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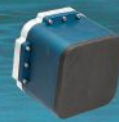
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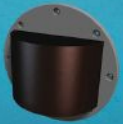
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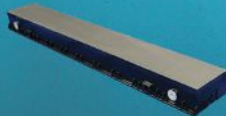
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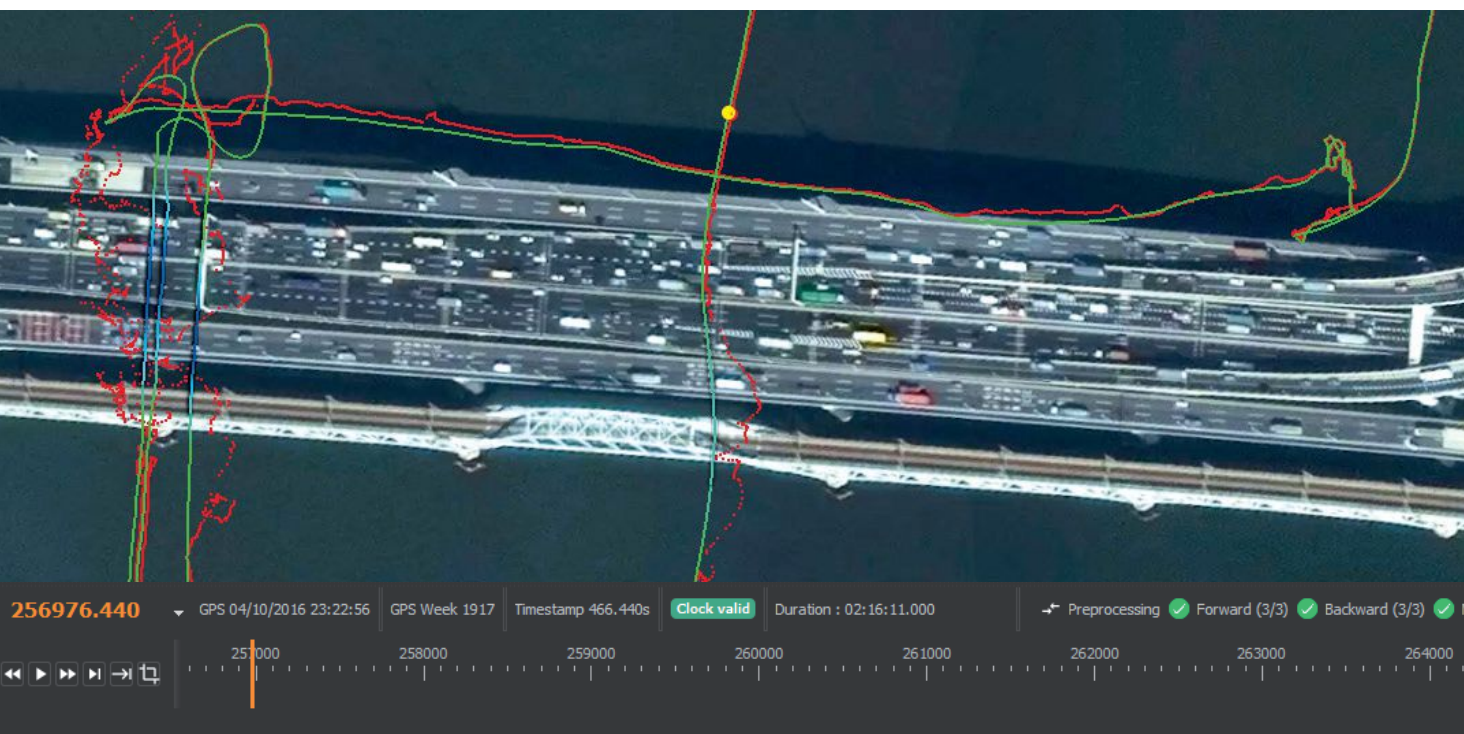
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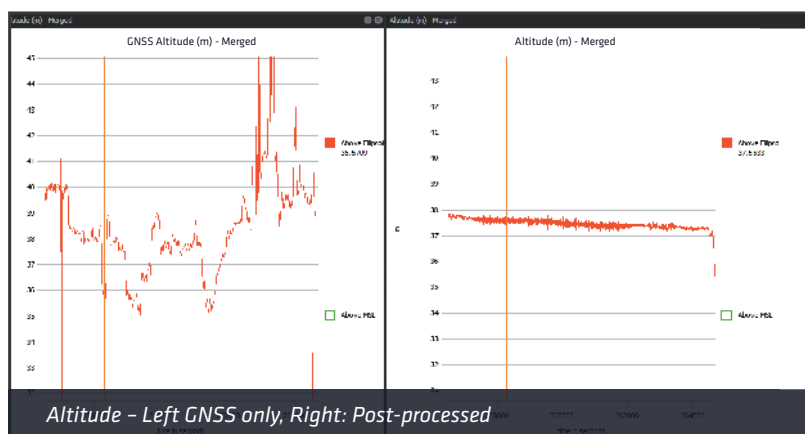
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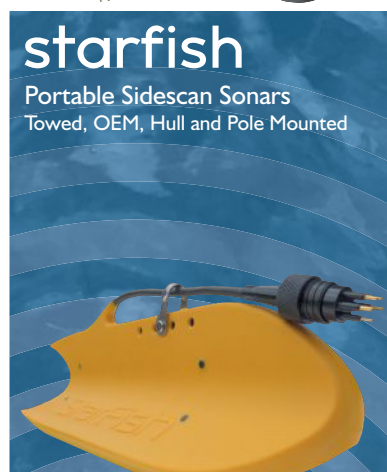
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Last spring, In-Situ Inc. demonstrated deployment of its global telemetry device, VuLink CI, for remote water-quality monitoring off the coast of Florida, near New Smyrna Beach. (Credit: Bill Sallaz, In-Situ Inc.)

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Electronic Charting/Vessel Management/

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MAY

Communications, Telemetry, Data Processing

**BlueTech Expo, June 3-4, Washington, DC

**CLEAN PACIFIC 2020, June 9-11, Seattle, WA

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SEPTEMBER

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**OCEANS 2020 Gulf Coast, October 19-22, Biloxi, MS

**CLEAN GULF 2020, October 20-22, San Antonio, TX

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

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Sulphur Cap Compliance Is Critical

With only a few months left to go until the implementation of the International Maritime Organization's (IMO) global 0.5 percent sulphur cap, there are concerns from shipowners and operators surrounding compliance; both from the perspective of the most appropriate solution to adopt and the operational implications of compliance once the regulation enters into force on January 1, 2020. There are many reasons why shipowners are reluctant to invest in existing compliance solutions—most of them relating to cost, return on investment and the risk to operational efficiency of the vessel. Making the right operational decisions is critical—and recognizing the extended benefits of having the correct monitoring tools and technologies on board outweighs the negative impacts. Unfortunately, when this process is mismanaged it can lead to serious consequences for the engine of the ship and ultimately affect companies' bottom lines.

Transitioning from a market with two main fuel grades—heavy fuel oil (HFO) and distillates—to a market that will see ultralow-sulphur fuel oil (ULSFO) and very-low-sulphur fuel oil (VLSFO) added to the mix is a significant challenge. Not to mention the adoption of LNG as a marine fuel, as well as new fuels such as hydrogen, methanol, ammonia and biofuel, which are likely to come onstream over the coming years. Within this context, there will be unintended consequences in terms of specification, compatibility and supply-chain management for the sector to overcome, specifically if companies are not investing in up-to-date technologies to deal with these issues.

An additional challenge is instability in fuel. If unrecognized and unchecked, results in the precipitation of asphaltenes, which can cause severe problems such as sludging of the fuel tanks, filter blockages and excessive sludging of the purifier, may lead, in the worst cases, to loss of propulsion and power. This can cause vessels to be stranded and potentially put the lives of crew members in immediate danger.

As the first line of defense for identifying and preventing issues with critical machinery and equipment, condition-monitoring tools and techniques have never been more valuable in helping operators manage and mitigate potentially costly issues. It is incredibly important that the industry is prepared for change and that sophisticated technology not only is ready for use but also represents a scalable solution. With onboard testing tools, shipowners and operators are empowered to proactively monitor the health of key machinery on board at any given time. Furthermore, condition-based monitoring helps ease the load on the crew by reducing the skills needed to do a job through the use of technology and sensors.

The industry as a whole is taking an interest in maintenance strategy, but there are still shipowners and operators that are not taking the necessary steps to ensure a smooth transition to the IMO's new sulphur-cap regulation of 2020.

With the clock ticking down to January 1, owners must look at the impact of managing their operations in an increasingly complex marine energy supply chain, as well as the consequences of getting it wrong.

Marine engines are valuable assets, but they are also vulnerable. The implications of mismanagement are severe—and it only takes one contamination incident to throw off the equilibrium of an entire ship. **ST**

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)) Newest Iteration of 'Boaty McBoatface' Completes Loch Ness Trials. The U.K. National Oceanography Centre's latest Autosub Long Range (ALR) vehicles, derived from the "Boaty McBoatface" AUV, have completed their first round of commissioning trials in the waters of Loch Ness, Scotland. The new AUVs, ALR1500, named for the 1,500-m depth to which they can dive, carried out a range of test missions of increasing complexity across three weeks this summer to test enhanced functionality, including terrain-aided navigation and environmental-profiling capabilities. Further trials are planned to demonstrate long-distance capabilities and integration with the new suite of sensors that are also being developed as part of the Oceanids program. ALR1500 is optimized for surveying the continental shelf and upper slope. Long-endurance missions could eventually cover hundreds to thousands of kilometers over several weeks to months at a time, including Arctic under-ice missions.

)) First DNV GL Certificate for Maritime 3D Printer. The shipping industry is looking to take advantage of additive manufacturing (AM), or 3D printing, to print spare parts, thereby reducing lead times, costs, stock requirements and environmental impacts. Certification ensures that AM-part users can have the same confidence in an additive-manufactured product as a conventionally produced one. The thyssenkrupp TechCenter Additive Manufacturing is the world's first producer of 3D-printed parts for maritime applications to obtain manufacturer approval from DNV GL. This means that thyssenkrupp TechCenter Additive Manufacturing is a DNV GL-approved supplier for maritime and general industrial applications. thyssenkrupp Marine Systems is working closely with international customers to integrate additive-manufactured parts on ships and submarines.

)) Maritime Start-Ups Have Critical Role. New and original research into maritime start-ups conducted for Inmarsat by U.K. GovTech venture firm and research house PUBLIC concludes that more bandwidth connecting ships to shore at lower cost than ever before is empowering a new breed of single-minded innovators to bring the benefits of digitalization to the shipping and offshore sectors. The report, Trade 2.0: How start-ups are driving the next generation of maritime trade, co-authored by Nick Chubb and Leonardo Zangrando, locates the maritime sector at an inflection point; open to big data, blockchain, artificial intelligence (AI) and cloud computing, at a time when emissions regulations are pushing it away from the fossil fuels that have framed its business model. Estimating that the ship technology market is worth \$106 billion as a whole today, the report predicts its value rising to \$278 billion by 2030. The projection is based on direct input from 100 start-ups and two years of tracking 240 active start-ups by the authors' database of maritime innovation. The report is available to download at www2.inmarsat.com/trade-2.0.

)) Start-Ups Chosen for Annual Techstars Energy Accelerator. Ten start-up companies have been selected from hundreds of applicants across 42 countries to be part of the Techstars Energy Accelerator (techstars.equinor.com). Through an intensive 13-week program, they will seek to accelerate their solutions by tapping into a global network of experts from Equinor and Techstars, as well as the partnering companies Kongsberg and Capgemini. The start-ups, representing solutions within oil and gas, renewables, new business models and digitalization, are: Fieldmade, Fuelsave, GamY, Navarra Tech, RagnaRock Geo, Salient Energy, SeeO2 Energy, Tempus, Terrapin and VesselAdmin. The accelerator is hosted at Equinor's Oslo offices. The start-ups arrived in September. At the end of the program, in December, they will present their solutions to Equinor, the partners and other potential investors. The Techstars Energy Accelerator selects 10 start-ups every year. Accepted companies receive up to \$120,000. The start-ups aim to compress two years of work into 13 weeks. Eight out of 10 companies from the Techstars Energy class of 2018 have signed deals with corporate partners.

)) Submerged Boat Building Site Discovery Dates Back to Stone Age. The Maritime Archaeological Trust has discovered a new 8,000-year-old structure next to what is believed to be the oldest boat-building site in the world on the Isle of Wight. This new discovery is particularly important as the wooden platform is part of a site that doubles the amount of worked wood found in the U.K. from a period that lasted 5,500 years. The site lies east of Yarmouth, and the platform is the most intact, wooden Middle Stone Age structure ever found in the U.K. The site is now 11 m below sea level, but during the period of human activity on the site, it was dry land with lush vegetation. It was at a time before the North Sea was fully formed and the Isle of Wight was still connected to mainland Europe. The site was first discovered in 2005 and contains an arrangement of trimmed timbers that could be platforms, walkways or collapsed structures. These were difficult to interpret until the Maritime Archaeological Trust used state-of-the-art photogrammetry techniques to record the remains, which make up a cohesive platform consisting of split timbers several layers thick, resting on horizontally laid round-wood foundations. This material, coupled with advanced woodworking skills and finely crafted tools, suggests a European, Neolithic (New Stone Age) influence. As the Solent evolves, sections of the ancient land surface are being eroded by up to half a meter per year, and the archaeological evidence is disappearing. The Maritime Archaeological Trust is working with the U.K. National Oceanography Centre to record, study, reconstruct and display the collection of timbers. **ST**

Phytoplankton Bloom Observation

Landsat 8 Satellite Images Depict Algal Bloom in Turkey

By Dr. Asli Sabuncu • Dr. Haluk Ozener

In the last three decades, researchers have investigated how remote sensing can be used to predict and monitor sudden algal blooms that occur in lakes, seas and oceans. For aquatic environmental studies, collecting water samples through ships is usually at high cost, and the data are limited in time and space. In contrast, remote sensing can offer a synoptic view of large areas uniformly in time and space at varying resolutions, regardless of national boundaries.

