

TOTAL OCEAN MARKET COVERAGE 2019

JANUARY

Annual Review & Forecast / Buyers Guide/Directory

****Oceanology International Americas**, February 25-27,
San Diego, CA

FEBRUARY

Instrumentation: Measurement, Processing & Analysis

****U.S. HYDRO 2019**, March 18-21, Biloxi, MS

****Ocean Business**, April 9-11, Southampton, U.K.

MARCH

Electronic Charting/Vessel Management/Ports &

Harbors/Dredging/Homeland Security

****AUVSI XPONENTIAL 2019**, April 29-May 2, Chicago, IL

APRIL

Offshore Technology/Alternative Energy & Ocean Engineering

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

****UDT 2019**, May 13-15, Stockholm, Sweden

MAY

Communications, Telemetry, Data Processing

****BlueTech Expo**, June 4-5, Washington, DC

****Oceans '19 MTS/IEEE Marseille**, June 17-20, Marseille, France

****CLEAN PACIFIC 2019**, June 18-20, Vancouver, Canada

JUNE

Seafloor Mapping/Sonar Systems/Vessels

JULY

Deck Gear, Cable, Connectors, Power Systems & Salvage

AUGUST

Geophysical Exploration/Seafloor Engineering

****SEG 2019**, September 15-20, San Antonio, TX

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****Oceans '19 MTS/IEEE Seattle**, October 28-31, Seattle, WA

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****International Water Conference**, November 10-14, Orlando, FL

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Undersea Defense/Antisubmarine Warfare

DECEMBER

Diving, Underwater Vehicles & Imaging

****Underwater Intervention 2020**, January 28-30,
New Orleans, LA

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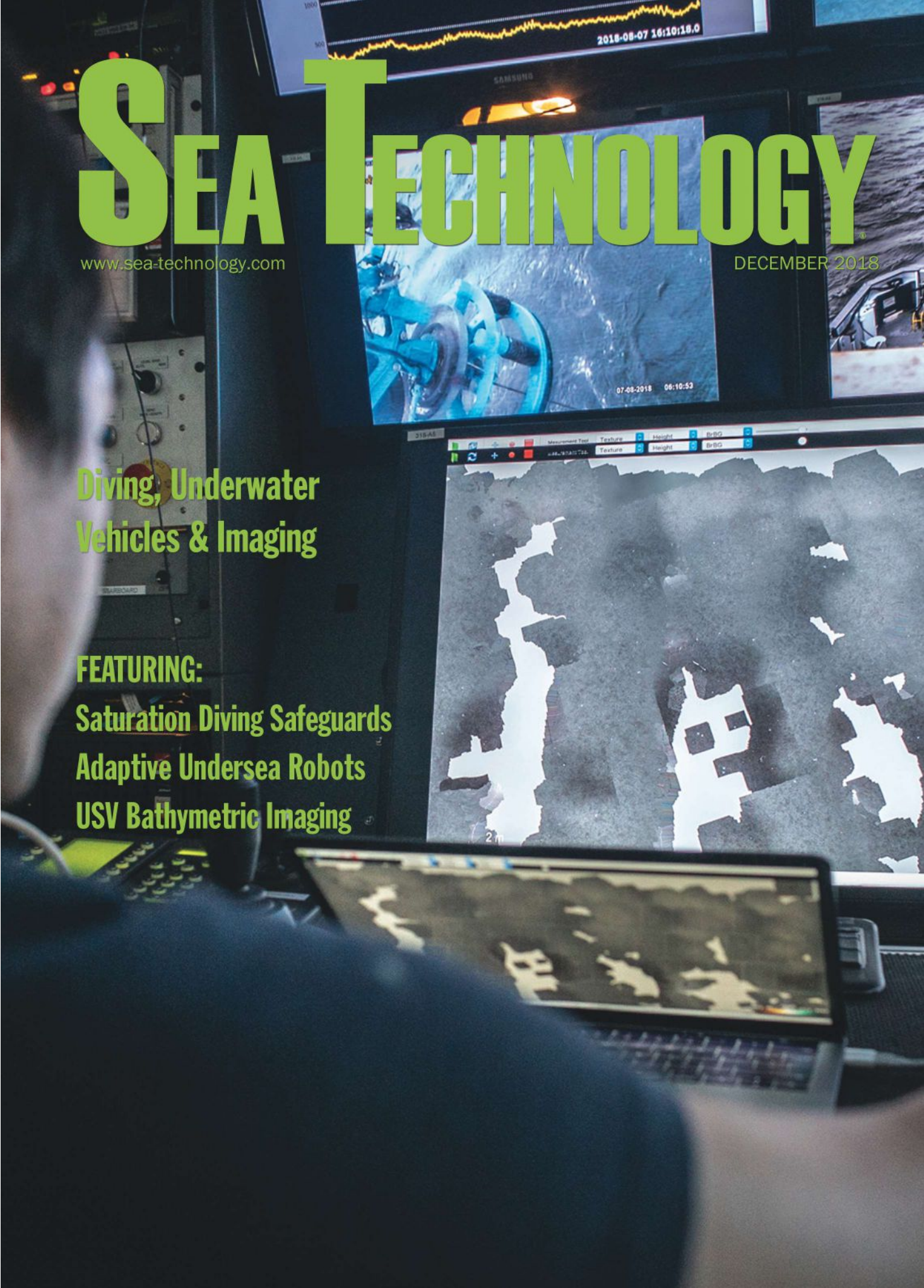
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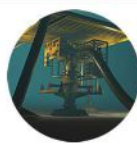
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Dr. Blair Thornton, chief scientist during an August 2018 expedition off the coast of the Pacific Northwest, consults the visual map of the seafloor in order to confirm where to send ROV SuBastian. (Credit: Schmidt Ocean Institute)

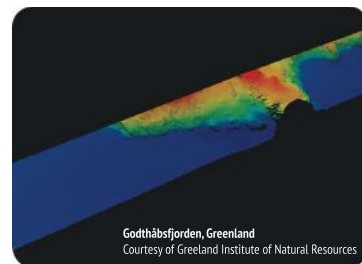
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IoT: Charting the Value Beyond the Hype

Many of the same questions that were asked about coal-powered propulsion are being asked of the Internet of Things (IoT) today: What's wrong with the traditional way; how will this benefit my fleet; why do we need to make this change?

They're all good questions, and they show a very natural human interest in the three areas that should matter most in deciding whether to use any maritime technology: safety, effectiveness and cost.

The biggest challenges to IoT adoption have already been overcome. In large part, this is due to the ready availability of high-performance data collection. This is a bottleneck that has only been recently resolved, and there's still a lack of understanding in some quarters about the cost and availability of the tools required to achieve it.

As I heard Hans Ottosen, CEO of Danelec Marine, say in July this year, "IoT installation is the simple part. For the basic IoT you'll use existing sensors, and sometimes you'll install additional ones, such as a flow meter, to get to the next level. But at the beginning, it's about connecting the pre-existing sensors, and that usually only takes about a day." It should be noted, however, that there's a substantial distance between the leaders and laggards at the implementation stage.

Value creation, whether it's improving business processes or introducing new services, can be accelerated by harnessing the power of data collected through IoT. Ships have a wealth of information available to them already, but much of it is fragmented or siloed. Almost none of it is entirely new, and most is immediately familiar to even an inexperienced mariner: engine data, charts and oceanographic information, meteorological updates, hydrodynamic performance, port data, traffic updates...the list is huge. The next step is transforming these disjointed sources into a holistic understanding of the ship and its performance and using that to improve operations. In my experience, the uptake is being driven mostly by owners' and operators' increasing awareness of what they've been missing out on.

In the last few years there has been no shortage of challenges for shipowners and charterers. For many of them, it has been an ongoing battle to ensure their assets remain competitive, and with IoT they're now seeing measurable gains from optimizing route planning, fuel saving and performing maintenance when it makes sense and in a way that limits downtime and off-hire periods.

