadequate de-

sign of lead into the monopile.

In addressing issues such as the laying spread—the combined set of systems required for the installation of the cable—as well as the interface between the vessel and the spread, and the safest methodology for overboarding, trenching and cable pulling, the IMCA Code of Practice establishes a new baseline for safely laying offshore submarine power cables that will significantly improve performance.

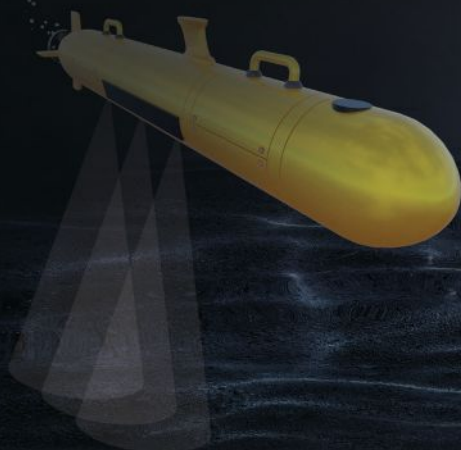
Seawing Demonstrates Fuel, Emissions Savings

Airseas, a provider of wind propulsion systems for the maritime sector, has announced that its latest sea trials have shown projected fuel and emissions reductions of 16 percent based on a normalized transatlantic voyage. These projections use traction data collected during the validation of automated dynam-

ic flights of the Seawing, where the kite flies in “figure-eight” patterns to multiply the traction delivered to the ship, helping to reduce its fuel consumption and greenhouse gas emissions. The projected fuel and emissions savings were calculated from the tonnes of traction measured on the Seawing system during the final round of sea trials on the 5,291-dwt RoRo vessel *Ville de Bordeaux*, owned by Louis Dreyfus Armateurs, during transatlantic voyages. The initial performance data are in line with the Seawing’s development roadmap aimed at delivering average savings of 20 percent.

The trials have also enabled Airseas to validate the technology’s automation system, which successfully controlled the Seawing’s dynamic flights without human intervention. This builds on earlier technical achievements in the sea trials on the *Ville de Bordeaux*, including the validation of automated take-off and landing phases, the first traction flights with the kite in “static” position, and dynamic flights that in-

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crease the kite's traction power.

The next steps of the Seawing development roadmap will focus on delivering the kite's full performance. These include testing in ground conditions at Airseas' new R&D center in Dakhla, Morocco. There will also be sea trials on a 211,982-dwt cape-size vessel owned by Japanese shipowner "K" Line, which has purchased five Seawings, including options for up to 51 in total.

Rotor Sails on World's Largest Ore Carrier

Brazilian mining giant Vale S.A. will install five Rotor Sails from Anemoui Marine Technologies Ltd. on board a 400,000-dwt Valemax, the world's largest ore carrier. The vessel is owned by Omani shipowner Asyad.

The 35-m-tall, 5-m-diameter, cylindrical sails will be installed by the second quarter of 2024 on the *Sohar Max* via Anemoui's bespoke fold-

ing deployment system, whereby the sails can be folded from vertical to mitigate impact on air draft and cargo handling operations.

Rotor Sails, also known as Flettner Rotors, are vertical cylinders that harness the renewable power of the wind to provide additional forward thrust and improve the energy efficiency of the vessel, along with significant cuts to carbon emissions.

Vale's fleet of Valemax vessels typically trade on deep-sea routes between Brazil, China and the Middle East, which are particularly well-suited for wind propulsion and analyzing the savings. The Anemoui Rotor Sails are expected to bring a 6 percent fuel reduction and CO₂ emissions reduction of up to 3,000 tons per ship per year.

HydroWing Tidal Project

HydroWing has been awarded a contract for a 10-MW tidal stream energy project in Wales at the Morlais tidal energy site in Anglesey, which is managed by the social enterprise Menter Môn. The site is the U.K.'s largest consented tidal energy scheme. Comprehensive research has already been conducted in partnership with Bangor University to assess the velocity of local tide currents.

HydroWing has a supporting structure that sits on the seabed under its own weight. The "wings" holding the turbines are lowered into position on this structure. The turbines are bidirectional, generating power as the tide moves.