In the early 1970s, a new awareness evolved concerning environmental issues, and the U.S. Geological Survey Landsat program was born. Landsat satellites have steadily acquired images of the Earth's land surface and provided valuable data for land-use/land-change research. These satellites have specific equipment to detect electromagnetic wavelengths, which are organized into spectral bands. Each band corresponds with reflectance values. These reflectance values give information on Earth's surface and its features.

In a balanced ecosystem, plankton are responsible for half the air we breathe and are critical to the marine food web as food for a wide range of sea creatures, including whales, fish, snails and jellyfish. When too many nutrients are available, plankton may grow out of control and generate harmful algal blooms (HABs). These events can produce extremely toxic compounds that have harmful effects on fish, mammals, birds and even people. Every day, in the ocean, oxygen-producing plankton, called phytoplankton, perform nearly half of the photosynthesis on Earth.

Typically, a phytoplankton bloom occurs in early spring in the Black Sea. In 2017, the annual bloom unexpectedly lasted more than a month. That year, the dust from the Saharan Desert was rich in nitrogen, iron

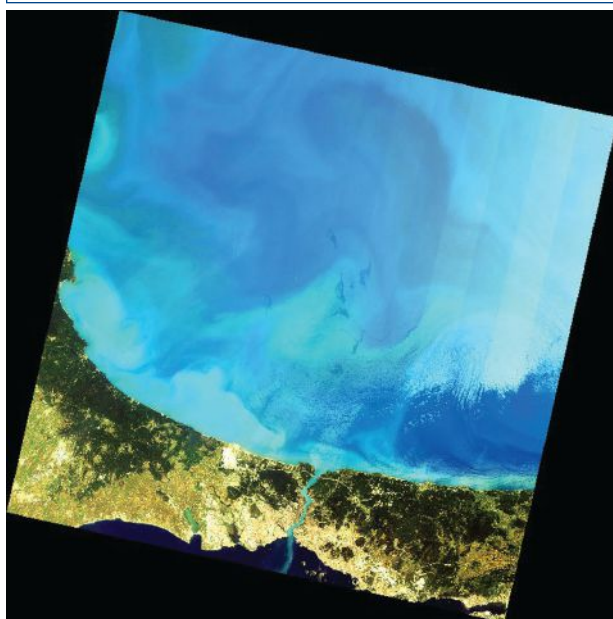
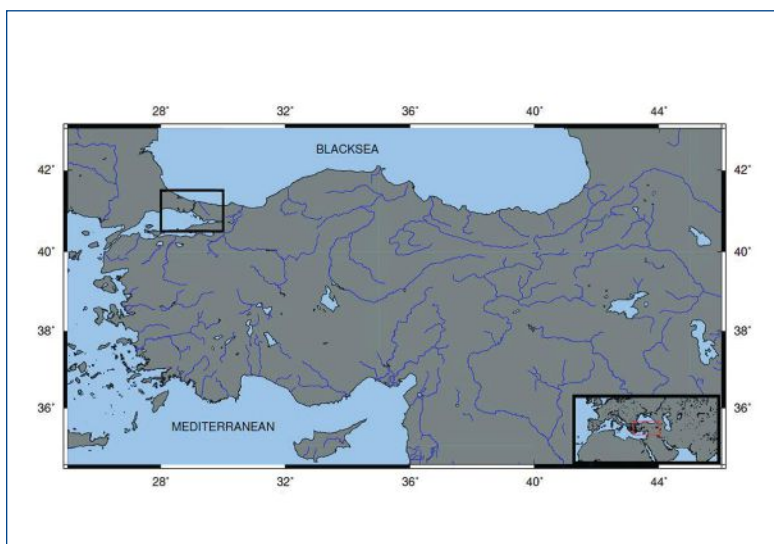


The Bosphorous Strait in Istanbul before and after the phytoplankton bloom in 2017.

and phosphorous. These particles and minerals acted as fertilizers, which were responsible for the production of plankton. Dust storms in the Sahara triggered a phytoplankton bloom in the western part of the Black Sea, turning the Bosphorous Strait into a swirling turquoise of excess nutrients between June and July 2017.

2017 Imagery

We concentrated our study of the bloom in the northern part of Turkey, specifically in the Bosphorous Strait and the western part of the Black Sea. Each satellite image covers 31,450 km², which is approximately 170 km North-South by 183 km East-West. The coordinates of the study area are: upper left 42° 48'54.54" N, 28° 15'57.42" E; upper right 42° 24'02.05" N, 30° 31'20.12" E; lower



(Top) The study area. (Bottom) Landsat 8 OLI image with bands four, three and one as RGB bands on June 23, 2017, showing that the phytoplankton bloom had entered the Bosphorous and continued to the Marmara Sea.

lite images are dated May 22, June 9, June 23, July 9 and July 23, 2017.

All the Landsat 8 OLI satellite images were downloaded from the U.S. Geological Survey website, usgs.gov. Landsat 8 images have a spatial resolution of 30 m for bands one to seven and band nine. The resolution of band eight (panchromatic) is 15 m. Band one and band nine are both new; the former is also known as ultrablue and is useful for coastal and aerosol studies, while the latter is applicable for cirrus-cloud detection. Thermal bands 10 and 11 provide more accurate surface temperatures and are collected at 100-m resolution.

As just one example of the images we examined, on June 23, 2017, the OLI on Landsat 8 captured a false-color view of what appears to be a large bloom of phytoplankton swirling in a large part of the western Black Sea and Bosphorous Strait. The image is composed as RGB bands from bands four (636 to 673 nanometers), three (533 to 590 nanometers) and one (435 to 451 nanometers).

Methodology

Land-use/land-cover (LULC) studies have been based on satellite data via remote sensing since the dawn of the Landsat program. Remote sensing is used to classify the satellite images and determine changes to areas under study. The accuracy of the thematic maps obtained by the classification of satellite images is extremely important for scientific research. Therefore, the strength of the classification method to be used in conjunction with the data set has a considerable impact on research results.

The Support Vector Machine (SVM) statistical-learning theory is a nonparametric classification method that is also a promising machine-learning methodology. Numerous studies have been carried out on the use of SVM in the field of remote sensing, and we used SVM in our study of the 2017 phytoplankton bloom.

Our first step was to rely on an unsupervised classification method, then apply an ISODATA algorithm to the data, which enabled some classes to be distinguished and easily detected. In the next step, SVM nonparametric classification was applied to all data. The classification process comprises five main classes: sea/lake, urban, bloom, vegetation/forest and cloud. The five Landsat 8 OLI images we examined were classified individually.

Results

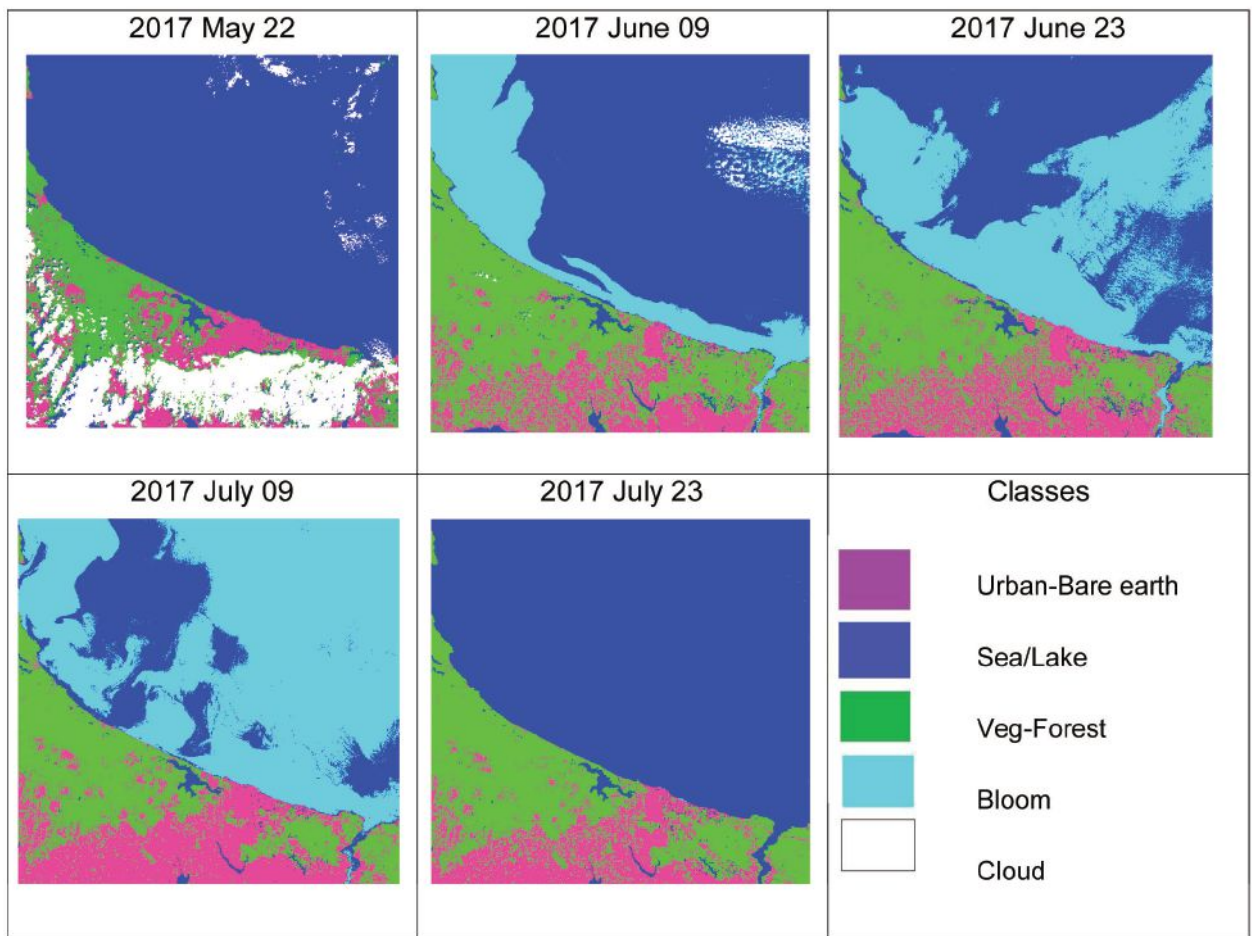
The phytoplankton bloom images were generated using SVM for five consecutive Landsat 8 OLI images dated May 22, June 9, June 23, July 9 and July 23, 2017 over the western part of the Black Sea and the northern part of the Bosphorous Strait. We identified the bloom period between June 9 and July 23 using different density and phases for the selected area.

In the May 22 image, there was no evidence related to the bloom. In the June 9 image, there was evidence that the bloom had started in the western Black Sea and had

left 41° 05'59.99" N, 27° 43'49.87" E; and lower right 40° 41'19.49" N, 29° 55'35.03" E.

Several satellite platforms (MODIS, Sentinel 2, Landsat 7, Landsat 8) have captured images of the 2017 phytoplankton bloom starting in the western Black Sea and crossing into the Bosphorous Strait. We chose Landsat 8 satellite images for our study instead of data from other satellites due to their spatial resolution. Landsat 8 also has what we consider to be the best temporal resolution. In addition, Landsat 8 images have a special band to capture algal blooms.

We looked at five Landsat 8 Operational Land Imager (OLI) satellite images to observe the phytoplankton bloom that occurred in a large part of the Black Sea and then spread to the Marmara Sea via currents. The satel-



SVM classification results of the phytoplankton bloom imagery.

spread to the Bosphorous Strait. In the June 23 image, the phytoplankton bloom had entered the Bosphorous and continued to the Marmara Sea. The heaviest bloom was observed in the fourth satellite image, July 9. The last image, July 23, shows the plankton bloom was finished.

Conclusion

Phytoplankton are a single-cell, floating algae responsible for producing food for themselves and most other sea animals via photosynthesis. In general, they support marine life. However, large phytoplankton blooms can bring about eutrophication and suffocate marine life. They play a tremendous role in local and global climate because they can remove carbon from the atmosphere and store it deep in the ocean when they die and fall to the seafloor.

The blooms can form quickly, making it difficult to evaluate their development and extent using traditional sampling methods such as in-situ data or a fixed-site monitoring station. In this context, remote sensing has an advantage, including obtaining relevant satellite data at no cost using online databases such as the resources at usgs.gov.

Various scientific studies have been performed in the last three decades using satellite imagery to observe and monitor water quality. Owing to the benefits of repetitive data acquisition, synoptic view, low cost and fast-re-

sponse possibilities, satellite images have become a key source of remote-sensing approaches in environmental studies.

Combining satellite imagery with SVM nonparametric classification has proven useful in understanding phytoplankton blooms in inland waters, seas and oceans. We recommend annual monitoring of blooms via satellite imagery to expand knowledge of the phenomenon.

Acknowledgments

The authors are grateful to the U.S. Geological Survey for providing Landsat 8 OLI data free of charge.

References

For a list of references, contact Dr. Asli Sabuncu at asli.turgutalp@boun.edu.tr. **ST**

Dr. Asli Sabuncu received her master's degree in geodesy from Bogazici University KOERI in 2010 and her Ph.D. in geomatics engineering at Istanbul Technical University in 2018. Her research interests are in remote sensing, GPS, precise-leveling applications and crustal deformations. She works at KOERI as a post-doc researcher.

Dr. Haluk Ozener graduated from Istanbul Technical University with a bachelor's in civil engineering, geodesy and photogrammetry in 1988, and he received his M.S. in 1992 and Ph.D. in 2000 in geodesy from Bogazici University. He is the director of KOERI and has been head of the Bogazici University's Geodesy Department since 2010.