We're still many years from a world in which all ships are connected and operators are aware of their circumstances 24/7. But the pace of technology development and adoption rate is accelerating so fast that I'm certain that within my lifetime we will see every ship connected.

While that is not yet a fully realized scenario, we're already seeing IoT connecting people in more relevant and valuable ways. It does this by delivering the right information to the right person or machine in time to turn data into actionable insights that measurably improve decision making and profitability. As just one example, our collaboration with Danelec Marine offers a comprehensive turnkey IoT package that encompasses elements from onboard data collection to actionable ship and fleet performance analysis and delivers a truly integrated IoT experience to shipowners, operators and charterers.

Like any successful voyage, the implementation of IoT will be a team effort between the owner, the charterer and the crew. The obstacles that once hindered implementing IoT in shipping have been overcome, and superconnected assets will soon be the norm in our industry. **ST**

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THE FUTURE IS ELECTRIC

)) Historic Ban on Arctic Fishing. Protection of the Arctic has been a significant gap in international ocean governance. A major move has been made to protect the region's resources through a new landmark global agreement that has resulted in a fishing ban in the Arctic Ocean, Climate Action reported. The European Union, Canada, China, Denmark, Iceland, Japan, South Korea, Norway, Russia and the United States agreed to the deal; collectively, they make up 75 percent of global GDP. The agreement states that commercial fishing in the high-seas portion of the Central Arctic Ocean will be banned until scientists can confirm that it can be done sustainably. The agreement will enter into force when all parties have ratified it. The Arctic region is warming at almost three times the global average rate, causing a change in the size and distribution of fish stocks. As warming opens up previously inaccessible parts of the ocean, the Arctic high seas could become more attractive to commercial fisheries in the medium to long term. Recently, the U.K. government announced its support to protect 30 percent of the world's oceans in a bid to protect marine life. In September, the United Nations concluded its first session on creating an intergovernmental legally binding treaty to protect marine biodiversity in ocean waters. The second session is scheduled for March 2019.

)) Big Data Project for Safety. The Blue Marine Foundation, a charity dedicated to creating marine reserves and establishing sustainable models of fishing, has embarked on a big data project to investigate how data can be used to support safety in inshore waters. OceanWise will provide the mapping data for situational awareness and to allow multiple sources of data to be integrated using location as the common link. The assembly of disparate data sets into a spatial data infrastructure will inform safety and risk assessments and allow preventative measures to be established and resources used in emergency response to be more effective.

)) Unprecedented Manned Sub Expedition to Broadcast. After three years of intensive efforts from some of the world's leading oceanographers, submarine engineers and scientists, the Five Deeps Expedition is launching as the first global ocean journey to send a manned submersible vessel farther and deeper than any in history. An expedition of this size and scope has never before been attempted. Discovery and Science Channel will capture the entire mission in the "Deep Planet" series to air in 2019. A collaboration between investor and explorer Victor Vescovo of Caladan Oceanic, Triton Submarines and EYOS Expeditions, the Five Deeps Expedition will deploy a two-person deep-sea research submersible named the Limiting Factor—the first commercially certified full-ocean-depth submersible. It will be transported and deployed into the ocean depths by the *Pressure Drop*, a ship retrofitted exclusively for the expedition. The mission will include dives to: Puerto Rico Trench (Atlantic Ocean, 8,648 m); South Sandwich Trench (Southern Ocean, 8,428 m); Java Trench (Indian Ocean, 7,725 m); Mariana Trench/Challenger Deep (Pacific Ocean, 10,898 m); and Malloy Deep (Arctic Ocean, 5,669 m).

)) Intel AI, Rolls-Royce Collaborate on Autonomous Shipping. Rolls-Royce is working to add autonomous shipping systems to its portfolio via artificial intelligence (AI) powered by Intel Xeon Scalable processors and Intel 3D NAND SSDs for storage. "Delivering these systems is all about processing—moving and storing huge volumes of data—and that is where Intel comes in," said Lisa Spelman of Intel. Ships will have dedicated Intel Xeon Scalable processor-based servers on board, turning them into cutting-edge floating data centers with heavy computation and AI inference capabilities. Rolls-Royce's Intelligent Awareness System (IA) uses AI-powered sensor fusion and decision making by processing data from LiDAR, radar, thermal cameras, HD cameras, satellite data and weather forecasts. The data will enable vessels to become aware of their surroundings, improving safety by detecting objects several kilometers away, even in busy ports. This is especially important when operating at night, in adverse weather conditions or in congested waterways. Data collected by the vessels are stored using Intel 3D NAND SSDs, acting as a "black box," securing the information for training and analysis once the ship is docked. Even compressed, data captured by each vessel can reach up to 1 TB per day or 30 to 40 TB over a month-long voyage, making storage a critical component of the intelligent solution. Ninety percent of world trade is carried out via international shipping—a number that is projected to grow.

)) Sonardyne Makes Acquisition. Sonardyne International Ltd. has acquired Chelsea Technologies Group Ltd. (CTG). The acquisition is part of a long-term growth strategy for Sonardyne to diversify into markets where it sees an opportunity to build on its core technology base and expertise in underwater acoustic and optical communications, navigation and autonomous monitoring systems. The acquisition will enable Sonardyne to strengthen its presence in the maritime, marine and ocean science sectors and create new opportunities in the water environmental, defense and process control markets. Chelsea will gain access to Sonardyne's considerable research, production, testing, compliance and global distribution capabilities, allowing the company to access many more international territories. Chelsea will remain an independent business as part of the Sonardyne group of companies. Chelsea's Brian Phillips will become executive chairman of the company, while Stephen Fasham will move from a senior management role at Sonardyne to become managing director at Chelsea. **ST**

Ensuring Safety Undersea

Technology Safeguards for Saturation Diving

By Danny Gray

Hidden far beneath the waves, commercial divers operate in some of the most dangerous and extreme conditions of any industry. Operating out of sight, often isolated and in a dark and cold environment, divers conduct complex operations even in the most hostile of settings, facing a plethora of potentially life-threatening risks. For this reason, it is vital that HSE (health, safety and environment) is the primary focus for every organization and corporation throughout all operations, and that divers have the utmost confidence in the safety standards applied to all work carried out in a subsea environment.

Divers are experts in their field and are trained to instantly recognize any signs of danger that may pose a risk to their lives or the lives of their fellow divers. However, the ability to successfully act upon these warning signs and conduct a safe rescue is almost entirely dependent on the capability and reliability of the equipment they are using, as well as the technologies they apply to provide the necessary contingency measures, should there be an incident.

Whether through accident or circumstance, the risks associated with any incident when operating subsea are of the highest degree and cannot be overstated. Reliable contingency measures need to be in place that cover all aspects of a safe rescue operation. This encompasses all stages of safely returning divers to the shore, from the provision of an emergency gas supply through to the safe decompression of the divers.

Divers need absolute assurance that, should they need it, their emergency gas supply will allow them sufficient time to return to the safety of the diving bell, even when operating in the more hazardous or extreme environments.



Given today's economic challenges, many divers operate as contractors to a range of companies and in a variety of regions, rather than as permanent employees to one company. As a result of this, safety provisions and emergency procedures can differ for individual operations.

Currently, regulatory requirements for the supply of emergency breathing gas vary

depending on the governing body and the regions in which the divers are operating. In addition, considerations need to be made for the conditions that will impact the supply of emergency breathing gas, in particular operating depth. Even where there is a more stringent regulatory requirement for the minimum supply of emergency breathing gas, such as under NOR-



The JFD COBRA rebreather set.

SOK or IMCA D 024 standards, it is not reflective of the technological capability available in the market today.

COBRA Rebreather

Until now, the industry standard for the provision of emergency breathing gas has been limited to just a few minutes, depending on the method employed and the diver's operating conditions. This poses a significant risk, particularly when working in extreme conditions. Indeed, there have been incidents that have resulted in a near-miss and could easily have become a fatality due to inadequate emergency breathing gas supply. It is a critical industry challenge that cannot be left unmet.