SIDS Focus on Ocean Energy

During COP28, a side event in Dubai with small island developing states (SIDS) highlighted the role that ocean energy technology, including ocean thermal energy conversion (OTEC), can play in the energy transition in tropical islands. Representatives of Tonga, Dominica, Seychelles, Tuvalu, Barbados, Bermuda, Palau, Saint Vincent and the Grenadines, Bahamas, and Grenada were present.

OTEC will have its first commercial implementation in São Tomé and Príncipe, Africa, by 2025, designed by startup Global OTEC. **ST**



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Satellites for Ship Detection

Unseenlabs has launched BRO-10 and BRO-11, the 10th and 11th satellites of its pioneering constellation committed to ship detection at sea. As the global maritime landscape experiences a surge in ship activities, the necessity for a technology that extends reliable, large-scale monitoring is paramount.

Unseenlabs provides RF data, ensuring detailed vessel characterization and precise geolocation for applications in a multitude of sectors worldwide, including government, NGOs and insurers.

With the addition of BRO-10 and BRO-11 to its satellite constellation, Unseenlabs amplifies its capability to deliver pivotal RF data and solutions to an ever-growing international customer base. The extended satellite fleet enhances the ability to monitor and characterize vessels globally, underscoring a tangible commitment to safeguarding marine assets and environments against illicit activities and threats.

Korean Register Approves Carbon Capture System

KR, in collaboration with the Marshall Islands Registry, has granted an approval in principle for an onboard CO₂ Capture System (OCCS) developed by Hanwha Ocean.

With the International Maritime Organization (IMO) and the European Union (EU) strengthening regulations concerning greenhouse gas emissions, including the recent implementation of Carbon Intensity Indicator (CII) regulations, shipping companies are faced with the imperative to closely monitor and reduce their vessels' carbon emissions to meet these stringent standards. Considering these evolving environmental regulations, onboard CO₂ capture and storage technology has emerged as a promising solution to effectively address global emissions requirements.

The onboard carbon capture and storage technology developed by Hanwha Ocean absorbs CO₂

generated on the ship using absorbents and converts it into mineral form. The OCCS incorporating this technology consumes very little energy compared to other CO₂ capture technologies, and the amount of additional CO₂ generated during its operation is relatively small. Furthermore, its compact design ensures efficiency in implementation.

KR verified the stability and suitability of the OCCS by reviewing classification rules and domestic and international regulations in collaboration with the Marshall Islands Registry.

Ammonia-Fueled Container Ship

Yara Clean Ammonia, North Sea Container Line and Yara International will collaborate on the world's first container ship using clean ammonia as fuel. Named "Yara Eyde," the vessel will be the first to sail an emission-free sea route between Norway and Germany.

Yara International is a founding member of the First Movers Coalition and supports the Green Shipping Challenge. Yara International and Yara Clean Ammonia promote low-carbon solutions across hard-to-abate sectors and clean ammonia as fuel in new and retrofitted zero-emission vessels. *Yara Eyde* is optimized for the trade corridor between Norway and Germany and will operate between Oslo, Porsgrunn, Hamburg, and Bremerhaven. From 2026, Norwegian companies can trade their products emissions-free in and out of Norway. Yara International is participating as cargo owner. The fertilizer produced in Porsgrunn will be shipped emission-free to Germany, cutting scope 3 emissions with 11,000 tonnes of CO₂ per year.

Enova has awarded *Yara Eyde* just over 40 million NOK, and the support is decisive for implementing the project. Yara Clean Ammonia AS and North Sea Container Line AS are establishing a joint venture to create *Yara Eyde*, which will be operated by NCL Oslofjord AS. The

joint venture aims to become the world's first line operator to focus exclusively on ammonia-powered container ships.

Global Reef Shark Survey

With reef shark populations in crisis, Mote Marine Laboratory & Aquarium and partners from around the globe are updating the seminal shark survey Global FinPrint and applying their findings to the design of new marine protected areas (MPAs). The Paul G. Allen Family Foundation is funding the \$1.5 million project, building on the first study in an overall effort to recover reef shark populations worldwide.

The first Global FinPrint, the world's largest shark survey on coral reefs conducted in 58 nations from 2015 to 2018, has found that reef sharks were declining globally but remained common in some MPAs when compared to unprotected areas. The second phase of the project will return to 26 nations to see how reef sharks are doing in their MPAs, help empower these nations to improve the MPAs they have, and provide guidance on the design of new ones.