An In-Situ Look at Jellyfish

Visualization Device Uses Bioluminescence to Gather Data at Depth

By Xi Zhang • Junshao Zhang • Junyi Yang

The outbreak of gelatinous zooplankton, particularly jellyfish, can cause economic and ecological trouble for the affected areas. Outbreaks can affect fish growth and development, reducing fisheries production. Cooling systems in coastal factories can be blocked by these outbreaks, which affect the operation of coastal power plants, chemical plants, etc.

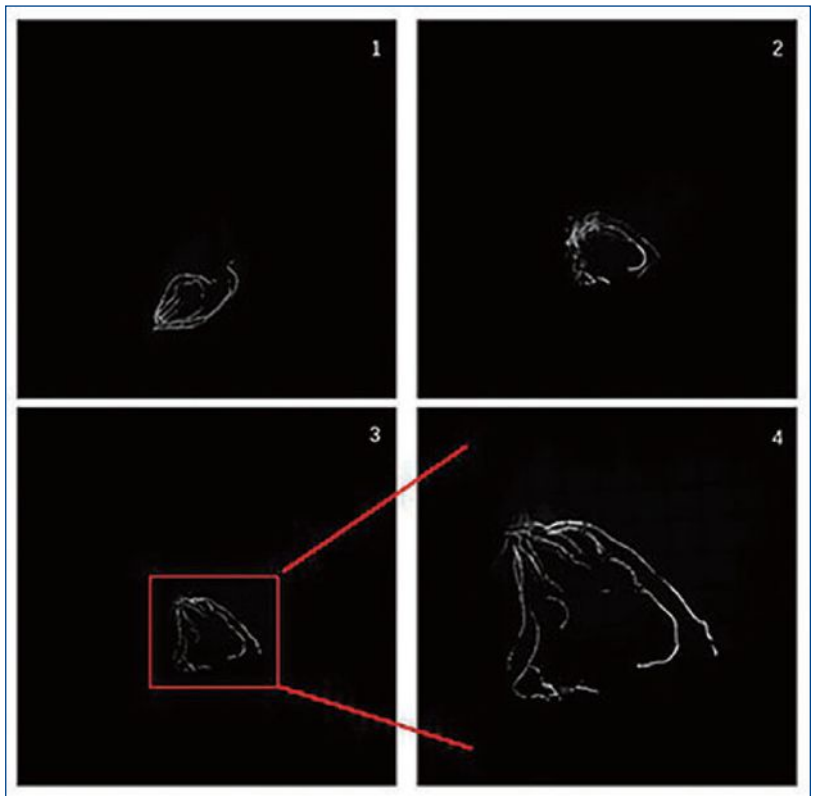
Gelatinous zooplankton also serve as vehicles for material transport between the upper and lower oceans and are a key part of the carbon pump. Therefore, the study of gelatinous zooplankton aids understanding of the global carbon cycle and global warming.

The Visual Intelligence System laboratory (VISLAB) at Shanghai University has developed an in-situ observation system for gelatinous zooplankton based on bioluminescence. It collects biological images with a camera and determines the number, shape and size of gelatinous zooplankton using an algorithm.

Survey Methods

Surveying gelatinous zooplankton entails gathering clear biological images and data on number, depth and biomass of organisms. Biomass information is the most difficult to obtain and is usually estimated via body length, surface area and other morphological features.

Current survey methods include trawl-based, acoustic and optical investigation. Trawl-based surveys mean researchers use trawls to catch gelatinous zooplankton and study the samples using instruments in the laboratory. However, gelatinous zooplankton are prone to rupture and deformation when taken out of their natural environ-



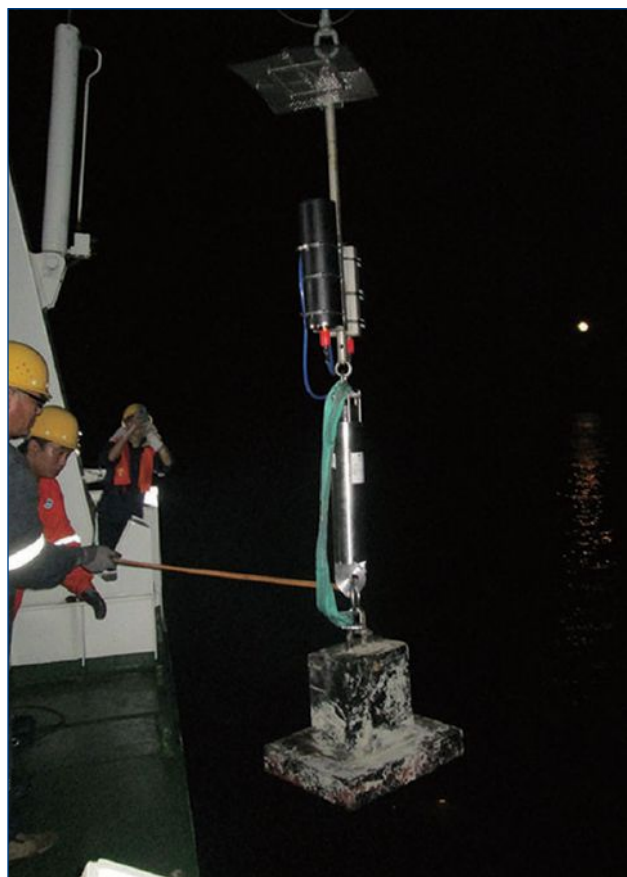
VISLAB's device captured images of a bioluminescent jellyfish around 100 m deep in the South China Sea.

ment. As a result, it is difficult for researchers to accurately measure size or amount from a sample.

Acoustic observation can determine the number of gelatinous zooplankton accurately but cannot determine size information due to low resolution.

Optical observation methods can be divided into observation based on auxiliary light and observation based on biological light (bioluminescence). Most gelatinous

(Left) The in-situ observation equipment being launched for testing at sea. (Right) The device upon ascent during at-sea testing.



zooplankton contain more than 95 percent water, making their bodies highly transparent, so it is difficult to distinguish gelatinous zooplankton from water when illuminated by an auxiliary light.

In principle, the observation method based on bioluminescence is most suitable compared with other observation methods. However, typical observation systems in China based on bioluminescence are unable to obtain clear images or morphological parameters.

System Design

Incorporating sCMOS camera technology, VISLAB has developed an improved gelatinous zooplankton observation system based on bioluminescence. The system is depth rated to 4,000 m.

Gelatinous zooplankton usually produce a bioluminescent response when they touch other objects as they move. In the deep sea, VISLAB's device collects images of bioluminescence via a low-light-level (LLL) camera, and the photos are processed by an algorithm to extract relevant information.

The device comprises four parts: the control cabin, battery cabin, mesh screen and fixed bracket. The function of the control cabin is to collect, store and analyze images, and it houses the LLL camera, lens, embedded mainboard and cooling device. The front end of the control cabin has an optical window for the camera. The window is made of sapphire material, and the cabin body is made of titanium alloy.

The deep-sea environment requires using a high-sensitivity and low-noise LLL camera. The chosen LLL cam-

era model is pco.edge 4.2, with a maximum quantum efficiency of 82 percent. It uses 24-V DC power supply, with maximum power consumption of 20 W. The camera has 4 million pixels, with a resolution of 2,048 by 2,048. The temperature of the camera's light-sensitive chips stays steady at 0° C by water cooling. The coolant in the pump transfers heat through the end-cap to the seawater. A16-mm-focal-length lens is used. The mainboard and camera are connected through a USB 3.0 interface for data exchange. A 1-TB mSATA solid-state drive stores the data.

The mesh screen is fixed directly in front of the control cabin as the system's triggering device. The LLL camera can observe the bioluminescence of gelatinous zooplankton caused by impact with the mesh screen. The mesh is 0.3 by 0.3 by 0.09 m, and it lies 0.35 m in front of the camera. At this distance, the field of view of the camera in water is 0.18 by 0.18 m.

The battery compartment holds a Panasonic lithium battery, which can output 24 V and 2 A of stable current. Considering the power supply of the mainboard, a step-down module converts 24-V input voltage into a stable 12-V output voltage. Pressure sensors fixed to the battery-bay cover enable the system to detect water depth.

The battery cabin and control cabin are connected by 13 core watertight connectors, which contain 12- and 24-V power supply lines, network lines and serial port lines. The power cord is used to power the mainboard, camera and cooling pump. The ethernet cable is used for data transmission between the embedded computer in the device and the user's computer. The serial port line

is used for communication between the pressure sensor and the mainboard.

Depending on the dive mode, different fixtures can be used to assemble the control cabin, battery compartment and mesh screen. The equipment can be attached to cables, an ROV, lander or other platforms.

Process

When the device enters the ocean, the camera begins to collect images. The system will only store images depicting bioluminescence. The device collects and processes images the entire time it is in the water column.

The purpose of image processing is to count the number of gelatinous zooplankton, record their depth and measure their morphological size.

The first step of the algorithm is to judge whether an image contains bioluminescent organisms. This process uses the grayscale of imaging. An image containing bioluminescence is filtered and denoised to improve the image quality.

The next step is to determine whether the bioluminescent organism is gelatinous zooplankton. The gelatinous zooplankton under study in China are generally umbrella shaped and have multiple tentacles. According to their distinct features, several parameters can be set for identification. In order to accurately count the creatures, our algorithm determines whether the creatures in adjacent pictures are the same creatures. Without this treatment, the number of organisms obtained by the experiment

may be much higher than the actual value. Finally, multiple pictures of the same creature are integrated to gather morphological-size data. Users can also view enhanced bioluminescent images through software on their computer.

Testing

In order to prove system performance, the equipment was first tested in the laboratory. The device was put into a large water tank and taken out 3 hr. later. The device demonstrated that it can take photos and process pictures underwater in the lab test tank.

We then tested the equipment in July 2018 in the South China Sea (22° 02' N, 118° 40' E). The experiment was conducted at night so that sunlight would not interfere with device operation. The equipment was attached to a cable, and the operator used a winch to control the equipment's descent and ascent. After reaching a depth of about 800 m, the device started to ascend. When the device surfaced, an operator checked the test data through software on the surface computer. This check revealed that the equipment is able to take images of bioluminescent gelatinous zooplankton and extract valuable information.

For example, the device captured a set of bioluminescent images of a creature at a depth of about 100 m. The algorithm determined that the creature in the images is a single gelatinous zooplankton. The researchers made the same judgment by examining the visual evidence.

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“The purpose of image processing is to count the number of gelatinous zooplankton, record their depth and measure their morphological size.”

Conclusion

VISLAB's in-situ observation system for gelatinous zooplankton has proven that it can acquire clear images and obtain accurate morphological information at depth. Users can easily operate the equipment due to its high degree of automation.

The device can monitor jellyfish populations to manage the effects of jellyfish outbreaks, and marine biologists can use the equipment to study the causes of outbreaks. In addition, scientists can use the device to study the carbon cycle in the ocean, which could help further understanding of global warming.

Future work will focus on pairing the morphological data obtained by the device with the biomass estimation method for more accurate biomass data.

Acknowledgments

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Xi Zhang is an associate professor at Shanghai University, with experience in developing visual-inspection equipment. His recent focus is on the application of such equipment in the ocean.

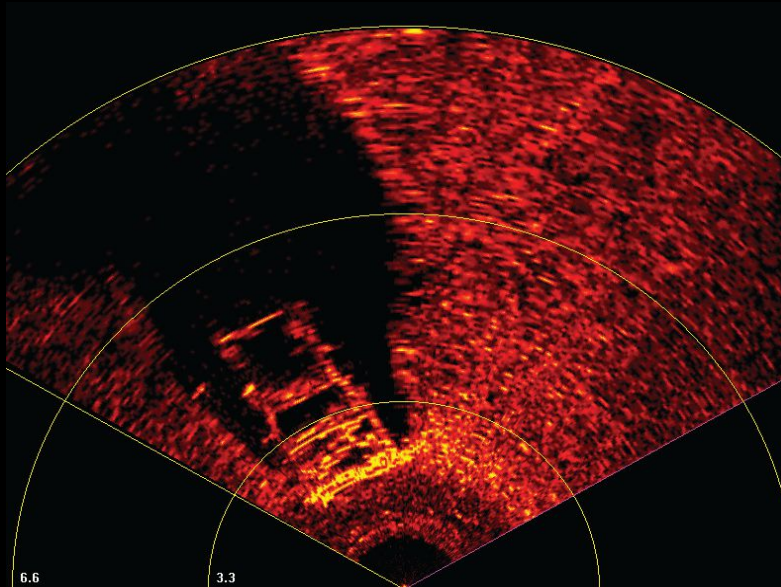
Junshao Zhang is a graduate student at Shanghai University, specializing in visual-inspection equipment and algorithms. Since 2017, he has been working on in-situ observation equipment for deep-sea creatures under the support of the National Key Research and Development Program of China.

Junyi Yang is a professor at Hangzhou Dianzi University. He has long been engaged in the development and application of equipment for deep-sea scientific research and has participated in many deep-sea scientific expeditions.