The JFD SPHL (self-propelled hyperbaric lifeboat).

In line with this, and as a direct response to the urgent need to drive significant improvements in safety standards, JFD developed the COBRA rebreather set, which provides an advanced emergency bailout provision that greatly extends the supply of emergency breathing gas, providing a supply of up to 33 min. at a depth of 120 m. COBRA is entirely mechanical with no complex electronic systems that could potentially compromise its safety and reliability. Compared to conventional bailout methods, such as the 7-liter/300-bar twin scuba set, which at 120 m provides 7.5 min. of breathing gas (based on a consumption rate of 40 liters per minute), the development of the advanced technology of COBRA is a significant step forward in improving subsea safety.

Earlier this year, JFD delivered six COBRA sets to Bibby Offshore in order to enhance diver safety, and since accepting delivery the company has successfully completed the first deep test dives in the North Sea. Bibby Offshore is the first North Sea contractor to adopt COBRA, thereby setting a precedent for diver safety in the region. COBRA is expected to be adopted by a number of other North Sea contractors as the requirement for safer practice increases, and JFD has also attracted interest from overseas customers who are recognizing the benefits the system offers.

The technology and capability exists in the market today to provide an extended emergency gas supply that will allow divers the best possible chance to get themselves to safety in the event of an incident that could threaten their lives. It is essential when undertaking operations of any nature or in any region that divers have the confidence that the companies they are working for will ensure the provision of a reliable, advanced emergency bailout rebreather capability that will provide absolute assurance that they can conduct their operations in the safest conditions possible.

Self-Propelled Hyperbaric Lifeboat

To safely return divers to the surface, all stages of the rescue and decompression process must be evaluated, and a capable provision provided to facilitate it in its entirety. Once the diver has left the diving bell, he or

she is reliant on the primary rebreather function, with the emergency gas supply readily available as a contingency measure to enable a safe return to the bell. However, this is one scenario and just one stage in the recovery process.

Saturation diving vessels (SDVs) require a rescue contingency for their divers in the form of a self-propelled hyperbaric lifeboat (SPHL). In the event of an emergency evacuation, hyperbaric lifeboats accommodate saturation divers for up to 72 hr. using onboard life support, during which time the vessel is transported to a facility where the divers can be safely decompressed.

SPHLs are one of the main means of evacuating divers from a saturation diving environment in the event of an emergency and are an important part of the majority of modern closed bell diving systems. Prior to SPHLs, less sophisticated evacuation methods, including floating pressure chambers, were used, but the operators had little or no directional control, and these chambers often drifted away from the vessel, increasing the complexity of the rescue operation. Alternatively, diving bells would be lowered over the side of the vessel, however, this required another vessel to rescue the stranded divers from the sea, increasing the length of time the divers remained at risk. Having access to an advanced SPHL capability ensures that divers can execute a controlled and safe return to the surface while remaining at pressure, minimizing the risk to the divers' lives.

JFD has supplied more than 135 integrated and modular saturation diving systems to clients around the world for the past 40 years, which includes some of the most advanced systems in existence. Through a recent joint venture alongside Singapore-based lifeboat manufacturer Vanguard, JFD has increased its capability and is now able to deliver a new generation of SPHLs, which greatly improve the chances of a successful, safe recovery and decompression of the divers. JFD has developed a range of advanced SPHLs for the commercial diving industry that combine proven, high-quality internal chambers and life-support equipment with specialist hull construction, ensuring there is a robust and reliable emergency-evacuation-at-pressure contingency in place.

Earlier this year, JFD successfully delivered two of the latest pair of SPHLs to Singaporean diving engineering firm Flash Tekk. The SPHLs are being delivered to Flash Tekk's parent company Ultra Deep Solutions, a builder and operator of ultradeep-diving heavy construction vessels, as part of an ongoing drive to realize significant improvements in safety standards in the offshore industry. In the event of a major vessel emergency, the new next-generation SPHLs have the capability to evacuate the entire complement of divers under pressure, safeguarding their lives and ensuring that the required decompression process can be carried out fully and without additional risk. The divers are transferred to a pressurized chamber contained within the SPHLs (located both port and starboard). They are then deployed with a coxswain and life support crew to deliver the divers to a safe environment where decompression can be carried out.

The successful delivery of the SPHLs represents the completion

of the second order under the partnership between JFD and Vanguard, with a further three planned projects underway. This partnership commits JFD and Vanguard to developing a range of next-generation SPHLs and integrated davit systems that drive significant improvements in safety standards within the industry.

Hyperbaric Rescue Facility

In the event that the SPHL has to be deployed from the DSV and has reached a safe haven, the divers are still at great risk of serious health complications, or even fatality, if they do not undergo a decompression process to gradually return their bodies to appropriate atmospheric pressure.

To undertake the operation of decompressing divers safely requires the capability of a full hyperbaric evacuation system (HES). A key part of this is a hyperbaric rescue facility (HRF) that can safely transfer rescued divers at pressure and deliver them to a hyperbaric rescue center (HRC) to facilitate decompression.

It is critical that this process is handled with care and due diligence to ensure that the divers are not exposed to any risk of decompression sickness.

JFD has designed and built multiple advanced HRF systems that are currently in operation globally. These are designed to allow for the configuration to mate to a recovered SPHL or to an HRC while operating anywhere in the world, connecting with a bottom or side-mated SPHL or side-mated HRC and maximizing the chances of a successful rescue. This allows divers to transfer under pressure to or from the HRF to carry out a safe decompression, thus minimizing health risks. JFD is proud of being at the forefront of hyperbaric safety and rescue, which is further supported by all activities carried out at our National Hyperbaric Centre.

Conclusion

The health and safety of divers must always be the primary concern for any operation, regardless of how or where it is carried out. In order to protect the lives of divers it is paramount that there are emergency measures in place, supported by the necessary technical capabilities, and that this covers the entire rescue and evacuation process, from deep sea to the shore. This means providing divers with advanced and reliable technical solutions that will allow them to return to safety at pressure and then undergo a safe decompression process. Every eventuality must be considered for each stage of the rescue operation, and the technical support solutions put in place for emergency life support must be innovative, reliable, fit for purpose and of the highest quality. Divers carry out vital work in keeping the offshore industries, including oil and gas, afloat. There can be no greater priority than ensuring their safety while they carry out their work. **ST**



The advertisement features a collection of Knudsen electronic equipment against a background of a fishing net. The products shown include a small 'SOUNDER' unit, a larger 'SOUNDER' unit, a 'CHIRP' unit, a 'CHIRP' unit with 'GOLD 5200' branding, a '320N' unit, and a 'PINGER' unit. A cartoon fish wearing a blue hat and goggles is positioned in the center. At the bottom, the text 'Survey's Best Catch of the Day' is written in a stylized font, followed by the Knudsen logo, the website 'WWW.KNUDSENENG.COM', and a Canadian flag.

JFD's Product and Support Director Danny Gray ensures compliance, safety and quality throughout the company's global product range. In a career spanning over 30 years, beginning at Gas Services Offshore, which became Divex and then JFD, Gray has worked predominately in production.