Throughout the coming year, Mote will work with partners in 26 nations in the Atlantic, Indian, and Pacific Oceans to survey 50 MPAs and 50 control sites previously sampled by Global FinPrint to assess changes and understand the relationships between MPA design features and reef shark abundance and trends.

Parameters such as size, shape, placement, and the management of shark fishing outside of MPAs will be studied to identify effective strategies for reef shark conservation.

The teams in the 26 nations comprise locals ranging from researchers to fisherfolk to government representatives, ensuring broad participation in the scientific process and inclusive access to the results to ensure they are incorporated into national MPA planning and fisheries management.

Many nations are in the process of expanding their MPAs as part of a global initiative to protect 30 percent of the oceans by 2030. **ST**

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Electric SOV



SOV 7017 E is a fully electric service operations vessel (SOV) measuring 70 x 17 m, with a 15-MWh battery. Featuring offshore charging capabilities, the vessel paves the way for significantly reduced emissions in the maintenance of offshore wind farms. The charging system uses the motion-compensated gangway to create a connection between the vessel and a turbine or substation offshore. The gangway is controlled from the wheelhouse. Damen Shipyards Group.

Environmental Scheduling

Blue Visby Solution is a ClassNK-endorsed multilateral platform for reducing shipping GHG emissions by 15% by eradicating the practice of "Sail Fast, then Wait" via "Just-in-Time" berthing. It is designed to provide participating vessels with environmentally optimal target arrival times, which take into account the overall conditions at the port, weather, and the position and course of other participating ships moving to the same destination. Blue Visby Services Ltd.

X-Band Radar

Pathfinder is an IMO-compliant solid-state X-band system designed for CAT 2 and CAT 3 SOLAS vessels. The radar is ideal for vessels up to 10,000 tons, including superyacht, megayacht and OSV/deepwater vessels. The system delivers exceptional resolution and detection capabilities, even in the most challenging maritime conditions, to enable situational awareness. Raymarine.

USVs for Survey

Uni-Mini is an economical, compact and lightweight vehicle that can be operated by just two people. It has been specifically engineered for shallow-water surveys and can integrate seamlessly with a wide range of transducers and GPS systems. Uni-Max has a hybrid power system, integrating a generator with a diesel tank and solar PV cells. It enables prolonged missions in remote or demanding terrains. Unique Group.

Onboard Network Cybersecurity



OptiShield is a comprehensive cybersecurity solution designed specifically for the maritime industry. It provides crucial threat protection and detection, while remote experts function as a cyber response team, ensuring vessels are ready to execute an effective response and quickly return to normal operations. IEC Telecom.

Shallow Sediment Sampling

The range of inshore sediment sampling equipment to assist with coastal studies now includes a rechargeable standalone mini vibro-corer for dense and compacted sediments; a mini box corer that enables direct sub sampling on recovery of the corer and sample; and a mini multiple corer that perfectly preserves the sediment sample (including the sediment/water interface and the overlying supernatant water). OSIL.

Modular Solid-State Radar

IMO-approved HALO 5000 provides superior situational awareness

for commercial vessels, reduced ownership cost and flexible installation. It has 130-W pulse compression, featuring excellent visibility in all conditions. Users can automatically monitor thousands of radar targets within a 24-nautical mi. zone, displaying as many as 100 of those targets on screen simultaneously. Simrad Marine Electronics.

Hull Cleaning Robot



Improvements to EverClean include supervised reliable autonomy with over-the-horizon operational capability for underwater hull maintenance. The robot can be used when the ship is in port or through resident systems on board. EverClean can autonomously cover areas up to 50 m² on a ship's hull, effortlessly detecting obstacles. Keep-out zones are more intuitively defined within the software. Greensea IQ.

Weather Insurance

Weather Cover offers shipowners and charterers with the first-ever marine insurance protection to mitigate the threat posed to ships solely by adverse weather conditions. Coverage includes up to eight days against the risks of a ship being delayed in or outside a port due to bad weather, as part of the broader Strike & Delay package. NorthStandard.

Deepwater Data Collection

The world's first real-time data collection system can build live 3D reconstructions down to 6,000-m depth. This depth of operation was requested by the marine ecology and salvage industries and will also be of use to the energy industry. SubSLAM X2 technology delivers

complete spatial reconstructions to advance understanding of challenging subsea environments using SubSLAM Deeper. Vaarst.