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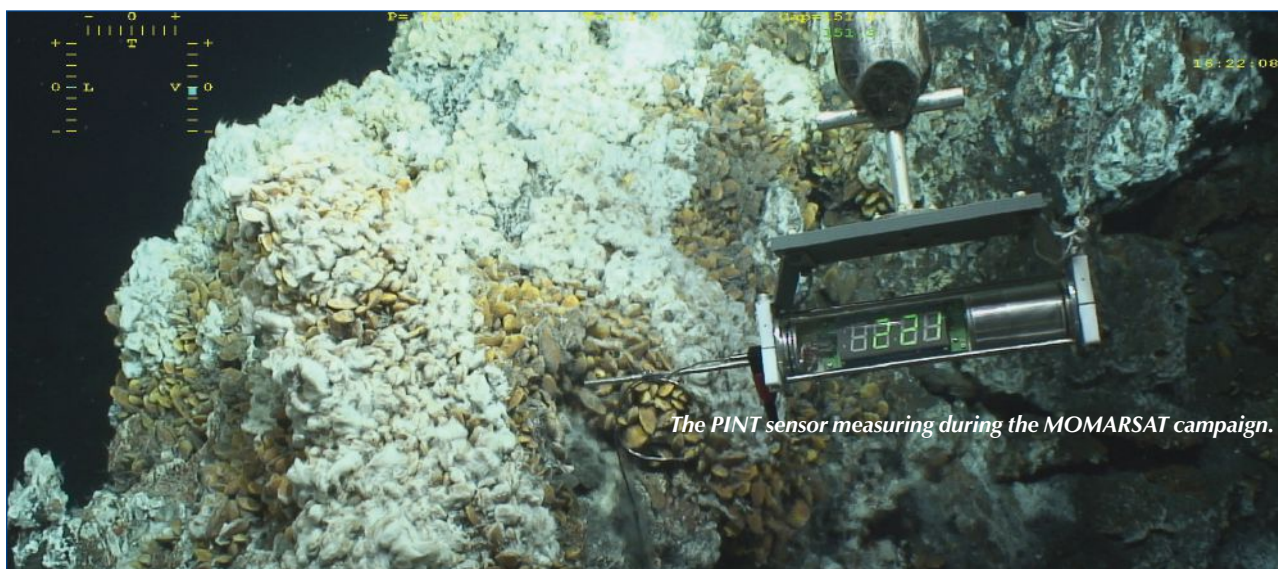
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Deep-Sea Temperature Sensor

In-Situ Readings from ROV

By Jean-Romain Lagadec • Sébastien Prigent • Jean-Pierre Lafontaine



The PINT sensor measuring during the MOMARSAT campaign.

One of the most recurrent questions that scientists from the French Institute for Exploration of the Sea (Ifremer) ask is: When sampling fluids from deep-sea hydrothermal sources, how can they be sure of obtaining an accurate fluid-temperature reading at the cannula's end when the sampler is triggered?

Currently, there are temperature probes directly connected to an ROV, but to position them correctly, they must be clamped onto the cannula. This works if the sampler is left in the ROV arm throughout the dive. However, if numerous samplings are programmed, each sampler will have to be stored incrementally.

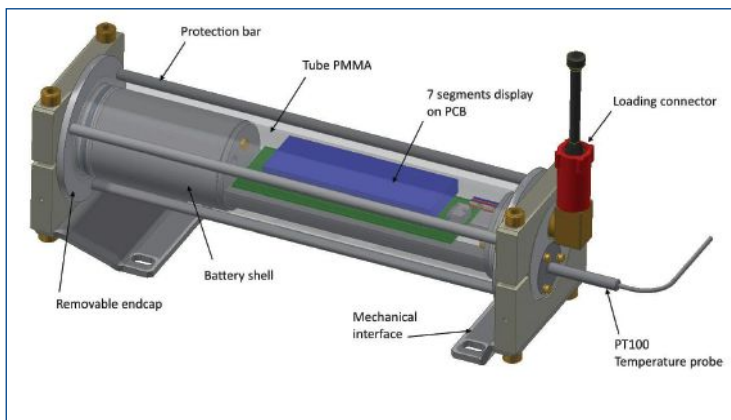
It is possible to unplug the filled sampler cable from the ROV and to connect another one. But this makes the handling complicated and requires a costly wet-mate connector. A solution could be the use of an optical or infrared connection. However, when the water is turbid or if the cannula is in the hydrothermal source, communication could be lost.

Until now, the common technique consists of pinpointing the targeted temperature area in the plume with the ROV's probe, estimating its situation, exchanging the probe for the sampler and positioning its cannula at the targeted location to take the sample. Unfortunately, as the plume moves and the temperature gradient changes quickly, it is hard to be sure to sample accurately.

To address these issues, the Ifremer R&D department has worked to design a system that meets user requirements.

In order to be able to fill several samplers in the course of a single dive, the R&D team decided to associate a temperature sensor with each sampler. As the precision and reactivity of the PT100 probe currently used on Ifremer's subsea vectors (HOV Nautilie, ROV Victor 6000, HROV Ariane) have been proven, it was decided to adopt the PT100.

The main parts of adopting this sensor to the sampler concerned the probe's signal processing and the trans-



with two cylindrical endcaps. The screen must be visible from the outside, so the tube must be transparent.

The use of glass, which has good mechanical characteristics, was not an option because it is not safe to use in a manned submersible. In case of rupture, fragmented glass could cause damage to the vehicle and personnel.

Instead of glass, we used an equivalent transparent plastic tube that requires a far thicker wall because of the poor mechanical resistance of plastic.

To stabilize the pressure, it is possible to fill the tube with dielectric oil, which still allows the electronics to function normally even under high hydrostatic pressure. This solution, while appealing, needs an additional membrane to balance the variation of the volume of oil, depending on temperature and pressure. This membrane requires space, which is not compatible with the equipment compactness specifications. Moreover, the batteries produce heat that could modify the volume of oil.

We opted to fill the tube with a transparent epoxy resin. However, overmolded batteries, which could dilate, are impossible to replace in case of failure.

Therefore, the design team chose the solution to overmold one side of a transparent PMMA (polymethyl methacrylate) tube, including the endcap, the acquisition system and the screen, and to position the batteries inside a

pressure-resistant cylindrical aluminum shell, placed inside the nonmolded side of the tube. This side is closed off by a removable endcap, allowing access for battery replacement.

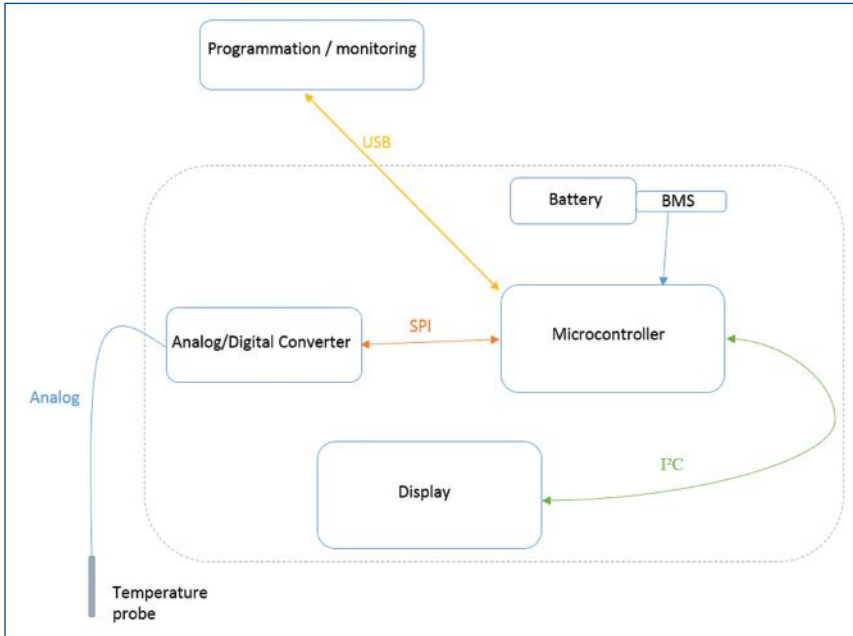
The whole sensor is compact and protected by three rods, which close off the endcaps.

Electronics

The electronic architecture is built around the temperature sensor, which is the sensitive part. A PT100 RTD (resistivity temperature detector) made of platinum was chosen thanks to its large temperature range, high precision and linear characteristic curve.

An amplifier coupled to a PT100 is essential to step up the signal from the temperature probe. The ADC MAX31865 was chosen as the best amplifier to automatically adjust and compensate for the resistance of the connective wires.

A compact microcontroller chip was used to provide the embedded intelligence of the system. The advantage of the Arduino Nano deck is the numerous libraries and open-source drivers available, built around a reliable microcontroller. The real-time signal is displayed on an Adafruit four-digit, seven-segment display. It can com-



(Top) Mechanical architecture of PINT (width 100 mm, length 370 mm). (Bottom) PINT's electronic architecture.

mission of the temperature signal to the user. For the communication between the sensor and the user, the R&D team chose a real-time display protected by a transparent tubular housing, with the temperature displayed directly on a screen fixed to the sampler, showing the temperature at the end of the probe, which corresponds to the tip of the cannula.

In order to display the information even in poor-visibility zones, the screen is wide (12 by 4 cm) and separated from the probe via an 800-mm flexible stainless-steel sleeve. This enables the display to be read through the Nautilé porthole, or by using an ROV camera.

Housing

As the system could be deployed up to a maximum depth of 6,000 m, the hydrostatic pressure forces must be evenly distributed. This is why the electronic board and the display are mounted within a tube, closed off

municate with the microcontroller via an I²C bus. The controller chip controls the multiplexing of all LEDs. The design team chose a green-light display for better visibility in the deep sea.

To preserve compactness, the functional blocks are welded onto a circuit board interface, integrating a power-surge conditioner and inverter protector.

Sampler equipment is generally designed to work on ROVs or HOVs between 12 and 72 hr. The energy pack must present an excellent weight-footprint-power ratio. This is indeed the case with lithium-ion technology. The Panasonic battery additionally offers a smart driver, preventing deep discharges.

Certification, Tests

In order to meet Ifremer's quality requirements and to validate the sensor's pressure resistance before its first deployment, the sensor underwent a certification test in a hyperbaric chamber.

This certification corresponds to the NF X10-812 standard and is composed of an 8-hr.-proof pressure test (750 bars at 4° C), then 10 cycles from 1 bar to service pressure (625 bars, in this case).

The PINT sensor passed the certification tests and has been deployed twice; the first time in a stand-alone operational mode during an oceanographic campaign in the Atlantic Ocean on hydrothermal sources at 1,700 m deep in June 2018. During this campaign, the Victor 6000 ROV positioned PINT at several locations in and out of the hydrothermal plume, validating the sensor and display reactivity in a quick temperature gradient.

In the second campaign, PINT was associated with the sampler IBIS (IsoBaric Isothermal fluid Sampler) during a test mission in the Mediterranean Sea in February 2019 with the HOV Nautille at 2,500-m depth.

Conclusion

The updated PINT is now ready for field service. One PINT was used in the MOMARSAT campaign in July 2019, and another PINT will be deployed in a separate campaign by the end of this year. These deployments will promote the precision of sampling by stand-alone equipment.

An upgrade of the PINT is scheduled for 2020 in order to miniaturize and add on a data logger.

Acknowledgments

This development was carried out by Ifremer's engineering and marine instrumentation service (SIIM), in collaboration with scientists of the Deep Environment Laboratory (LEP) and the Submarine Systems Unit (SM) and with the support of the GENAVIR team operating the HOV Nautille and the ROV Victor 6000.

The project was financed by the Institut Carnot Ifremer-EDROME and the French National Research Agency (ANR), within the framework of the DEEPECOS 2015 Carnot project.

References

For a list of references or additional information, con-

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Jean-Romain Lagadec is a mechanical engineer at Ifremer's engineering and marine instrumentation service. He is responsible for the PINT mechanical design in the DEEPECOS project and has also developed two deep-sea sampling systems for fluids and fauna. His is involved in various seafloor observatory projects.



Sébastien Prigent is an electronics engineer at Ifremer's engineering and marine instrumentation service. He is in charge of the PINT electronic architecture. His work includes developments for operational oceanography, in both coastal and seafloor fields.



Jean-Pierre Lafontaine is a development and assembly technician in the engineering and marine instrumentation team of Ifremer. He is a major contributor to the mechanical design phase of the DEEPECOS project, which includes the implementation, monitoring and assembly of PINT and an additional fauna sampler. His work also includes precision machining and oceanographic systems deployment.



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Coastal Wireless Monitoring

New System Collects, Transmits Environmental Data via 4G Network

By Liu Pei-Xue • Dong Li • Feng Fei

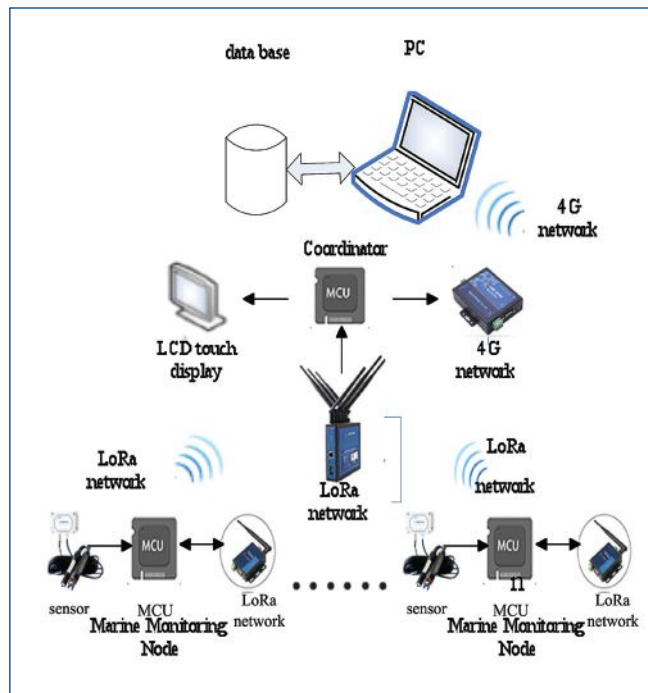
Monitoring of the coast is vital to maintaining a healthy marine environment and supporting industries such as marine aquaculture. Traditional coastal monitoring systems in China rely mainly on wired detection, with high equipment and maintenance costs.

There have been several attempts to develop a coastal wireless monitoring terminal in China. One version was based on Zigbee and intended to detect dissolved oxygen (DO), pH, ammonia-nitrogen and temperature in real time. The downsides of this wireless system were low measurement accuracy, static location and short communication range.

Another system was developed, suitable for only small and medium-scale projects, with a slow data-transmission rate.

Yet another system was developed to adopt GPRS technology for long-distance data transmission and large-scale monitoring for fisheries, but this system was made obsolete with the development of 4G network technology.