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Adaptive Robots at Sea

AUVs, ROVs and AI are Changing how we do Oceanography

By Kate Herries • Dr. Carlie Wiener

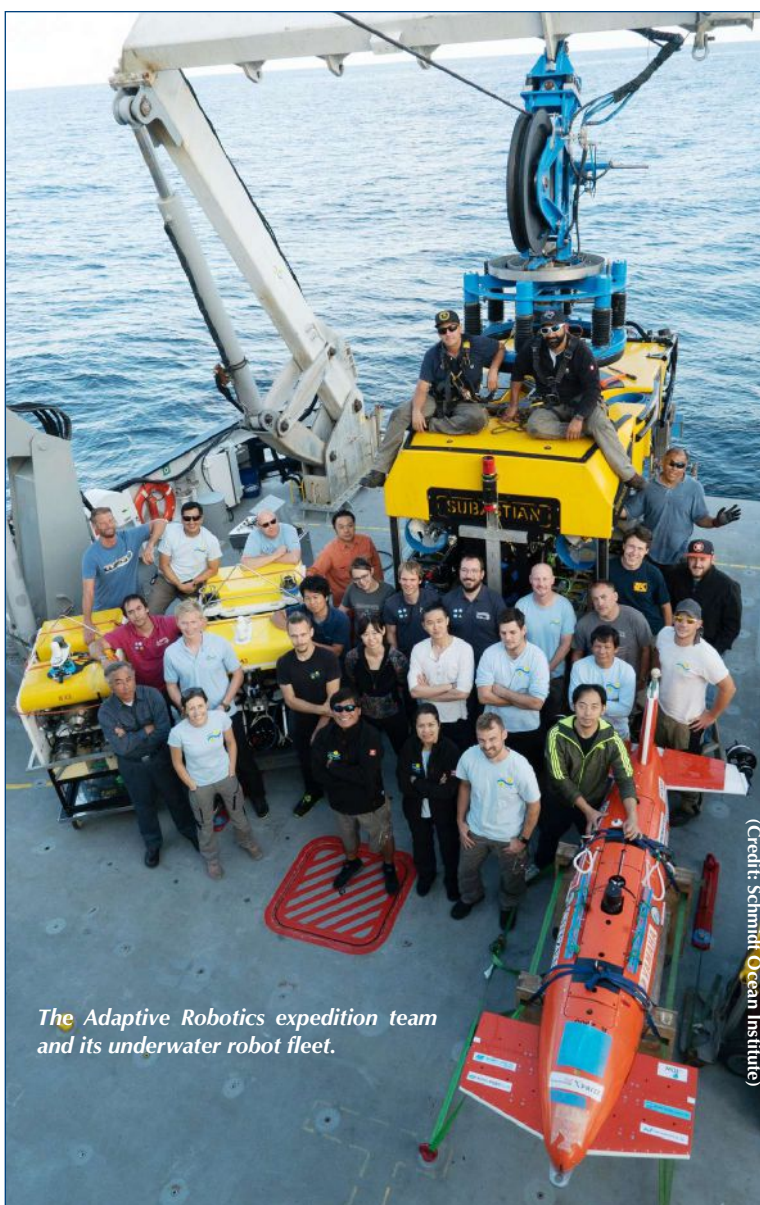
Data collection is something that happens in the field, and data processing typically occurs after data collection. Most discoveries that ocean scientists make occur when they come back to land after processing all of the data, instead of while they are at sea, when the information could be useful in real time.

Dr. Blair Thornton, University of Southampton (adjunct professor, University of Tokyo) and his international team of scientists and engineers sought to do things differently during an expedition aboard Schmidt Ocean Institute's RV *Falkor* in August 2018.

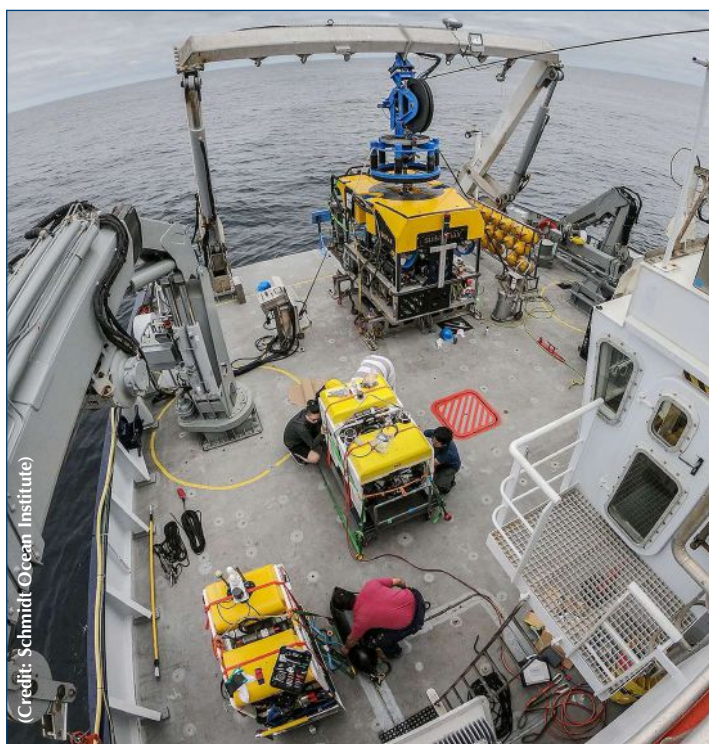
The Adaptive Robotics team headed to Hydrate Ridge off the coast of Oregon, a dynamic environment where gas is trapped inside pockets of "ice" (hydrate). When the hydrate melts and releases the gas, huge holes can be created on the seafloor. This environment is constantly changing and hard to predict. Understanding it, and the distribution of life within, is paramount for benthic ecology, climate and geologic hazards research.

The best way to understand environments such as these is to use large-scale, high-resolution mapping techniques. Traditional methods of studying these environments do not suffice. Thornton and his team were able to push the envelope on this expedition by processing data from underwater vehicles while at sea to make informed decisions, using observations from one underwater vehicle to educate them about where subsequent vehicles should be deployed.

"Most people are familiar with the fact that there are robots in the ocean doing things," said Thornton. "But many people think that if we have the robots, then the challenge of studying the ocean is solved. However, the robot is only



The Adaptive Robotics expedition team and its underwater robot fleet.



(Credit: Schmidt Ocean Institute)



(Credit: Schmidt Ocean Institute)

(Top) TUNASAND01, TUNASAND02 and ROV SuBastian on Falkor's aft deck. The robots worked together in coordination, acquiring high-resolution imagery of the seafloor during the Adaptive Robotics expedition. (Bottom) ROV SuBastian being recovered to Falkor's aft deck after a successful dive.

a platform to collect data, which humans need to interpret and understand in order to build new insight."

With the use of artificial intelligence (AI), underwater robots can boost human understanding by carrying more of the load of interpretation.

Robot Fleet

For this expedition, there were three AUVs (TUNASAND01, TUNASAND02 and AE2000f), developed by the University of Tokyo, and Schmidt Ocean Institute's 4,500-m-depth-rated ROV SuBastian. The team undertook data-gathering deployments with these robots to look at how the chemical, physical and biological prop-

erties in the water column and on the seafloor influence, or are influenced by, the distribution of animals in these environments.

Using AE2000f as a scout, the team created initial 1-cm-resolution, 3D visual reconstructions by flying the AUV at 10 m above the seafloor at 4 km per hour in order to identify areas of interest. This is higher and faster than typical AUV activity for color seafloor photography, allowing for a large expanse of seafloor to be covered. Once biological and chemical hotspots, such as bacterial mats and bubble plumes, were found, the team prepared for the next phase using artificial intelligence to determine where to do higher resolution photo mosaicking at 10 times the resolution of phase one.

During the second phase, two AUVs and ROV SuBastian were deployed to carry out more detailed surveys. The underwater robots hovered close to the seafloor, covering a smaller, targeted area and generating several 1-m-resolution, 3D visual reconstructions. These 3D photomosaics were obtained using a unique camera system designed for the AUVs and data-processing algorithms, which allow scientists to understand the data being obtained much faster than would otherwise be possible. The team also adapted ROV SuBastian with additional instruments, such as a Raman spectrometer, which tested pore water and the sediments within the hydrate fields.

With each vehicle deployment, Thornton and his team simultaneously began processing the new data that they received. Each robot brought about 200 gigabytes of imagery, or 20,000 images per dive, plus chemical and other measurement data. If the team were to look at all of that data manually, it would take a lot of time and effort. Using unsupervised clustering/unsupervised learning, a type of artificial intelligence, on the images allowed the team to make quick and informed changes to the expedition deployment plans and focus their investigations on specific areas of interest.