Methanol Engines

In addition to the Wärtsilä 32 methanol engine launched in 2022, Wärtsilä will add the Wärtsilä 20, Wärtsilä 31, Wärtsilä 46F and Wärtsilä 46TS to its portfolio of engines capable of operating with methanol fuel. Methanol is one of the primary alternative fuel choices for the shipping industry to achieve net-zero carbon emissions by 2050. Wärtsilä Marine Power.

Cloud-Based Wave Modeling

MIKE Metocean Simulator (MIKE MS) is a fast, easy and flexible wave modeling tool for offshore energy and marine infrastructure projects. Regardless of numerical modeling experience, users can assess wave conditions rapidly and accurately in both offshore and nearshore environments. Features include assisted meshing, advanced statisti-

cal methods, easy data access and cloud computing. DHI Water and Environment Inc.

Increased Sonar Depth

The standard depth rating is now 3,000 m on all new 2050-DSS combined tri-frequency side scan sonar and high-resolution sub-bottom profiling sonar systems. The 2050-DSS enables any two, operator-selectable frequencies to run simultaneously. The system can be provided with either a 120-, 410- and 850-kHz towfish, or a 230-, 540- and 850-kHz towfish. Both towfish options are equipped with a 2- to 16-kHz sub-bottom profiler that utilizes a PVDF panel receive hydrophone. EdgeTech Inc.

Route Security Updates

The digital routing service has been updated to provide route planning flexibility within a recommended security corridor for the region of the Persian Gulf, Strait of Hormuz, and Sea of Oman. ChartWorld GmbH. **ST**



Emission-Free Ferries

Wärtsilä has signed a strategic partnership agreement to provide its Fleet Electrification and Systems Integrator Services for a project to build the first zero-emission, high-speed ferries in the U.S. The fully electric vessels will be built for San Francisco's Water Emergency Transportation Authority (WETA), the operator of the San Francisco Bay Ferry system.

The project, and several others Wärtsilä will work on under this partnership, is a part of the agency's Rapid Electric Emission-Free (REEF) Ferry Program, a phased decarbonization of high-speed, high-capacity ferry service in the San Francisco Bay. Wärtsilä will work within the WETA project team to finalize vessel and charging system concepts.

Digital Ecosystem Notation

A partnership bringing together ship management company Laskaridis Shipping, digital technology provider METIS Cyberspace Technology and classification society Bureau Veritas (BV) has developed new notations reflecting the latest advances in digitalization, particularly the use of augmented data to optimize the efficiency of shipping operations and reduce greenhouse gas emissions.

The project, launched in June 2022, led to BV delivering an approval in principle to METIS Cyberspace for its METIS Ship Connect System, an automated data acquisition platform for the monitoring of vessel operations and subsystems. Furthermore, two new classification notations were awarded to the bulk carrier *LETO*, built in 2015 and managed by Laskaridis Shipping Co. Ltd., which is one of the 20 ships of the company's fleet equipped with METIS Ship Connect.

With METIS Ship Connect on board, *LETO* became the first vessel to be awarded the DATAINFRA notation, which was developed by BV for the project. The notation recognizes that the ship is equipped with data infrastructure comprising data

assets, technologies, organizations and data management processes, ensuring the reliable collection, transmission, storage, sharing and availability of data to multiple data consumers.

LETO is also the first in-service vessel to receive BV's SMART notation, which recognizes that the company and the vessel incorporate software and hardware that provide smart functions for the collection, transmission, analysis, and visualization of data related to energy efficiency, speed optimization, weather routing, and emissions monitoring.

Focusing on the use of big data and AI technology, the new notations and the METIS Ship Connect platform will help ship managers reduce greenhouse gas emissions from vessels and optimize performance. The project and notations' scope support ship-to-shore connectivity, remote decisions and remote operations.

AI for Port Operations

Johor Port Berhad, a major trade hub in southern Malaysia, has made an agreement with Innovez One to leverage artificial intelligence (AI) to optimize operations and reduce greenhouse gas emissions at the fully integrated multi-purpose port. Innovez One's AI-powered marineM software will be used to digitalize and optimize the entire chain of marine services for ships arriving and departing Johor Port, from vessel registration to billing.

MarineM will use machine learning, a subset of AI, to automate and optimize the scheduling of port, tug and pilotage services. Algorithms, using data on Johor Port's unique operations, will dispatch pilots and tugboats in the most efficient way and reallocate resources seamlessly when vessels' ETAs change. This is key to maximizing fuel efficiency and reducing greenhouse gas emissions from those fleets while also minimizing congestion for visiting ships. The marineM platform will provide port managers with real-time tracking of operations while

integrating data into a single dashboard for business and operational analytics.