We have developed a new system based on linear prediction, with high data-transmission speed, long-distance communication, lower power consumption, high measurement accuracy and real-time data transmission. This system is suitable for applications such as general environmental monitoring and marine aquaculture.



A diagram of the wireless monitoring system.

System Components

The system comprises two parts: a terminal data-acquisition module and shore-based coordinator module. The terminal data-acquisition module is on a floating platform. It works in real time and uses a star-link network to form the terminal nodes into a LoRa network, through which the data are sent to the shore-based coordinator module. The shore-based coordinator includes a data display and 4G network transmission.

Upon receipt of data, the shore-based coordinator first fuses the data and makes a linear prediction via Kalman filtering that estimates the data values closest to the real values

based on previously obtained data and the most current data collected from the sensors. Then, it stores the data according to dissolved oxygen, temperature, pH and terminal-node designation. At the same time, it uploads the information to the cloud through the 4G network for users to see.

Data-Acquisition Module Design

The terminal data-acquisition module works at sea and needs a low-power design, so we used an MSP430F5529 ultralow-power MCU as the control chip. This MCU belongs to an ultralow-power signal processor developed by Texas Instruments (TI), which includes integrated

“We have developed a new system based on linear prediction, with high data-transmission speed, long-distance communication, lower power consumption, high measurement accuracy and real-time data transmission.”

USB and PHY supporting USB 2.0, four 16-bit timers, a high-performance 12-bit analog-to-digital converter (ADC), two universal serial communication interfaces (USCI), DMA module, real-time alarm function, clock module and 63 I/O pins. The DMA module can increase the data-transmission speed.

The LoRa module adopts the LG206-L-C module, a communication system that integrates a node module, gateway and cloud platform at low cost. It supports an ad-hoc network and can realize data transmission from end to cloud in one step, without needing a separate server. LG206-L-C supports the use of a nondormant environment, can carry out real-time transmission, and offers free choice of an RS232/485 serial-port-networking mode. LG206-L-C can accurately transmit different signals at different periods without interference. Users can receive accurate signals directly in vast outdoor areas. The maximum transmission distance is up to 2 km.

Among the wireless monitoring sensors is the ZZ-DPT-300 split DO+pH sensor, manufactured by Beijing Bohai Zhiyuan Technology Co. Ltd., that can simultaneously detect pH, DO and temperature. This split sensor has 0- to 5-V analog output, 4- to 20-mA analog current output and digital 485 communication output. It uses 12-V working voltage. The dissolved oxygen detection range is 0 to 20.00 mg/L; pH detection range is 0 to 14; and temperature detection range is 0 to 60° C. The resolution is 0.01 mg/L, 0.01 pH and 0.1° C.

Shore Coordinator Module Design

The shore-based coordinator comprises an STM32 controller and 4G, LoRa, display, clock and power modules. The STM32 is the control chip of the whole shore-based coordinator; the 4G module is responsible for remote communication; the LoRa module realizes one-step transmission from end to cloud; the LCD touch screen is used in the data display module; and the clock and power modules are used respectively to control timing and power supply.

The controller uses the ARM microcontroller STM32F103VGT6, which is a 32-bit processor with 1,024 KB program memory, 96 KB data memory, and an analog-to-digital converter. The 4G module uses USR-G780 V2 to support five-mode, 13-frequency, mobile, Unicom and 4G high-speed access for telecommunications. USR-G780 V2 software can realize two-way transparent data transmission from serial port to network through simple settings. This module has the characteristics of high speed, low latency and fast response and trans-

mission, and supports TCP client and server, UDP client and server, and serial AT instruction. The LoRa module uses USR-LG220-L and LG206-L-C of the data-acquisition-terminal module to form a network and realize wireless data transmission from end to cloud in one step.

The display module has an LCD touchscreen with 800-by-480 resolution and the capacity to support five touch points at the same time.

Data-Acquisition Software

The main process for the data-acquisition module is to initialize the control registers, establish the communication connection with the MCU by setting the working parameters of the sensors, and configure the working parameters of the LoRa wireless module data-transmission terminal to set up an ad-hoc network with the LoRa concentrator. The MCU then receives, converts and filters the sensor data, and then reports the data and processes the parameters. Numeric data are sent to the server.

In order to reduce the collision interference when users upload data and to improve the accuracy of data transmission, the data-reporting mode is divided into two types: regular reporting and early-warning reporting. Data-reporting time is set up for each node, as is the time to upload data by waking up the user equipment through the timing node. Early-warning reporting wakes up the LoRa node to report an alarm.

Shore-Coordinator Software

The shore-based coordinator is the bridge between the host computer and the LoRa LAN. It receives instructions from the host computer for corresponding operation, receives terminal data transmitted on the LoRa LAN, and performs filtering, display and upload processing.

Once the system is powered on, the modules are initialized and the loop detects whether the data sent by the wireless node are received correctly. If they are, it carries out linear prediction processing and temporary storage, and initiates an alarm when the parameters exceed the standard. The display interface shows real-time data and warning information.

If an interruption occurs, it can be divided into two cases. One is the interruption sent by the host computer, which requires the coordinator to execute the relevant instructions; the other is timing interruption. Without specific programming by users, the coordinator reports data to the host computer through the 4G network.

An adaptive Kalman filter is used for linear prediction to deduce and calculate sensor noise.

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“The system realizes multipoint, large-scale monitoring and wireless transmission.”

Deviation Test

We tested the wireless monitoring system in March 2019 2 km off Qingdao in Shandong Province, China, in level-three sea conditions. The system comprised six terminal data-acquisition nodes and a shore coordinator. We compared the data results with standard instrumentation, and the resulting pH error was about 0.02, the maximum temperature error was 0.3° C, and the maximum dissolved oxygen error was 0.4 mg/L. We are confident that errors can be corrected by software.

Conclusion

Based on 4G and LoRa ad-hoc network technology and a Kalman-filter algorithm, a remote monitoring system with linear predictability was designed for coastal use. The system realizes multipoint, large-scale monitoring and wireless transmission. The system can easily establish connections with other PC systems for general

environmental monitoring and marine aquaculture applications. Additional sensors, such as those for salinity and turbidity, can be added.

The system is currently deployed in aquaculture settings by companies such as Huipeng Marine Breeding Co. Ltd. in Qingdao.

References

For a list of references, contact Liu Pei-Xue at ytulpx@163.com. **ST**

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Feng Fei is a professor at Qingdao Huanghai University. Her research focuses on marine information acquisition and image processing.

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workshops are offered on Wednesday and Thursday, November 13 and 14. Each workshop will provide an opportunity for a technical exchange between the students, the instructor and other workshop participants.

Exhibit Hall

The exhibit hall is the hub of all attendee gatherings and networking events, hosting luncheons, receptions and the chance to meet with suppliers, manufacturing companies and more. It will feature more than 100 different opportunities to learn about practical and innovative solutions for the industrial water treatment industry from industry leaders.

Networking coffee breaks, luncheons and receptions are hosted throughout the exhibit hall, giving attendees plenty of opportunities to continue their learning experience in between technical sessions. These well-timed networking breaks also afford exhibitors an opportunity to attend technical sessions along with other attendees.

An outdoor exhibit and demonstration space will return in 2019 after a successful debut in 2018.

Technical Program

Conference attendees learn about new applications available in the industrial water and wastewater treatment industry through the conference's technical program, which includes 76 individual presentations, all of which are peer reviewed by a committee of industry experts prior to acceptance for presentation at the conference and to ensure no commercial aspect is evident.

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Workshops

In addition to the technical program, the IWC Continuing Education Workshop program is designed to provide practical information that includes a basic understanding of the topic, as well as detailed case studies. These workshops, each 4 hr. in length, are presented by experts in the field and are loaded with technical content, not sales information. Pre-conference workshops are offered on Sunday, November 10; post-conference

Highlights

The IWC keynote session is the official start to the 2019 conference on Monday, November 11. This year, Charles Fishman, author of "The Big Thirst," will make the keynote presentation. Fishman has stood at the bottom of a half-million-gallon sewage tank; sampled water directly from the springs in San Pellegrino, Italy, and Poland Spring, Maine; and carried water on his head for 3 km with a group of villagers in India.

Presentation of the annual IWC Awards is also scheduled.

The conference additionally offers the IWC Golf Outing on November 10; a special 80th Anniversary Celebration Dinner on November 11; and discounted hotel and Disney theme parks tickets.

To learn more, visit eswp.com/water, or check out the IWC app in the Google Play and App Store by searching "International Water Conference." **ST**

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Industry Group for IT in Shipping

KVH has joined the Smart Maritime Network (SMN) as one of the founding members of the initiative dedicated to supporting collaboration and standardization in the development of IT systems for the shipping sector. As a founding member, KVH will participate in Smart Maritime Council meetings with a select group of maritime technology developers, systems integrators and vessel operators to discuss issues relating to the compatibility, standardization and harmonization of the technology used in the modern shipping industry.

ComMar Reaches Half-Century Milestone

ComMar Sales LLC is celebrating its 50th anniversary. ComMar represents equipment and accessories manufacturers in the U.S. Northeast, Mid-Atlantic, Gulf Coast and Southeast.

Founded in Massachusetts by Bill Glaser in 1969 and now headquartered in Rhode Island, ComMar got its start representing technical marine electronics manufacturers from Maine to Virginia. When current partners Tim Conroy, Mark Mitchell and Norm MacLeod came on board in the 1980s, ComMar added marine hardware and safety lines and expanded its representation to the Southeast U.S. in the '90s, Caribbean islands in 2005 and Gulf Coast in 2008.

New FRC for US Coast Guard

Bollinger Shipyards has delivered the USCGC *Angela McShan*, the 35th fast response cutter (FRC), to the U.S. Coast Guard in Key West, Florida. The 154-ft. *Sentinel*-class FRC has a flank speed of 28 kt.; state-of-the-art command, control, communications and computer technology; and a stern launch system for the vessel's 26-ft. cutter boat.

Panama Canal Aids Cetacean Protection

From August 1 to November 30, 2019, the Panama Canal is promoting the implementation of the International Maritime Organization's (IMO) annual recommendations on speed and maritime transit aimed at protecting cetaceans, including whales, dolphins and other large aquatic mammals, during their nearby seasonal migration.

With these measures, ships should proceed at a speed of no more than 10 kt. in specified areas.

Mussel Watch Program Services

TDI-Brooks and B&B Laboratories have been awarded a five-year GSA contract for analytical chemistry services in support of NOAA, the National Ocean Service (NOS) and the National Centers for Coastal Ocean Science (NCCOS).

The project is a continuation and extension of three previous five-year projects for the NOAA NS&T Mussel Watch Program, recognized for its status and trends assessment of chemical contaminants measured in bivalve tissue (mussels and oysters) nationwide.

Moving Vessel Profiler to Map Seafloor

A newly acquired AML Moving Vessel Profiler (MVP) will help Nova Scotia Community College (NSCC) develop improved methods of mapping the seafloor. With its ability to conduct real-time, vertical profiles continuously and automatically, the MVP200 is expected to improve the efficiency and quality of data collection.

Looking to add ground-truthing to the process of multibeam data acquisition, AML and NSCC are working together to integrate lights and a high-resolution camera to the tow body that houses the underway profiling system's sound velocity, CTD or multiparameter instrumentation.

Partnership to Meet Compliance

Helm Operations and the ACTION group have signed a new partnership agreement to help inland marine companies address the challenges of SubM and implement new software to reduce the costs of compliance. As part of the agreement, the ACTION group will begin offering safety management services via Helm CONNECT and provide consulting and training to companies moving to the industry-standard platform.

SonarWiz Helps Spot Shipwrecks in North Sea

The HMS *St. George* shipwreck museum is responsible for the maritime archaeology of a large part of the Danish North Sea, including investigating and safeguarding underwater cultural heritage.

SonarWiz software by Chesapeake Technology recently helped the museum identify two potential archaeological objects on the seabed. They are now protected by a 100-m-radius safety zone to reduce risk of damage during cable-laying construction work for a transatlantic fiber cable in the North Sea.

Law Firm Expands to Florida

Shipping law firm Campbell Johnston Clark (CJC) is opening a Miami office after appointing litigator Neil Bayer as a partner. Bayer will head a team focusing on marine claims, with an emphasis on hull and yacht work.

The London-headquartered firm, which also has offices in Singapore and Newcastle, will initially focus on marine incidents in the U.S. and Caribbean from the new office.

LiDAR Integration Partnership

Teledyne Optech's new compact LiDAR sensor, the CL-90, is available for purchase through its first integration partnership with LiDAR USA.

For more than 20 years, LiDAR USA has been building UAV sensor systems that meet the demands of a growing number of applications. LiDAR USA's products are used for survey-related purposes.

New US Sales Rep for Glomex

Glomex Marine Antennas USA has signed Waters & David Co. as its newest U.S. sales rep group.

Waters & David is a marine specialist company that also works in the industrial, safety, utility, and oil and gas markets.



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Demos for Marine Oil-Spill Operations

As a part of its cooperative agreement with the U.S. Department of Transportation Maritime Administration (MARAD), Boston-based Sea Machines Robotics has successfully demonstrated its autonomous systems on board a skimmer boat along the Portland harbor, showing the systems' ability to increase the safety, productivity and predictability of response for marine oil-spill operations.

The demos took place aboard the world's first autonomous spill-response vessel, a Vigor/Kvichak Marine Industries-built skimmer boat owned by Marine Spill Response Corp. (MSRC), before a live audience of government, naval, international, environmental and industry representatives.

TMA Rebrands

The Maritime Alliance (TMA) has rebranded as TMA BlueTech to better reflect its commitment to the full gamut of blue tech, including ocean tech and water/waste-water tech. The change is also a recognition of the role the organization plays in promoting the concept of blue tech globally.