Color and texture provide a way for the algorithms to search for the main features desired by the team and cluster pictures that look similar. These groups of photos are then used by the scientists and engineers on board to determine where to sample next.

Evolving Toolset

"At the moment, humans generally make the decisions, but if we can prove that interpretations made by the vehicles can be trustworthy, then we will be confident enough to hand over the responsibility without jeopardizing valuable opportunities to get important information," said Thornton.

Because of this innovative underwater technology and algorithms, the team is confident that the detailed observations and in-situ chemical analysis were made exactly where needed in the field. The collected measurements gave the team detailed knowledge to make informed



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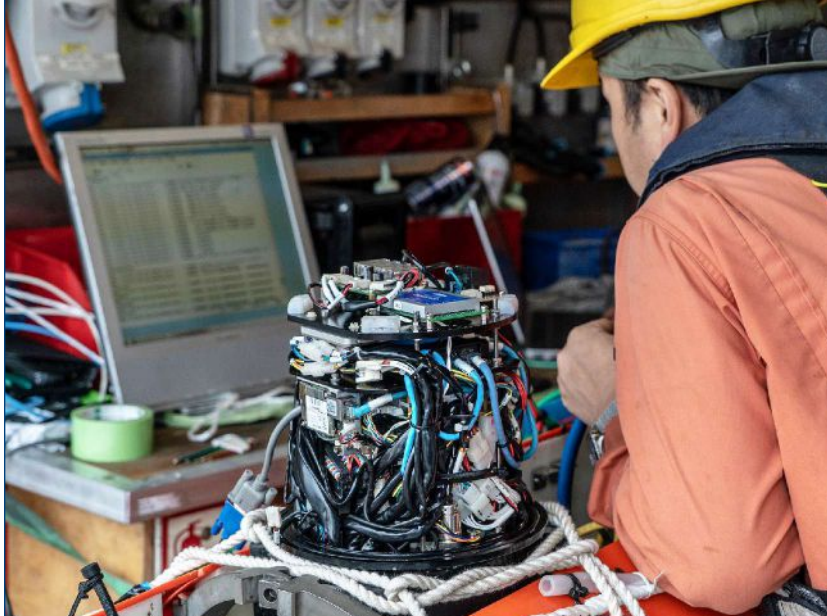
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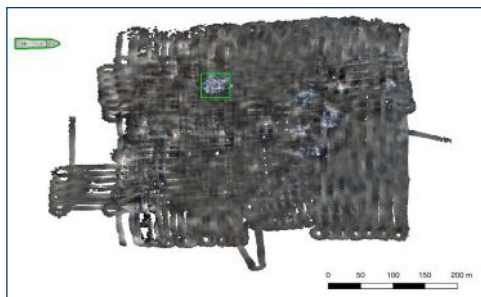
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(Top) The science team working on an AUV camera system in between deployments. (Credit: Schmidt Ocean Institute) (Right) One of the areas surveyed by AE2000f AUV, in rough proportion to RV Falkor. Note the observed area is about 500 by 300 m. The seafloor images were collected in less than 24 hr. of bottom time and processed while the team was still on site during the expedition. (Credit: Schmidt Ocean Institute, University of Southampton, University of Tokyo)



decisions on subsequent dives and data collection. This is an important process that future scientists can use to act and deliver on research within a 24-hr. period in quickly changing environments.

"In the future, if we can trust these algorithms enough, it should be possible to change traditional workflows and have robots inform each other of what they see in real time and make reliable decisions without the aid of a human in the loop," Thornton predicted.

The ocean is changing over multiple spatial and temporal scales. Oceanographers have many tools to study slow changes that take place in a single location but are limited when trying to understand processes over large areas and at fast temporal resolution. This work with AUVs and ROVs to quickly map and analyze the seafloor will contribute to the toolset of techniques available to oceanographers that will allow them to address things

they were not able to in the past. The work for Thornton and his team does not stop after leaving Falkor.

Even with artificial intelligence doing work in the field, there are still many images that need more detailed analysis and interpretation to help achieve a deeper understanding of the areas that were surveyed. The team will continue the work of analysis, likely with more expeditions in the future.

A summary video of the August 2018 expedition can be viewed at youtu.be/C-3ZZiw8fd4.

To learn more about the expedition, visit schmidtocan.org/cruise/adaptive-robotics-at-barkley-canyon-and-hydrate-ridge. **ST**

Kate Herries is a master's candidate at the University of Hawaii at Manoa. Her research focuses on reconstructing sea level rise during the last deglaciation. She received her bachelor's degree from Missouri University of Science and Technology. Herries is currently a science communications intern at Schmidt Ocean Institute.

Dr. Carlie Wiener is the senior communications manager at Schmidt Ocean Institute. She has more than 12 years of experience in marine science communications working on research, outreach, evaluation and professional leadership. She received her doctorate in environmental studies from York University in Toronto, Canada.

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USV Versatility

Bathymetric Dam Imaging for Infrastructure Safety

By George Galdorisi

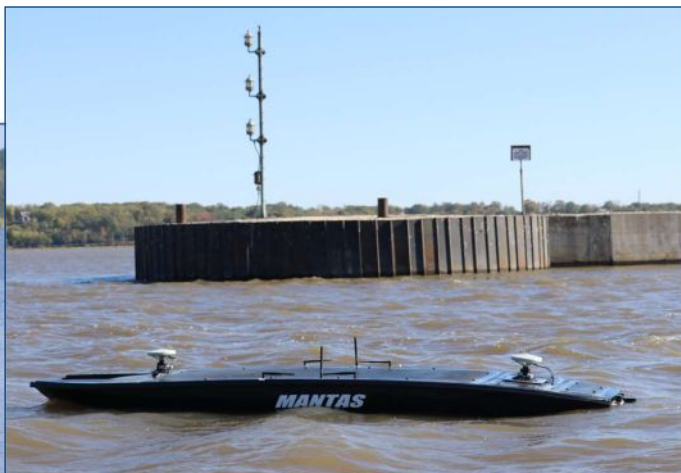
America's infrastructure is crumbling. We are far too accustomed to hearing a news report about a bridge collapse, a highway buckling or other local catastrophe as one indicator of this pervasive situation. Beyond these grim anecdotal news reports, most of us understand that deteriorating infrastructure is impeding our ability to compete in the thriving global economy. That said, most have only a general notion of the extent of the infrastructure challenge.

That is why every four years U.S. civil engineers provide a comprehensive assessment of the nation's sixteen major infrastructure categories in the American Society of Civil Engineer's (ASCE) Infrastructure Report

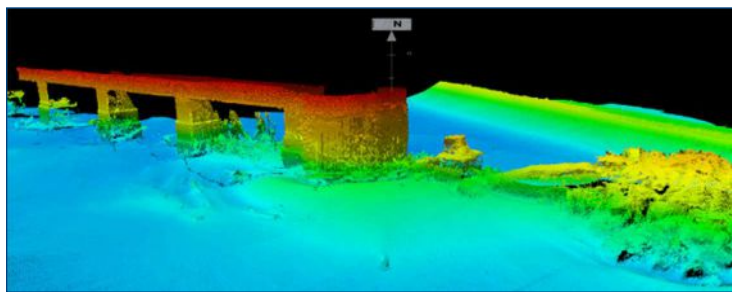
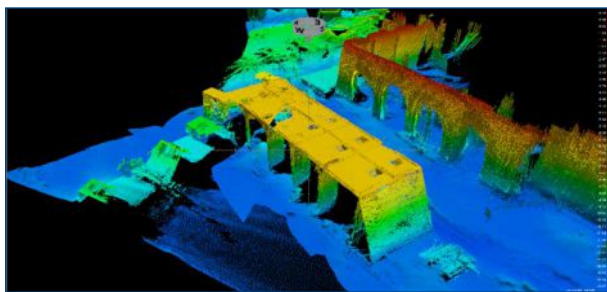
Card. Using a simple A-to-F grading system, the report card examines current infrastructure conditions and needs, assigning grades and making recommendations to raise them. Sadly, ASCE's 2017 report card assigned a D+ grade to the 16 collective U.S. infrastructure categories.