Advancing Autonomous Sailing

Damen has embarked on a comprehensive study of Zeabuz's cutting-edge technology for autonomous sailing. Damen and Zeabuz are on a mission to enable autonomous operations on different levels in the coming years.

Autonomy holds the potential to revolutionize vessel operations by enhancing safety protocols, optimizing asset effectiveness, and paving the way for the creation of new business models. The industry's growing interest in autonomous and technologically advanced solutions underlines the need for collaboration between advanced knowledge partners. The exploration process will encompass rigorous testing, analysis, and collaborative endeavors to pinpoint areas where Damen's expertise in systems integration can potentially bolster and enhance Zeabuz's technology.

Collision Avoidance System

ClassNK has issued an approval in principle for the Advanced Maneuvering Assistant System, the core technology for the autonomous navigation system developed by Kawasaki Kisen Kaisha Ltd., Kawasaki Kinkai Kisen Kaisha Ltd., Japan Radio Co. Ltd. and YDK Technologies Co. Ltd.

The system automatically generates routes to avoid collision with other ships on a monitored route when a collision is predicted and assists the operator in collision avoidance.

The system will consider COLREGs and suggest up to two avoidance routes that will enable the ship to return to its original course line within 1 hr. Track control is performed for the selected avoidance route by linking the system with autopilot and ECDIS.

A demonstration test of a single function was conducted on a cargo ship as part of the MEGURI 2040 Fully Autonomous Ship Project administered by the Nippon Foundation. **ST**

people

Crowley has named offshore wind veteran **Christy Guthman** as vice president of business development for wind services as the company grows in the clean, sustainable energy sector. Guthman most recently served as executive general manager of sales and commercial operations for GE Offshore Wind. During her tenure there, she built the company's North American sales, marketing and supply chain strategy. Guthman also worked as General Electric's senior sales director for the western U.S. and Mexico.



The Board of Corvus Energy has appointed **Fredrik Witte** as the new CEO. Witte joins from his position as the managing director of Cargill Aqua Nutrition. Witte lives in Bergen, Norway, and has extensive international experience in leading growth companies. He has served previously as the chief financial officer for Rieber & Søn ASA in Bergen and has experience with Tomra Systems and DNB.

Hydrogen East Cluster, launched in May 2023, has made three key appointments to deliver hydrogen projects in the East of England. **Steve Ross**, a former part of the ORE Catapult energy transition team and business lead for the South Wales Industrial Cluster, will lead on coordinating the cluster and working with the Industry Advisory Group (IAG) to develop core work programs and a regional hydrogen roadmap, as well delivering collaborative workshop sessions for local government and businesses that represent the entire hydrogen value chain. **Anne Haase**, renewable director at Aquaterra Energy with over 25 years of experience in the energy sector, has been appointed as chair of the IAG. **Mark Turner**, director of HydroGenus with over three decades' experience in the electricity and water utility sector, has been appointed as vice chair of the IAG.

Oceaneering International Inc. has promoted **Catherine E. Dunn** to vice president and chief accounting officer. Dunn joined Oceaneering in June 2002 and has served as corporate controller since January 2012.

Innovasea, a provider of aquatic solutions for aquaculture and fish tracking, has hired **Rudi Seim** as managing director of its office in Bergen, Norway, to oversee business development, sales, field service, and customer support. Seim has over 15 years of experience in the global aquaculture industry.

ChartWorld Group, offering digital navigation solutions for the maritime industry, has welcomed back **Bjoern**

Roehlich as the global director of customer success to oversee customer service and technical support. He will also be managing director for both SevenCs GmbH and ChartWorld GmbH in Hamburg.

METIS Cyberspace Technology has appointed **Panos Theodossopoulos** as CEO. He is an expert in driving business development through technological innovation. He co-founded a maritime tech startup in 2015 and later served as chief digital officer at OceanKing, a marine technical and commercial group.

DNV has appointed **Jamie Burrows** as head of its Carbon Capture, Utilization and Storage (CCUS) unit. DNV's 2023 Energy Transition Outlook report highlights the importance of CCUS, alongside enhanced energy efficiency, renewable integration and other decarbonization solutions, in reaching Paris Agreement targets.