Two Winners of AZFP Contest

ASL Environmental Sciences has chosen Dr. Laura Hobbs and Dr. Roland Proud as the winners of the fourth-annual Acoustic Zooplankton Fish Profiler (AZFP) early-career scientist award contest. They are Scotland-based marine ecologists, specializing in bioacoustics. The two will deploy the AZFP in Lake Victoria, East Africa, to study the vertical distribution, dynamics and ecology of important fish species (e.g., Nile Perch, Dagaa and Haplochromines) and their prey (e.g., zooplankton). This will provide the first continuous data set of this kind for Lake Victoria, describing both the diel and seasonal changes in species abundance and vertical distribution.

Benthic Center in Rio de Janeiro

Benthic, a global geosciences company in subsea services group Acteon, will open its first Brazilian technology center and geotechnical laboratory in Rio de Janeiro later this year in the Technological Park of the Federal University of Rio de Janeiro. It will focus on geoscience research, development and innovation projects for the oil, gas and offshore wind sectors.

Deep Trekker Explores HMS Terror Site

This summer, Parks Canada's Underwater Archaeology Team left Cambridge Bay for the site of HMS *Terror*, equipped with a Deep Trekker ROV.

In partnership with Inuit, Parks Canada has been working to explore the wrecks of HMS *Erebus* and HMS *Terror*, the famous ships that set sail from England in 1845 in search of a Northwest Passage across what is now Canada's Arctic. After getting stuck in sea ice, 129 crew members were forced to abandon ship in 1848.

The Parks Canada team and Deep Trekker's ROV will continue to discover and assess more of the found artifacts and the history that lies on the Arctic seabed into the fall season. **ST**

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iXblue Expands Regional Offerings

iXblue Pty Ltd. in Brisbane, Australia, part of iXblue Group based in France, has diversified its Sea Operations division to include aerial mapping for commercial and government clients across Australia, New Zealand and the South Pacific, in partnership with Woolpert. Offerings will include digital imagery and topographic and bathymetric LiDAR via helicopter and fixed-wing platforms.

Online GHG Data Management

The Korean Register (KR) has established a new greenhouse gas (GHG) online data-management system, KR GEARs (GHG Emission Authentic Reporting System). The new service will help shipowners comply with GHG regulations (EU MRV, IMO DCS). By uploading the collected data directly on the KR GEARs website, users can automatically create their EU MRV emission report and IMO DCS fuel consumption report.

KR GEARs can enhance a fleet's operational-efficiency management and support ship operators' fuel-oil sulphur management.

WOC Adds Member

Topaz Energy and Marine has joined the World Ocean Council (WOC), a growing coalition of companies committed to ocean sustainable development, science and stewardship.

Topaz has installed a fuel-management system on a large share of its fleet to reduce fuel consumption and emissions.

Topaz also develops local workforces; more than 75 percent of its seafarers are from the countries in which the company operates.

First Survey of its Kind in Poland

Polish Consortium MEWO Ltd. and Pro Geofizyka Kraków have completed Poland's first 3D seismic OBN (ocean bottom node) survey.

The prospecting work was done for Central European Petroleum in the southwestern part of the Pomeranian Bay in the Baltic Sea.

The main survey comprised 49,000 airgun shots over 125 km² at depths of 2 to 15 m. Because of dense traffic and shallow water, the operator used 800 OBNs, multi-beam echosounders, sonars and ROVs.

Initial post-processing indicates good data quality.

Partnership for Underwater Training

JFD, part of James Fisher and Sons plc, has partnered with the Aquacentrum Den Helder, which combines submarine escape training, commercial-diving training and recreational pools for public use within a single building. The partnership will allow both new and existing submarine-operating nations to train their submariners in escape and abandonment in the most realistic environment possible. JFD will provide three-day courses for navies, even at short notice.

Marine E-Marketplace Grows

Digital ship-supply platform Moscord has added Schneider Electric to its portfolio, allowing shipowners and managers direct access to Schneider's marine products. This move demonstrates belief in the e-marketplace for maritime supplies as the best way to do business for both suppliers and customers.

New Wastewater Treatment Units For Croatian Vessels

ACO Marine has successfully completed the commissioning of wastewater treatment units aboard the Ropax vessels *Sveti Krševan*, *Supetar* and *Cres* operated by Croatian owner Jadrolinija. The three 87.6-m vessels were each retrofitted with a Clarimar MF-2 biological-type sewage treatment plant at the Dalmont shipyard in Kraljevica, Croatia, the oldest continuously operating shipyard in the world, dating back to 1729.

Larger Office for Trelleborg in Dubai

Trelleborg's marine and infrastructure operation has relocated its headquarters and Dubai marine-fender sales operation to Jafza One, a new, premium commercial complex in the heart of Jebel Ali Free Zone, Dubai, United Arab Emirates. The move to a larger office space follows the formation in the first quarter of 2019 of Trelleborg's marine and infrastructure operation, formerly Trelleborg Marine Systems. Trelleborg has also expanded its team at the Dubai office, with two new additions to the operation's management team and three appointments to the marine-fender sales team.

Svanehøj Sees Growing Demand For LNG Pumps

DNV GL estimates that in 2030 more than 10 percent of the global shipping fleet will be powered by LNG, up from 0.3 percent today. Pump manufacturer Svanehøj Group, which is behind the brands Svanehøj, Hamworthy Pumps, Eureka and Dolphin, sees this as a market opportunity.

This year, the company, headquartered in Aalborg, Denmark, expects to quadruple sales of its ECA fuel pump for LNG, ethane and methanol and has set a goal for additional doubling in 2020. Svanehøj has also established a sales office in Kobe, Japan.

Giant Piston Corer Passes Sea Testing

OSIL has successfully completed sea-acceptance tests aboard the MV *Xue Long 2* on an OSIL 22-m Giant Piston Corer system in the South China Sea, proving the system has excellent sample recovery rates and ease of handling.

The system was installed and operated over a 10-day period, with two OSIL engineers on board to provide training to local scientists. It was deployed using a MacGregor Triplex handling system. The corer demonstrated over 85 percent sample recovery on its first deployment. Further system tuning could yield 95 percent or more recovery rates.

The Giant Piston Corer will be used by the Polar Research Institute of China for marine sediment studies. **ST**

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ecoSUB to Gather Data on Arctic Calving

A team from the Scottish Association for Marine Science (SAMS), led by oceanographer Mark Inall, will deploy a small AUV, an ecoSUB, to the foot of a melting glacier in Arctic Norway to learn more about the effect of meltwater on a process called calving, which causes huge chunks of ice to break off the glacier edge.

Less than 1 m long and only 4 kg in weight, the ecoSUB will take measurements such as temperature and salinity down to 100 m below Kronebreen glacier on Svalbard. This will offer a clearer picture of how warming ocean properties affect the calving process.

MacArtney Backs Student Team from England

MacArtney UK Ltd. has provided a range of underwater connectors to a student-led team from the University of Sheffield.

Avalon Underwater Robotics is the first entry from England to qualify for the prestigious MATE ROV competition, where student teams, faced with real-world problems to solve, must hone their critical thinking, collaboration, entrepreneurial and innovation skills.

This year's MATE ROV competition is in collaboration with the Eastman Foundation and the Good for Good initiative, which hopes to find an ROV and crew that can operate in the freshwater of Boone Lake, Tennessee. Specific tasks include ensuring public safety with regard to the Boone Hydroelectric Dam, maintaining healthy waterways by monitoring water quality and preserving history through the recovery of Civil War-era UXO.

First-Ever Type Approval of Digital Component

Hyundai Heavy Industries Co. Ltd. (HHI) has received type approval from Lloyd's Register (LR) for the network-security digital component of its Integrated Smart-ship Solution (ISS), confirming that the component performs its functionality seamlessly.

Digital type approval delivers an assurance system to provide confidence in the market for the supply of digital components and offers all the benefits of traditional type approval; reassurance on supply chain quality and robustness within the marine environment. Digital type approval can apply to both components in information technology and operational technology systems.

HHI's first-line network-security component establishes a barrier between controlled internal networks and untrusted outside networks to mitigate against information and operational vulnerabilities as an increasing amount of data is stored, processed and transmitted by digital systems on board ships.

Valeport Sensors for Freedom ROV

Valeport sensor technology has been selected by Oceaneering International for integration into its subsea Freedom vehicles. Oceaneering's next-generation hybrid ROV, Freedom, will be fitted with Valeport Bathypack, Altimeter and Hyperion Fluorometer sensors. **ST**

Resolve, Bibby Team for Offshore Wind Solutions

Resolve Marine Group Inc. and Bibby Marine Services have signed a memorandum of understanding to develop Jones Act-compliant vessel solutions for the U.S. offshore wind sector.

Resolve's nearly four decades of experience as a Jones Act operator, together with Bibby's already established U.K. and European services in the target sector, provides a platform to provide wind farm operators and wind turbine suppliers effective Jones Act-compliant walk-to-work vessel solutions.

While the initial focus will be on walk-to-work vessel solutions, the partnership is targeting a wider range of multi-faceted solutions, including CTV vessel requirements, safety training, emergency response, firefighting standby services and logistical support.

Consortium to Develop Wind Farm off Ulsan

Equinor, Korea National Oil Corp. (KNOC) and the Korean power company Korea East-West Power (EWP) have formed a consortium to develop the floating offshore wind project Donghae 1 off Ulsan in South Korea.

The consortium is currently launching the development of a 200-MW floating wind farm near the KNOC-operated Donghae natural gas field. The consortium will carry out a feasibility study for the wind farm, including use of the Donghae 1 platform as a substation.

Pending results of the feasibility study, the consortium will start constructing a floating offshore wind farm in 2022, with possible power production start-up in 2024.

Orbital Chooses Contractor to Manufacture O2 Tidal Turbine

Orbital Marine Power Ltd. has awarded the main manufacturing contract for the company's first commercial O2 tidal turbine to Scottish-based TEXO Group, which will carry out the work at their

quayside facilities in Dundee. The contract marks the start of major construction for the company's new tidal turbine, the O2, which builds on the hugely successful 2-MW SR2000 turbine that generated over 3 GWh in its first year of testing at the European Marine Energy Centre (EMEC) in Orkney, Scotland.

The O2 will enter operation in 2020 as part of a long-term project at EMEC.

Bureau Veritas Commits to Promoting Wind Propulsion

The decarbonization drive is gearing up to be the defining issue faced by the shipping sector in the coming decades, and the industry is searching for low-carbon and zero-emissions technologies that will deliver on the International Maritime Organization's (IMO) initial strategy of reducing emissions by at least 50 percent by 2050.

Wind-assist and primary-wind-propulsion solutions are part of this drive, and classification society Bureau Veritas is joining the International Windship Association to promote wind as a credible, viable and increasingly economic option for commercial vessels.

ClassNK Releases Wind-Propulsion Guidelines

Environmental regulations continue to tighten, and the IMO has announced its goal to completely eliminate greenhouse gas emissions within this century. In light of the situation, ClassNK has developed its Guidelines for Wind-Assisted Propulsion Systems for Ships in order to contribute to the safe integrity and design of this technology and the ships that are installed with it.

In addition to verifying structural strength, outlining methods for proving structural integrity of strength members, and utilizing calculation methods for load amounts, the guidelines provide class notations for ships whose equipment is designed and installed in line with the guidelines. The contents of the guidelines will be consistently re-

vised in following with the developmental progress of the related technology.

The Guidelines for Wind-Assisted Propulsion Systems for Ships are available to download free of charge at classnk.com.

Encouraging Sharing, Collaboration in Marine Energy

The European Marine Energy Centre (EMEC) and Enel Green Power SpA (EGP) have signed a memorandum of understanding to encourage knowledge sharing in marine-energy technology development and performance assessment and to drive forward collaborations in marine-energy demonstration projects.

The partnership will address a gap in independent marine-energy testing against international standards, the development of which would increase credibility and trust in the sector.

Working in collaboration and sharing their wealth of knowledge and experience in the field, EMEC and EGP will provide both public and private investors with increased confidence in the industry and, therefore, encourage future investment and growth in marine renewable energy.

LUXUS PUR Range to Light Offshore Wind Farms

MacArtney Benelux has accepted a large LUXUS PUR order for customized wireless camera and LED light systems for the guidance and inspection of J-tube cage installation onto monopiles for offshore wind substations.

The LUXUS PUR camera and LED lights will help wirelessly guide the installation of the J-tube cage onto the monopile using a battery-powered control box mounted atop the installation frame. Images are transmitted to the control room aboard the vessel via a Wi-Fi antenna connected to the control box on the installation frame.

The order covers: 24 LUXUS PUR Cameras, 24 LUXUS PUR LEDs, eight cable systems, Wi-Fi control boxes and rechargeable battery pack. **ST**

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Ropeless Fishing System



Featuring embedded acoustic release technology, the new system was developed to eliminate vertical lines connecting a surface buoy to bottom fishing gear. It was designed with the input of fishers to prevent whale entanglement and other negative effects of seafloor-to-surface fishing and trap lines. EdgeTech.

Man-Portable Multibeam Package

PicoPOD is suitable for USVs and small vessels to survey ports, harbors, tidal barriers, bridge footings, dams and reservoirs. It has a very simple mechanical interface and is supported by industry-standard acquisition and processing software. Picotech Ltd.

Noncontact Oil-Spill Monitoring

Providing spill-monitoring data and alarms directly to internet-enabled devices from any location with GSM/GPRS or satellite coverage, the system can be moored to floating buoy platforms or fixed stations in shallow waters. Individual sensors can be networked together to cover multiple locations. Ocean Scientific International Ltd.

Electric Work-Class Vehicle

A light, heavy-duty ROV, the Phantom X8 features deep-sea maneuverability and power. It has high-definition (1080 p) front (+/-90°) (pan optional) and rear (low-light) cameras. Deep Ocean Engineering Inc.

Sound-Speed Profiler

Upgraded to provide enhanced versatility and deployment, the SWIFT SVP delivers high-accuracy sound

velocity, pressure, temperature, salinity and density measurement, with Bluetooth connectivity, rechargeable battery and an integral GPS module to geolocate each profile. Valeport Ltd.