A Focus on Dams

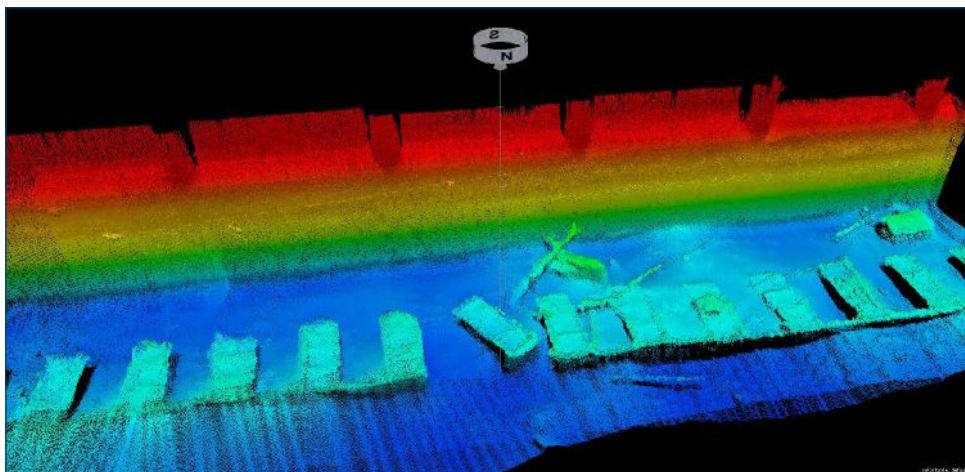
In these 16 categories, America's 90,000-plus dams fared among the worst, attaining an overall grade of D.



A MANTAS USV equipped with a Teledyne RESON T20 multibeam echosounder for Keokuk Dam survey.



(Top) Representative scans of dam structures from the Keokuk Dam survey. (Bottom) Expanded view of a Keokuk Dam structure.



Part of the challenge with managing and sustaining this part of U.S. infrastructure is the fact that the average age of dams in this nation is over 56 years old. Therefore, it is no surprise that the ASCE Report Card identifies more than 15,000 dams as “high hazard,” while 11,000 more are listed with “significant hazard” potential, meaning a failure would not necessarily cause a loss of life but could result in significant economic losses.

Many of us are only vaguely aware of what dams do for their local communities. Dams come in a variety of sizes and serve a number of purposes. Our nation’s dams provide essential benefits such as drinking water, irrigation, hydropower, flood control and recreation. The public most commonly thinks of engineering marvels like the Hoover Dam in Nevada rather than a smaller structure that, for example, creates a lake at the center of a planned community, provides power for a small city, or ensures flood control for a valley.

No matter how large or small, dams have a powerful presence that frequently is overlooked until failure has occurred.

By 2025, seven out of 10 dams in the United States will be over 50 years old. Fifty years ago, dams were built with the best engineering and construction standards of the time, but today’s standards are different. Many dams are not expected to safely withstand current or future predicted large floods and earthquakes.

One of the major challenges of certifying that America’s dams can be upgraded to ensure their continued viability is surveying underwater. Doing this kind of survey with divers is slow, expensive and essentially hazardous. The danger of using humans to survey the underwater portion of dams is not well understood. Many dams have violent, high-speed and high-volume currents that even the strongest divers cannot cope with.

Until recently, the technology needed to do a proper survey of the underwater portion of dams without putting humans at undue risk simply did not exist. Now, there are new and emerging technologies such as sturdy and reliable unmanned vehicles equipped with sophisticated sonars.

A Case Study: The Keokuk Dam

One recent example of how emerging technology has been employed to survey dams involved marrying an unmanned surface vehicle with a high-resolution multi-beam echosounder to conduct an underwater survey of the Keokuk Dam on the Mississippi River near Keokuk, Iowa in October 2017.

The Keokuk Dam is considered a nine out of 10 on the scale of danger and difficulty due to the high currents and eddies caused by water flowing through the dam. This made an appropriately equipped USV the ideal solution to examine the dam and provide precise underwater structural imaging.

By way of background, the Keokuk Dam was completed over a century ago in 1913. The movable portion of the dam is more than 4,500 ft. long, with 119 separate 30-ft. rectangular, steel-skin-plated, sliding gates. The gates are either installed or removed, and river flow is controlled by the number of gates installed. The gates are removed by a gantry crane that travels on the service bridge above the dam. At the time it was completed, the Keokuk Dam was second in length only to the Aswan Low Dam on the Nile River.

Due to the age of the Keokuk Dam, as well as the high risk to divers due to the strong currents and eddies, the facility’s owner and operator, Ameren Missouri, contracted with a Florida USV manufacturer, Maritime Tactical Systems (MARTAC) Inc., to conduct a comprehensive survey of the underwater portions of this dam. MARTAC produces a family of MANTAS unmanned vessels built on a catamaran hull. Ameren Missouri selected a 12-ft. MANTAS for this underwater bathymetric imaging. The MANTAS was equipped with a Teledyne RESON T20 multibeam echosounder.

The objective of the Keokuk Dam hydrographic survey was to develop the capability to map and inspect underwater structures with an unmanned surface vehicle, followed by the USV surveying the upstream and downstream sections of the dam.

The primary deliverable was a comprehensive, real-time, on-location hydrographic survey. This survey, in turn, resulted in a complete high-resolution bathymetric map and inspection report necessary to achieve the imaging and scanning requirements for the Ameren Dam Safety Group.

Earlier maps were developed using divers and manned surface vehicles. Not only did this technique put divers and other operators in harm's way but the resulting data lacked the necessary resolution to adequately detect scouring, defects or structural problems over a large coverage area. Using the autonomous USV equipped with the multibeam echosounder was expected to correct these issues.

The USV solution performed as expected with excellent resolution and in a short amount of time. The final survey took less than two days to complete and was performed through the joint effort of a MANTAS remote operator seated next to a hydrographer. Operating as a team, the real-time USV track and the real-time display of the received echosounder imaging was coupled to achieve the best dam and bottom images possible.

Based on the results of the Keokuk Dam hydrographic survey, additional proof of concepts were requested and

demonstrated. As a result, other dam imaging has been performed and more are scheduled. With more than 26,000 dams in the United States deemed structurally unsound by ASCE, there is a large potential market for such surveys that don't put people at risk.

Expanding USV Applications

While the focus of this article has been on commercial applications of highly capable and well-equipped USVs, uses for these vessels are vast and growing. As industry partners continue to bring increasingly capable and sophisticated USVs to U.S. Army, Navy, Marine Corps and Special Operations exercises, experiments and demonstrations, military operators will both help refine the missions these USVs can conduct and demand that these systems be made available as soon as possible.

In similar fashion, the continued introduction of USV technology into the commercial arena will continue to spread the need for USVs in a number of areas. Given the "D+" grade for all of America's infrastructure, USVs will likely be in increasing demand for survey operations for bridges, ports, inland waterways, dams, levees, canals and other infrastructure that cannot be safely or effectively inspected by humans.

Furthermore, given the urgency of addressing America's infrastructure issues and the staggering cost estimates for repairs, funding will always be a challenge. Using low-cost, off-the-shelf unmanned vehicles to replace human operators when inspecting infrastructure wherever



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“Using low-cost, off-the-shelf unmanned vehicles to replace human operators when inspecting infrastructure wherever and whenever possible will likely be a key factor in successfully undertaking needed infrastructure upgrades.”

and whenever possible will likely be a key factor in successfully undertaking needed infrastructure upgrades.