Greensea IQ has appointed **Jeff Vos** as the business development manager for integrated systems. Vos has worked in ocean robotics for the past five years, most recently at Oceanbotics Inc.

BMT has appointed **Jan Caers** as marine consultant for the survey market in Belgium and the rest of Europe. He has a 30-year career in maritime and terminal business development. **ST**

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contracts

Global OTEC, London, England, has signed an agreement to combine expertise in ocean thermal energy conversion (OTEC) technology and marine engineering. The partnership will focus on the development of floating OTEC, with emphasis on water-intake riser systems. 2H Offshore.

Steerprop, Rauma, Finland, will supply tunnel thrusters and retractable combi thrusters for two new-build multi-purpose patrol vessels for the Finnish Border Guard. Meyer Turku.

Ashtead Technology, Aberdeen, U.K., will be an exclusive global reseller, as well as a rental provider, of i2S Orphie camera systems used by ROV and divers to improve observation in turbid waters. i2S.

WinGD, Winterthur, Switzerland, has concluded a four-party agreement underwriting a Belgian bulk carrier operator's order of X72DF-A ammonia-fueled engines. CSSC Qingdao Beihai Shipbuilding, CSSC Engine Co. and CMB.TECH.

Jiangnan Shipyard (Group) Co. Ltd., Shanghai, China, has issued a joint declaration on 3D auditing and recognition to accelerate the process of 3D submission and approval by shipyards and classification societies. Bureau Veritas.

Erik Thun Group, Öckerö, Sweden, has selected dynamic drive technology to optimize efficiency on board all 10 of its latest newbuilds. Pilot installations exceeded energy efficiency gain expectations at a savings of 10 to 20 percent of fuel. Berg Propulsion.

The government of Canada, Ottawa, will allow Newfoundland and Labrador (NL) to lead the regulation of offshore wind projects in its inland bays. The agreement delineates the boundaries between provincial waters and jointly managed waters. NL.

Pioneer Consulting, Hoboken, New Jersey, has been selected to provide initial engineering and design services for the FISH in SEAK submarine cable system (Fiber Internet Serving Homes in Southeast Alaska), an early-stage submarine cable that complements the FISH in AK project (Fiber Internet Serving Homes in Alaska). Cordova Telecom Cooperative Inc.

Climeon, Stockholm, Sweden, HeatPower 300 waste heat recovery systems will increase energy efficiency on board two large existing container vessels for a repeat customer. Undisclosed.

Technomar Shipping, Aalborg, Denmark, has chosen the SERTICA vessel reporting system (VRS) to cover all reporting requirements. It enables easy monitoring of all key data and metrics from vessels in real time through one platform. RINA. **ST**

meetings

MARCH

March 11-15—Marine Energy Wales, Swansea, Wales. www.marineenergywales.co.uk/mew2024.

March 12-14—Oceanology International, London, U.K. <https://www.oceanologyinternational.com>.

March 24-26—Canadian Underwater Conference & Exhibition, Toronto, Canada. www.cuce.ca.

APRIL

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

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

April 16-18—Subsea Technology Eastern Mediterranean, Limassol,

Cyprus. www.subseatechnologyconference.com.

April 17-19—NOIA Annual Meeting, Washington, D.C. www.noia.org.

MAY

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

May 20-23—MTS Buoy Workshop, Sequim, Washington. www.mtsociety.org/buoy-workshop.

May 27-30—Canadian Hydrographic Conference, St. John's, Canada. www.chc2024.org.

JUNE

June 4-6—Capitol Hill Ocean Week, Washington, D.C. <https://marinesanctuary.org/chow-2024>.

June 10—Speed@Seawork, Cowes, U.K. <https://seawork.com/about/speed>.

June 11-13—Seawork, Southampton, U.K. www.seawork.com.

SEPTEMBER

September 11-12—Oil Spill India, New Delhi, India. <https://oilspillindia.org>.

September 17-19—South America Offshore Wind, Rio de Janeiro, Brazil.

NOVEMBER

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

November 7-10—Europort, Rotterdam, Netherlands. www.europort.nl.

November 19-21—Marine Renewables Canada Conference, Halifax, Canada. <https://marinerenewablesconference.ca>.

November 19-21—MAST Australia, Adelaide, Australia. mastconfex.org.