Automated Fiber Placement

AFP is an additive manufacturing method to create advanced-composite structures using continuous-fiber tape. Advanced composites are ideal for applications in oil and gas that require weight reduction and environmental resistance. Trelleborg Sealing Solutions.

Compact Remote-Survey Vessel



A smaller version of the ARCboat, the ARCboat Lite weighs only 15 kg and is just 1.3 m long. It can be carried and deployed by a single person and can operate in flows of up to 2.5 m/s, in water as shallow as 22 cm. HR Wallingford Ltd.

Linear Position Sensor

Ideal for use in remote, hard-to-reach and difficult locations where sensor replacement would result in high costs and downtime, LVDT sensors are constructed from materials that can survive indefinitely in corrosive subsea applications where service life requirements are typically 20 years. NewTek Sensor Solutions.

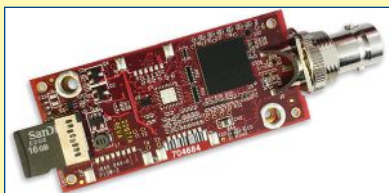
Inertial Measurement Unit

Combining low-noise, high-range sensors and VELOX high-speed output, the LandMark 007 IMU measures only 0.7 in³. It has rate ranges up to 2,000°/s and acceleration ranges as high as 200 g. Gladiator Technologies.

North Sea Inspection Tool

Advanced Inspection Data Analytics (AIDA) could save companies upward of 20 percent a year in inspection costs per asset. AIDA processes reams of legacy data attached to mature North Sea assets to give reliable, trendable and actionable information. AIDA's models and algorithms determine threat levels, predict imminent failures and provide accurate corrosion and remaining-life assessments. IM-RANDD.

Digital Video Recorder



Model 4067 is an ultracompact HD-SDI DVR optimized for OEM systems. It records to a micro-SD card and includes mic or stereo-line audio inputs and a clock/calendar with battery backup. It captures JPEG snapshots without video interruption. Sensoray.

Heavy-Duty LED Floodlight

HypaLUME shines 28,000 lumens of daylight-white light using only 300 W, providing commercial mariners and terminal operators a secure, well-lit working area without the eye strain and fatigue common with older tungsten or quartz-halogen technologies. It comes in close-range, long-range and extra-wide versions. Hella marine.

8-Ft. VHF Antenna

With a frequency range of 156/162 MHz, the RA1225HP collinear-phased antenna has a gain average of 6 dB, maximum input power of 100 W and 50 ohms impedance. Vertically polarized to minimize signal reflection on the water, it's ideal for inland, coastal and offshore vessels. Glomex Marine Antennas USA Corp.

Work-Class ROV

The Quantum/EV has electric-drive technology, a high-power 25-kW electric-thrust system, a new

long-distance DC-transmission solution and locally managed DC power system. SMD.

Offshore Cable

RADOX OFL can cope with a smaller bend radius to save space by up to 70 percent and weight by up to 60 percent. It is ideal for monitoring and control, as well as sensor applications on offshore platforms. HUBER+SUHNER.

LiDAR Solutions

The CL-360 is a new compact LiDAR, and the CL-90 has higher point density and long-range performance. For airborne LiDAR, a new model has been released based on the popular Galaxy platform. Designed for permanent monitoring applications, the new TLS M3 combines the measurement efficiency of the tripod-based LiDAR system with a complete internal sensor package and API software. Teledyne Optech.

Electro-Optics Suite

Comprising the TORNADO-ER and

the SPEED-ER systems, the EO suite provides a panoramic infrared image, automatic detection of moving maritime targets, multi-target tracking and long-range observation to explore targets. The suite is controlled by a dedicated C2 system, a man-machine interface that includes intuitive panoramic imagery, maps, enlarged images and observation videos. CONTROP Precision Technologies Ltd.

Rescue Strobe

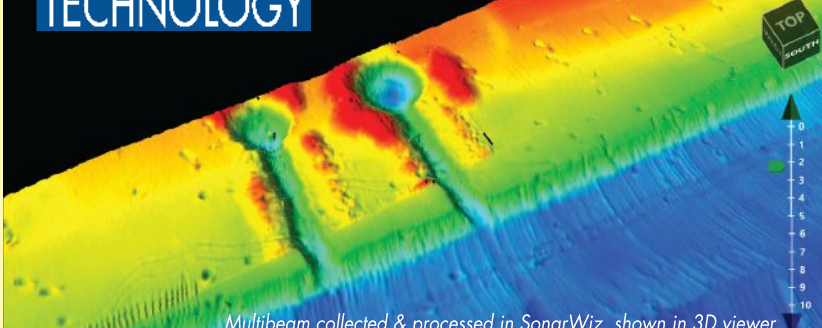
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Joint Industry Guidance On New Sulphur Cap

A number of shipping, refining, fuel-supply and standards organizations have worked together to produce joint industry guidance on the supply and use of 0.50-percent-sulphur marine fuel. Key messages include: ensure fuel quality by ensuring that blend components are suitable for bunker-fuel production, with particular attention to ensure that the final product is stable; fuel suppliers and purchasers should provide adequate information to the ship concerning the fuel as supplied to enable ship crew to identify and manage potential safety and operational issues; fuel characteristics are expected to vary considerably between bunkers, so the ship's crew will need to adopt a more proactive approach to fuel management; assessing compatibility of 0.50-percent-sulphur fuels from different

sources will be key, and fuel should be loaded into an empty tank to avoid commingling on loading; and ship operators and fuel suppliers should review operational practices to allow sufficient time to test for compatibility between existing and proposed bunker-fuel delivery, especially if no empty, dedicated storage tank is available on the ship.

A related e-learning course will be released in October 2019.

New Underwater Art Museum At Great Barrier Reef

Jason deCaires Taylor's most ambitious underwater art project to date is the Museum Of Underwater Art (MOUA) within the Great Barrier Reef, Australia. It will feature galleries located throughout Townsville, Magnetic Island, Palm Island and the Great Barrier Reef region. The first galleries are due to open in December 2019. For the first time, the artist will combine a range of inter-

tidal and fully submerged artworks, including pioneering large-scale architectural installations and sculptural works that change in response to environmental conditions.

The aim is to encourage environmental awareness, increase knowledge of marine ecosystems and help instigate social change.

Free Online Tool to Prepare For 2020 Sulphur Cap

As entry into force of the International Maritime Organization's (IMO) 0.5 percent sulphur cap approaches, preparation is key. DNV GL offers a free web-based application of the Ship Implementation Plan (SIP) that shipowners and managers can use to prepare vessel-specific SIPs and maintain an overview of their fleet. While not mandatory, the SIP is an IMO guidance that all ships are encouraged to prepare and implement for the new regulation effective January 1, 2020.

DNV GL also recommends supplementing the plan by documenting implementation-related actions.



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Sonar Critical to Historic Bridge Demolition, Recovery

The historic 1936 Highway 47 Bridge over the Missouri River was demolished this past spring. The old bridge was located 12 ft. from the new bridge that was built over the last several years.

The historic bridge was demolished via strategically placed explosives. The blast dropped the roughly 2,000-ft. span using 145 lb. of explosives, 750 individual charges and 8,000 ft. of detonation cord.

After demolition, the underwater recovery tasks began. Three Rivers Diving Inc. located the pieces with JW Fishers' side scan sonar system. The sonar was mounted on a fixed beam to the bow of a boat and used to locate the bridge section and help position a crane barge.

Sat Tech Supports Sustainable Fishing in Indonesia

Inmarsat, working with the Indonesian Ministry of Marine Affairs and Fisheries, the U.K. Space Agency and other partners, have completed a three-year fisheries innovation project. Using low-cost, solar-powered satellite technology on smaller fishing vessels, the project aimed to enhance safety, efficiency and ship-to-shore contact, and offer potential fish-stock sustainability improvements.

With Indonesia's long coastlines and more than 17,000 islands, it is difficult and costly to monitor vessels. Independent analysis by Poseidon Aquatic Resource Management Ltd. showed that applying satellite-based technology to smaller boats below 30 gross tonnage, not currently legally required, supported the local industry's move toward safer, more sustainable and profitable operations and could improve the government's ability to address illegal fishing.

Potential Malaria Treatment From Southern Ocean Sponge

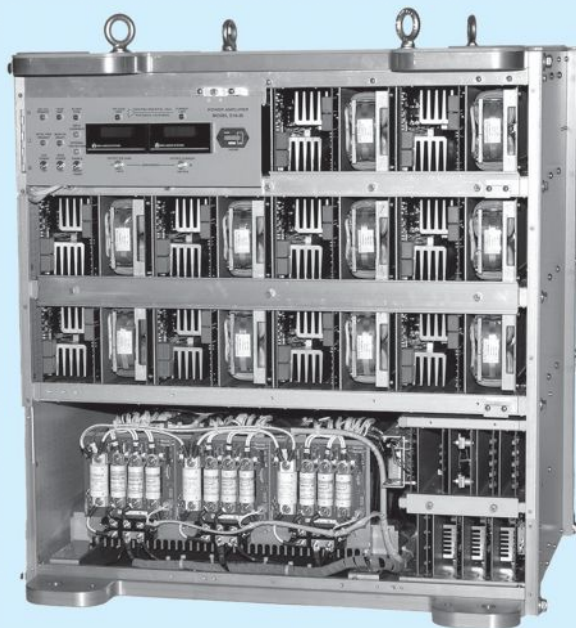
Researchers report in ACS's *Journal of Natural Products* that a peptide they isolated from an Antarctic sponge shows promise as a lead for new therapies for malaria. The malaria parasite, *Plasmodium*

falciparum, is transmitted to people through mosquito bites. Conventional treatments based on artemisinin and its derivatives hold the parasite in check in patients' blood, but the parasites are increasingly becoming resistant to these medications. One solution is to attack the organism at an earlier stage in its life cycle, when there are fewer parasites and resistance might not have developed yet—namely,

when it's in the liver. Researchers screened natural products extracted from the Southern Ocean sponge *Inflatella coelosphaeroides*. A compound dubbed friomaramide blocked infection and development of the malaria parasite in liver cells in a culture dish as effectively as primaquine, one of the few existing liver-stage treatments. Friomaramide, nontoxic to liver cells, is a promising lead for treatment. **ST**

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UK Students Conduct Microplastics Survey

The planet's use of plastics has come under much scrutiny in recent years, and particular attention is being paid to the damage caused in the marine environment by microplastics, defined as all forms of plastics less than 5 mm in size. They can enter the oceans as primary microplastics such as beads from personal-care products and microfibers from clothes, or as secondary microplastics derived from larger plastic items such as drink bottles, which slowly get broken into smaller pieces. Many microplastics find their way into the sea from the wastewater systems that feed into rivers.

During the 2019 spring and summer school terms, the Norfolk Rivers Trust used a grant from the Sheringham Shoal Community Fund to work with four North Norfolk primary schools on a project to

investigate microplastics in the local environment. The project involved more than 150 pupils, seven to 10 years old, from Blakeney, Holt, Kelling and Walsingham schools. These students participated in a national campaign called the Big Microplastics Survey, managed by Just One Ocean and the University of Plymouth.

The project, managed by the Norfolk Rivers Trust education team, measured the amount of microplastic pollution on the beaches of North Norfolk and included beach litter picking and plastic sorting. Beach samples were sent to Just One Ocean for analysis.

Students were taught how to conduct a survey using scientific equipment. They also learned about water quality in rivers and seas and the importance of protecting the aquatic environment for native wildlife and for human health and food production.

Coastal Mud Holds Key To Climate Cooling Gas

Bacteria found in muddy marshes, estuaries and coastal sediment synthesize one of the Earth's most abundant climate cooling gases, according to new research from the University of East Anglia (UEA).

Dimethylsulfoniopropionate (DMSP) is an important nutrient in marine environments. Billions of tonnes of DMSP are produced annually by marine phytoplankton, seaweed, corals and bacteria.

When marine microorganisms break down DMSP, they release a climate-cooling gas called dimethylsulfide (DMS). This gas also causes the characteristic smell of the sea-side.

Until recently, it was thought that DMSP was mainly produced in the ocean's surface waters by photosynthetic algae. But new research reveals that the molecule is produced in coastal sediment and at much higher levels than in seawater.

When DMS is produced as microorganisms break down DMSP, this affects atmospheric chemistry,



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cloud formation and, potentially, climate by increasing cloud droplets that reduce the amount of sunlight reaching the ocean's surface.

LARS for Chinese RVs

MacArtney has provided a third, fourth and fifth launch and recovery system (LARS) in the Asia-Pacific market this year for the RV *New Ocean Researcher 1, 2 and 3* vessels.

MacArtney Asia Pacific accepted a full LARS order for two 500-GT vessels and one 1,000-GT vessel.

The RVs are to be managed by the National Taiwan Ocean University and the National Sun Yat-sen University. They are being tested in the South China Sea.

The full scope of supply for each vessel includes: MERMAC stern A-frame (15 m); wireless remote-operated folded boom crane with 10-ton capacity and active heave compensation; hydraulic power units for A-Frame and crane; MERMAC storage and traction winch with 6,000 m of ready-spoiled stainless-steel wire, wireless remote and constant-tension technology; MERMAC CTD winch, including 6,000 m of armored coax cable and slip ring; and portable MERMAC winch with 4,500 m of hybrid instrumentation cabling, slip ring and spare cable.

Water-Flow Researcher Wins Stockholm Prize

Dr. Jackie King has received the 2019 Stockholm Water Prize for pioneering research on water flows. Her work has led to new tools to help decision makers assess costs and benefits of alterations to rivers.

She began developing her models as a researcher at the University of Cape Town, funded by South Africa's Water Research Commission. This work influenced South Africa's 1998 National Water Act. Her work is now guiding governments and institutions around the world.