Selection Criteria

Both military and commercial USV customers typically consider several criteria when choosing which technology to use. One is endurance (underway time) and persistence (on-station time), as well as the need to launch and recover the unmanned asset. Since many infrastructure survey projects involve launching and recovering the USV at some distance from the survey site, unmanned vessels with low endurance and persistence can drive up costs to unacceptable levels.

A second factor is range, closely related to endurance. Affecting the range is whether the USV must be controlled via line-of-sight links, or whether it can operate beyond line-of-sight using military or commercial satellite communications. Where survey work is involved, distance and obstacles often make commercial satellite communications the preferred option.

A third factor is scalability. While using a single model of an unmanned surface vehicle can allow for a variety of functions, if a USV is part of a family of unmanned surface vehicles of the same basic construction and configuration, this greatly enhances the options for use. For bathymetric survey work, this might involve using a smaller USV to get into tight confines and a larger USV to deal with high-speed currents or other dam-created turbulence.

A fourth factor is payload capacity. Extended payload capacity enhances the utility of any USV. This includes not only how much weight the USV can accommodate to support various sensors but how these

sensors can be packaged on the unmanned surface vehicle to enable it to have the most operational flexibility. Also important is the ability to switch sensor packages in the minimum amount of time.

A fifth factor is durability. The harsh maritime environment can damage, disable or even destroy small vessels like unmanned surface vehicles. If a specific USV design is restricted to calm sea states, its operational value is greatly diminished. This is one reason why those seeking to use USVs for bathymetric surveys and other infrastructure inspection efforts often turn to USVs that have been “wrung out” in military exercises, experiments and demonstrations.

A sixth factor is speed, including: most economical cruise speed, burst speed and speeds in various sea states. In much the same way as high endurance, persistence and range, high speed can lower costs, especially in extensive survey work.

As readers of *Sea Technology* know, the commercial uses of unmanned surface vehicles are growing rapidly. This is due to the fact that these USVs are proving to be increasingly adept at doing “dull, dirty and dangerous” work in commercial applications as they do in the military missions that keep warfighters out of harm’s way. Look to these pages in the future for additional applications of this technology. **ST**

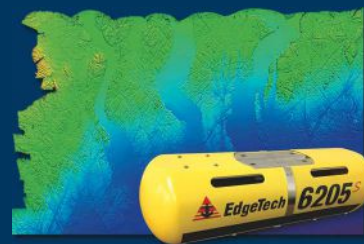
Captain George Gal-dorisi (U.S. Navy, retired) is a career naval aviator whose 30 years of active-duty service includes four command tours and five years as a carrier strike group chief of staff. He has a graduate degree in oceanography and has worked with unmanned systems throughout his Navy career.



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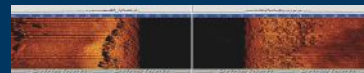
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Underwater Intervention

UI 2019 UNDERWATER INTERVENTION

Underwater Intervention (UI) is the world's premier event for commercial diving contractors, ROVs, manned submersibles and all other aspects of the underwater operations industry. It will take place February 5 to 7, 2019 in New Orleans. UI 2019 promises to be a must-attend event. Industry leaders from around the world will converge for three days of face-to-face meetings, education and networking.

In today's competitive climate, it is the goal of UI 2019 to provide as much value to all of its participants as possible. It is no secret that in order to flourish, we must evolve to best position ourselves for success. In that spirit, UI continues to best meet the needs of the entire underwater operations industry and help companies position themselves for success now and in the years to come.

As with past conferences, the Underwater Intervention Leadership Committee has been working tirelessly to deliver compelling, topical education. Organized in a thoughtful, well-planned schedule, you won't have to choose between sessions or time in the expo hall because there is dedicated time for both.

Premier Events

At its latest show, UI will feature the 2025 Offshore Oilfield Panel. This industry-shaping discussion is hosted by BP. Unique to UI 2019, this panel will unite top operators and service companies in conversations regarding leading-edge safety, technology and cost-effectiveness within the inspection, maintenance and repair (IMR) market. This event is guaranteed to attract many industry thought leaders in the audience.

Another event highlight, exclusive to UI 2019, is the Stennis Space Center Tour. The U.S. National Buoy Data Center (NBDC) and Naval Oceanographic Office (NAVO) will host a

tour of their operations facility on Monday, February 4. Those participating will gain an understanding of how data are generated, maintained and utilized at this core asset within the U.S. space in-

frastructure.

Special Features

The UI Think Tank will return, located in the exhibit hall for added convenience. Two sessions are being planned and designed to be informative as well as interactive. Join either or both sessions to learn and share ideas on industry challenges and best practices.

Supplier solutions will, as always, be part of UI. Attendees will have the chance to learn from the leading exhibitors who have their thumbs on the pulse of our industry. See from their perspective the latest and best innovative solutions for the industry challenges we face every day.

Another recurring UI feature, the Underwater Innovation Showcase is designed to push boundaries in underwater intervention with informative, interactive sessions that will provoke thought sharing in industry-shaping conversations.

With dedicated hours for the exhibit hall, UI 2019 is an efficient and cost-effective means for top-level industry executives and suppliers to meet in person and develop meaningful business relationships while evaluating the best products and services on offer in the industry.

UI 2019 is the best platform to learn, share and network for the underwater operations market. It is designed to be an enriching and enjoyable experience.

To register, visit underwaterintervention.com. To exhibit, contact the UI 2019 show management team at ui@naylor.com. **ST**



iXblue navigation expertise chosen for Kaombo ultra-deep-water offshore project

sponsored by iXblue



iXblue Phins Subsea & Rovins Inertial Navigation Systems (INS) have been chosen by TechnipFMC and Fugro to provide accurate and reliable navigation information for the highly complex Kaombo ultra-deep-water offshore project.

Located 140 km off the coast of Angola, the Kaombo project is one of the biggest ultra-deep offshore development in the world. Reaching depths of 1,950 meters, the six fields of the project cover a surface of 800 km² and are connected to two FPSO (Floating Production Storage and Offloading) vessels via 300 km of subsea pipelines, making it one of the largest and most complex subsea well system for a single project. This high complexity in terms of size and duration of the project (over 2 years), as well as the extreme temperature

and pressure conditions due to the depths involved thus required the use of sea-proven inertial navigation technology that is both reliable and cost-effective.

iXblue FOG (Fiber-Optic Gyroscope) inertial navigation expertise was therefore selected by TechnipFMC and Fugro, who chose the Phins Subsea and Rovins INS to provide highly accurate and reliable position, heading and attitude to the WROVs conducting the challenging subsea operations.