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

The Sea Ranger Service: Get Paid to Protect the Ocean—Wietse van der Werf

Wietse van der Werf is the founder and CEO of the Sea Ranger Service, which he established in 2016 after having worked at international conservation organizations in more than 10



countries over 20 years. He is building a global network of governments, agencies, investors and entrepreneurs to scale the work and impact of the Sea Ranger Service. He leads the company's international expansion.

Our oceans are in bad shape. This has been known for decades, and the international community has acted with increasing urgency to turn the tide for ocean health. By now, more than 14,000 marine protected areas (MPAs) have been designated through numerous policies and international treaties. Such protected areas at sea restrict fishing and other activities that could damage marine biodiversity or overexploit fish populations.

In some cases, MPAs are managed by local fishing communities, but national governments are primarily responsible for their management. This is where a problem arises. Operating ships at sea is very costly. Therefore, managing MPAs by having a physical presence on the water is expensive. MPAs globally are experiencing a serious lack of management capacity. A study published in *Nature* in 2009 concluded that only 0.63 percent of existing MPAs have capacity (management plan, ships, personnel) to be enforced adequately. The risk is that MPA policies, which have been hard-fought for globally in recent years, are ineffective. The danger is that they end up as mere “paper parks,” worth only as much as the piece of paper on which their designation is written.

Having worked as a fisheries investigator for almost 10 years, spending numerous nights working

undercover at fishing ports and fish markets, I witnessed personally the decline in ocean wildlife and the numerous ways in which people continue to act illegally in order to obtain illicit catches. In the coastal communities where I investigated, it was starkly obvious that the illegal activity was partly driven by poverty and a lack of opportunities for young people to find meaningful alternative career opportunities.

In almost all countries bordering the sea, the highest rates of youth unemployment are in coastal areas. In times gone by, these places would have been teeming with activity around fishing and manual port labor, but deprivation has prevailed in modern times. With port processes increasingly automated and fishing fleets consolidated, few job prospects remain. This forces young people to move away, leaving such communities further socially isolated. Such deprivation can be a driver for illegal fishing activity, further complicating adequate MPA governance and enforcement. While in theory, young people in coastal communities are ideally placed to be activated for MPA management, a substantial skills gap exists, with limited local training capacity.

To address the problems of MPAs (i.e., cost-effective ships and personnel) and lack of socioeconomic opportunities in coastal communities, I worked together with other conservationists to start a new social enterprise in the Netherlands in 2016: the Sea Ranger Service.

After two years of development work, we launched the Sea Ranger Service operationally in 2018. Ever since then, young people have been recruited and trained in coastal areas as Sea Rangers to work on MPA management tasks full-time, as a direct extension of government agencies, which contract the Sea Ranger Service for the capacity it offers. Just like park rangers on land, Sea Rangers are in fully paid employ-

ment and have a variety of tasks for MPA management, such as fisheries monitoring, seabed surveying, water quality sampling, ground-truthing of satellite data and, where possible, seagrass restoration.

Over the past five years, as our young company piloted its approach in the North Sea in close collaboration with the Dutch government, 16 government contracts were carried out by Sea Rangers, 13 of which were not previously contracted outside of government. This shows the unique need the Sea Rangers fulfill: supporting government agencies with impactful implementation of ocean conservation, climate and nature restoration policies. All the while, it builds a movement of young people who work professionally to care for the environment around them.

This approach also creates a tangible social impact as young participants, who join the program for one year, during which they obtain a commercial sailing endorsement, can subsequently transition into maritime industry jobs. The sector is in need of young talent, and Sea Rangers are ideally placed to bring renewed momentum and ideas into the industry.

The Sea Ranger Service approach is now set to scale to neighboring countries, with Sea Rangers already involved in seagrass restoration in France. In 2024, we will select and train Sea Rangers in the U.K. for the first time.

Going through a tough 10-day bootcamp selection, participants are tested on team work, personal development and physical conditioning. Those selected will undergo a year of additional training, working at sea, making lifelong friends and doing impactful work: helping to manage MPAs and monitor ocean health. No previous sailing experience or specific education is required. You can learn more at: searangers.org/bootcamp. **ST**

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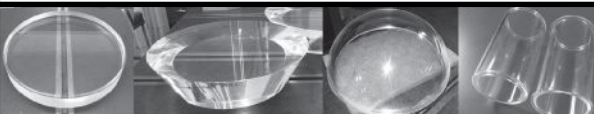
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