Active Heave Compensation Aids Research from Vessels

Sweden's new RV *Svea* is now fully equipped with Scantrol control systems for the electrical Ibercisa trawl and research winches

on board. The vessel is especially adapted for research and environmental monitoring in the Baltic Sea, Kattegat, Skagerrak and Öresund. The vessel's main activity is ecosystem investigation, with a focus on recurrent monitoring of fish stocks and water quality, by the Swedish University of Agricultural Sciences and Swedish Meteorological and Hydrological Institute. Scantrol reports that more research vessels are

investing in active heave compensation (AHC) for research winches.

With Scantrol AHC, the vessel can conduct research sampling at desired water depths, even if the vessel is rolling and moving in rough sea.

Scantrol AHC removes the effects of the vessel's motion from equipment deployed in the sea, enhancing the precision and data quality of subsea and sampling operations. **ST**



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meetings

NOVEMBER

November 4-6—Oceans in Action, Gulport, Mississippi. laurie.jugan@usm.edu or www.mtsociety.org/oceans-in-action.

November 5-7—International Conference on Marine Engineering and Technology Oman, Muscat, Oman. +44 (0)20 7382 2656, marketing@imarest.org or www.icmetoman.com.

November 6—OPITO Global, Kuala Lumpur, Malaysia. www.opito.com/events/opito-global.

November 6-7—ASNE Design Sciences Series Workshop: Digital Engineering: Digital Twin, Washington, D.C. 703-836-6727, asnehq@navalengineers.org or www.navalengineers.org/Symposia/Digital-Engineering-Series-Digital-Engineering-Digital-Twin-2019.

November 10-14—International Water Conference, Orlando, Florida. 412-261-0710 ext. 13, t.bombalski@eswp.com or www.eswp.com/water.

November 12-14—U.K. National Oceanography Centre's Marine Autonomy and Technology Showcase, Southampton, England. +44 (0)23 8059 6170, dcook@noc.ac.uk or <https://conference.noc.ac.uk/mats-2018-delegate-registration>.

November 18-22—BlueTech Week, San Diego, California. mbjones@themaritimealliance.org or <https://www.bluetechweek.org>.

November 20-21—Combat Systems Symposium, Arlington, Virginia. 703-836-6727 or www.navalengineers.org/Symposia/Combat-Systems-Symposium-2019.

November 20-22—Sustainable Ocean Summit, Paris, France. info@oceanCouncil.org or www.oceanCouncil.org.

November 21-23—Pacific Marine

Expo, Seattle, Washington. 207-842-5666, cdimmerling@divcom.com or www.pacificmarineexpo.com.

November 26—Marine Data Management & GIS Workshop, London, England. katie.eades@oceanwise.eu or www.wheretheyourdatamatters.com.

November 28-30—International WorkBoat Show, New Orleans, Louisiana. 508-743-8567, info@workboatshow.com or www.workboatshow.com.

DECEMBER

December 3-6—Marintec China, Shanghai, China. marintecchina@126.com or www.marintecchina.com.

December 4-5—Maritime Security & Coastal Surveillance, Singapore. +65 6722 9388, KunLim.Lau@iqpc.com.sg or <https://bit.ly/2XqMelu>.

December 4-5—West Coast Small Business Defense Contracting Summit, San Diego, California. 202-552-0179, info@defenseleadershipforum.org or <https://tinyurl.com/y3z9jvmj>.

December 10-12—Chesapeake Technology's Annual Training Workshop, Savannah, Georgia. 650-967-2045 or workshop@chesapeakektech.com.

2020

JANUARY

January 6-9—HYPACK 2020, Jacksonville, Florida. 860-635-1500, Brittany@hypack.com or www.hypack2020.com.

January 7-9—Challenge of Science Leadership, Totnes, England. info@scienceleadership.co.uk or www.scienceleadership.co.uk.

January 14-16—Blue Innovation Symposium, Newport, Rhode Island. <https://salve.edu/blue-innovation-symposium>.

January 15-16—Coastal Futures, London, England. bob.earll@coastms.co.uk.

FEBRUARY

February 4-6—EUROMARITIME, Marseille, France. +33 1 56 59 15 07, anne-charlotte.micca@gican.asso.fr or www.euromaritime.fr.

February 4-6—Underwater Intervention, New Orleans, Louisiana. ui@naylor.com or www.underwaterintervention.com.

February 11-13—Subsea Expo, Aberdeen, Scotland. www.subseapoxpo.com.

MARCH

March 9-10—World Ocean Summit, Tokyo, Japan. +971 552215208, oceansummit@economist.com or www.woi.economist.com/world-ocean-summit.

March 23-25—International Lidar Mapping Forum, Washington, D.C. www.lidarmap.org.

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

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Nonrequested outside USPS	300	100
Total nonrequested	300	100
Total distribution	8,933	8,064
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people

TDI-Brooks has hired **Jayme McBee** to lead the Surface Geochemical Seep-Hunting service line. McBee holds a master's degree in geology from Texas A&M University and brings more than seven years' experience serving the onshore and offshore energy industries. She was previously at Fugro USA Marine as a senior geoscientist.



iXblue has appointed **Thomas Buret** as chief operating officer, taking over from **Fabien Napolitano**, who takes up duties as CEO. Previously in charge of the company's space and maritime activities, Buret was head of the navigation department since 2017. iXblue is looking to the talents of this duo to generate a cycle of strong growth for the civil, space and defense markets.

Mote Marine Laboratory & Aquarium's **Dr. Erinn Muller**, science director of Mote's Elizabeth Moore International Center for Coral Reef Research & Restoration and manager of Mote's Coral Health & Disease Research Program, has been awarded the Presidential Early Career Award for Scientists and Engineers. It is the highest honor bestowed by the U.S. government on outstanding scientists and engineers who show exceptional promise for leadership.

ASL has hired **Dr. Matthew Asplin** as metocean and Arctic project manager. He has research skills in meteorology, sea ice and oceanography, and has more than 15 years of experience in these fields.

The board of directors of StormGeo has appointed **Søren Andersen** as CEO. He has more than 20 years of leadership experience from companies such as A.P. Møller – Maersk, APL, Rickmers and several start-ups. Most recently, he served as the CEO of 2020seaways.

Sea Machines Robotics has hired industry veteran **Frank Relou** as European business development manager. Relou is based in the Netherlands, with responsibility over Europe, the Middle East and Africa.

Teledyne CARIS and Teledyne Optech welcome **Daniel Kruimel** to the group as regional sales manager for Australia and New Zealand. In this dual role, he will concentrate on expanding the reach of both the CARIS and Optech product portfolios and providing seamless service and support for existing clients.

Chelsea Technologies has appointed **Elizabeth Paull** as its new managing director. Paull joins from Sonardyne Inter-

national and will further develop Chelsea Technologies as a market leader in environmental-sensing technology, particularly in maritime, where the regulatory landscape of today is creating significant challenges for shipowners and operators. **ST**

contracts

Jotun, Sandefjord, Norway, has signed an agreement to provide its Hull Performance Solutions (HPS) anti-fouling coating system across 42 vessels in an advanced RoRo fleet. Wallenius Wilhelmsen.

Interventek, Aberdeen, Scotland, has been awarded a contract to deliver its 6-3/8", 15,000-psi Open Water Revolution valves by early 2020 for integration into an MkII 15K light riser intervention system. Trendsetter Engineering.

The South Korean Information and Communication Technology Promotion Agency, Seoul, South Korea, has awarded a contract to supply a fully featured bridge simulator for a new autonomous ship research facility in Ulsan, South Korea. The goal is to start operations in 2023. Kongsberg Digital.

The World Ocean Council, Honolulu, Hawaii, has signed a partnership agreement to collaborate on ocean sustainable economic development through information exchange, communications, events, joint working groups, etc. World Association for Waterborne Transport Infrastructure.

JFD, Inchinnan, Scotland, has formed a strategic partnership on the world's deepest pool (42.15 m) to facilitate submarine escape training as required by navies worldwide. Y-40.

ABB, Zurich, Switzerland, secured a first contract for ABB Ability Tekomar XPERT, to support management of a 55-vessel fleet. CPO Containerschiffreederei.

Trelleborg's, Stockholm, Sweden, offshore operation has received a fast-track contract to produce more than 80 laminated elastomeric bearings to be installed on an FPSO vessel for use in the Area 1 block offshore Mexico. MODEC.

Siccar Point Energy E&P Ltd., Aberdeen, Scotland, has awarded an exclusive front-end engineering and design contract for a Sevan cylindrical FPSO for its Cambo field development on the U.K. Continental Shelf. Sembcorp Marine Rigs & Floaters Pte Ltd.

Damen Shipyards Group, Gorinchem, Netherlands, has sold two azimuth stern drive tugs to assist bunkering operations for Corpetrolsa's tankers and other vessels entering the Esmeraldas and La Libertad ports. DLEN S.A. **ST**

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Questions? seatechnologybg@sea-technology.com.

Ryan Matuzak has been a boat captain for 17 years, with experience on all five Great Lakes. He is the safety-boat captain for the Stand Up For Great Lakes expeditions, responsible for the safety of the paddlers. He is also the owner of North Country Sportfishing, a charter-fishing operation based in Frankfort, Michigan. Matuzak can be reached at northcountry.mi@gmail.com.



Five years ago, I answered a phone call from this fellow wanting to paddleboard across Lake Michigan with a couple of his friends. My first thought was: Who are these guys, and what is the inspiration? Why take on such a huge challenge filled with danger and inevitable adversity? I had to know more.

So, we began a friendship that was about our love of the Great Lakes, an invaluable resource for so many people.

Four expeditions later, the Stand Up For Great Lakes team, including stand-up paddleboarders Jeff Guy, Joe Lorenz and Kwin Morris, is making a difference by raising awareness of, and funds to combat, pollution and other ecological dangers to the Great Lakes. Our partners include the Thunder Bay National Marine Sanctuary, Great Lakes Shipwreck Museum and Cooperative Institute for Great Lakes Research (CIGLR).

There are many stories about what we have experienced crossing these majestic and powerful bodies of water, but one topic has sadly been prominent throughout these adventures: pollution. We have seen plastics and other trash along all of our routes, with no exception.

Crossing lakes Michigan, Huron, Superior and Erie showed us that humans are messy critters that have a long way to go in how we manage our waste. We have seen plastics of

all sizes, from smaller than a postage stamp to floating household debris and industrial materials the size of a couch.

That is why we are crossing these Great Lakes. We must do our part to bring awareness to the pollution problem.

As we crossed Lake Superior in 2018, the trip would've been perfect, except for one thing: the plastic. It was floating everywhere. The lake gave us uncommon glass conditions, and with that gift, it showed us its wounds that would have otherwise been obscured by the wind and waves. In the stillness of the lake, we saw plastics floating on the surface and down in the water column during all the daylight hours of the expedition.

Each lake has its own set of ecological challenges, but common to all of them are harmful algal blooms (HABs), which are scientifically complex, economically damaging and a threat to ecosystem and human health.

Algae blooms are a huge problem. Being an angler who has fished all around the Great Lakes, I've seen this problem from Green Bay to Lake Erie. With this summer's high-water issues through all of the Great Lakes, algae issues are also on the rise.

Our friends from the Cooperative Institute for Great Lakes Research are doing a great job trying to investigate these blooms in an effort to reduce the man-made ingredients contributing to this terrible problem. CIGLR and Great Lakes Environmental Research Laboratory scientists use water-quality data along with satellite data, weather forecasts and water-movement forecasts to predict future HABs in western Lake Erie. They have developed a specialized tool called the Lake Erie HAB Tracker that gives current bloom conditions and a five-day forecast of algal bloom movement and size through 3D simulations

and graphics. These predictions can provide stakeholders, such as drinking-water-intake managers, commercial-fishing operators and beach-goers, with timely information for public-health decision making. Their team is currently using observed data to improve 3D prediction capabilities and developing methods to incorporate toxin concentrations into the model. Furthermore, they are developing a new model for Lake Erie to examine relationships between HABs and key environmental factors, including water temperature, river flows, nutrient loads, water-column mixing and sediment resuspension.

With brilliant minds like these working on the problem, we can be confident they'll find out the cause of HABs and develop the solution.

The Lake Erie crossing that the Stand Up for Great Lakes team embarked on this June—a 24-hr., 70-mi. journey against 20 hr. of headwinds—enabled our team to support this important research. The expedition raised about \$16,000, surpassing the initial goal of \$10,000. This money will provide direct funding to help with the pervasive problem of harmful algal blooms.

It was fantastic to see every Detroit news outlet, from CBS, NBC, FOX and ABC, as well as CBC of Canada, cover the event, in addition to 9 & 10 News from Northern Michigan. They helped bring awareness of our water-quality problems to a huge metropolitan audience.

As we start planning for our last Great Lakes crossing, focused on Lake Ontario, we will be working once again to help bring light to the challenges the Great Lakes face.

You don't have to be a scientist to make a difference. Being aware of the problem is the first step.

To learn more, visit StandUpForGreatLakes.com, [Facebook.com/StandUpForGreatLakes](https://www.facebook.com/StandUpForGreatLakes) and [Instagram.com/StandUpForGreatLakes](https://www.instagram.com/StandUpForGreatLakes). **ST**

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highly accurate, precise and stable performance, simultaneous positioning and data transmissions

- flexible SiNAPS positioning software
- reliable data transmissions
- range: up to 8000 m
- accuracy: better than 0.01 m

NEW!
ULTRA-COMPACT
"TINY" MODEMS



S2C M (left) and the new S2C T "tiny" modem - 20% smaller and lighter



SEA-BIRD
SCIENTIFIC

SeapHOx™ V2

Ocean pH Sensor + CTD

Studying Ocean Acidification?

Are you Looking for Stable, Long-Term pH Measurements?

The SeapHOx™ V2 is the optimal pH sensor for moored deployments. Here's why:

- High-accuracy ISFET pH sensor
- Proven long-term pH deployment stability (up to 1 year before recalibration)
- Collect over 340,000 samples in a single year (90-second sample interval)
- Integrated pump and flow path with anti-biofouling measures
- Integrated CTD provides temperature, salinity, pressure, and dissolved oxygen



seabird.com/SeapHOxV2

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