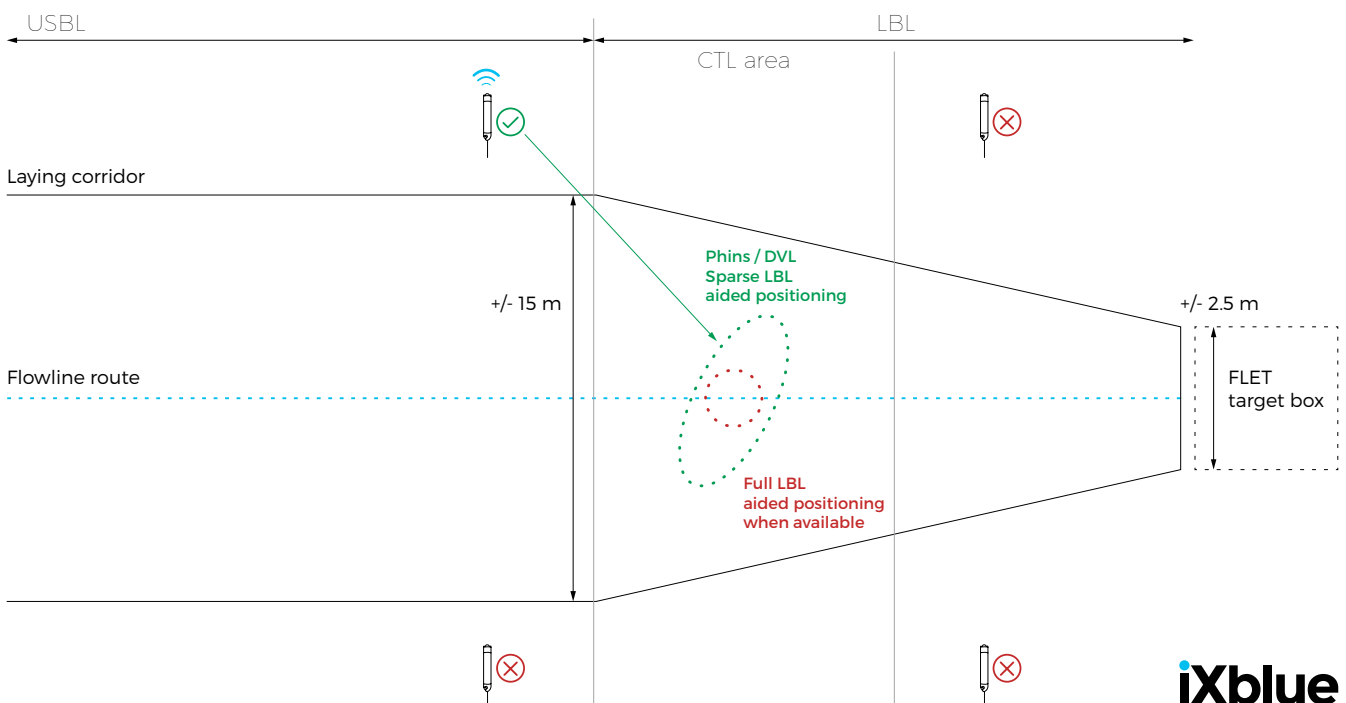
iXblue Rovins INS, that now provides a position accuracy of 0.1% of the Traveled Distance, was thus mobilized on the construction vessel to conduct various operations such as umbilical lay, flying leads, jumper and spool installations, as well as installation of 500 structures on the seabed.

"In support of Fugro FineTrack, our field proven solution using its own Kalman filter, iXblue INS provides a robust positioning reference. This strong combination provides our surveyors and clients with excellent subsea navigation." Explains Hans Vink, Project Manager at Fugro.

iXblue Phins Subsea INS, that equipped TechnipFMC Deep Blue pipelay vessel's WROV, also played a crucial de-risking role during CTL (Cut To Length) operations, in

case of third-party LBL transponder failure within the second-end FLET (Flowline End Termination) target box LBL array. Indeed, by providing high positioning performance (now 0.05% of the Traveled Distance), iXblue Phins Subsea INS, tightly coupled with a DVL (Doppler Velocity Log), was able to greatly reduce the dependence to full LBL position, allowing for accurate positioning of the WROV even with only one remaining functional transponder within the second-end FLET array (see figure below). An essential advantage for this project, without which LBL transponder failure would have led to lost vessel time and higher operational costs, as a LCV (Light Construction Vessel) would have had to come replace the faulty transponder, while the pipelay vessel would have been in stand-by.

"Accurate and efficient subsea positioning requires the use of Inertial Navigation Systems. INS not only enhance acoustic positioning but also allow a drastic reduction of the LBL interrogation rate thus removing the need for transponder replacement. iXblue Phins and Rovins have perfectly supported our WROV's operation all over the 2-years ultra-deep offshore operation." States Elie Jelelaty, Operation Manager at TechnipFMC. ■



Delving Deeper into Biofilms

Understanding Biofilms to Develop Industry Solutions

By Jennifer Longyear • Marie Dale



(Top) Ship slime is a smart microbial lifestyle: Microalgae and bacteria produce an extracellular matrix that provides the micro-organisms with adhesion to the surface, cohesion within the biofilm and protection from mechanical and chemical disruption. (Bottom) Environmental scanning electron microscopy reveals the often beautiful morphological detail of diatoms, single-celled microalgae that are typically major constituents of marine fouling biofilms.

the International Space Station. As researchers, we look for solutions by examining similar problems that exist across fields. Understanding biofilms in a holistic way helps us find a solution for the issue of biofilms in the marine industry.

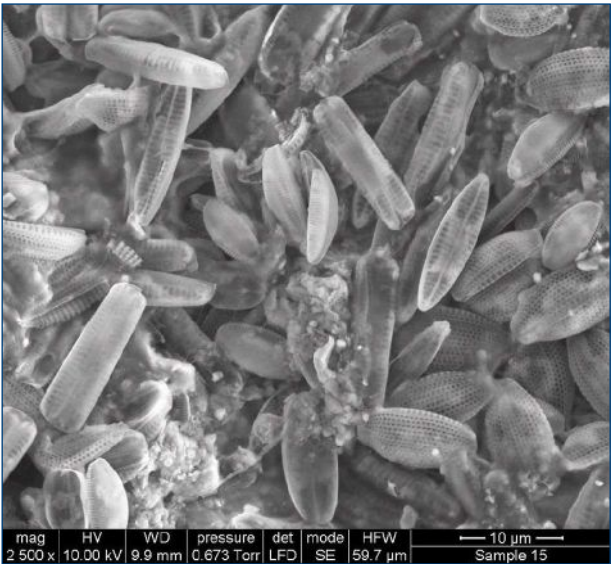
Community and Composition

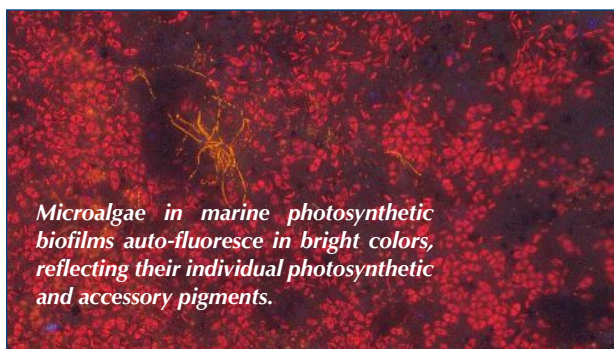
Whether marine, clinical, industrial or extraterrestrial, biofilms are characterized by properties that give them superpowers of persistence, which are especially vexing in industrial contexts. A biofilm is made of living micro-organisms embedded in an extracellular polymeric matrix, which some or all of the cells produce, and typically is adhered to an immersed surface.

Ships that sail the seas foul to slime. What do we know about this universal biofouling problem, and what are we doing about it?

As fouling control coatings researchers at AkzoNobel, we are interested to know about the drag consequences of biofilms (slime) on ships. But it is important to note that the marine industry is not alone in facing a biofilm challenge.

Surgeons worry that biofilms on implanted medical devices will introduce pathogens to patients, or that biofilms in chronic wounds will lead to reinfection. Biofilms in dairy plants can result in food spoilage. Accumulated biofilms in power plant cooling towers can drastically reduce heat exchange. Biofilms can reduce the cross-sectional area of pipes, making drinking water transport inefficient or blocking fuel lines. Dental biofilms can lead to painful tooth decay. Biofilms are even a problem in space, where they might act as hotbeds of microbially induced corrosion on long-term installations, such as





The community diversity can range from biofilms dominated by only a few species of bacteria to highly diverse environmental biofilms that contain thousands of species of bacteria, microalgae, fungi, protozoa and other species, all living in close association. The architecture, chemical compositions and physical properties of biofilm matrices are likewise variable, reflecting the species that form the biofilm and the local environmental conditions, such as local flow conditions. Finally, these diverse microbial systems are highly adaptable and can respond to environmental change on a time scale of minutes, hours or days by modifying their biological, chemical and physical properties.

The Matrix: A Slime Shield

Living within the slimy biofilm matrix provides micro-organisms with notable advantages. The matrix is not

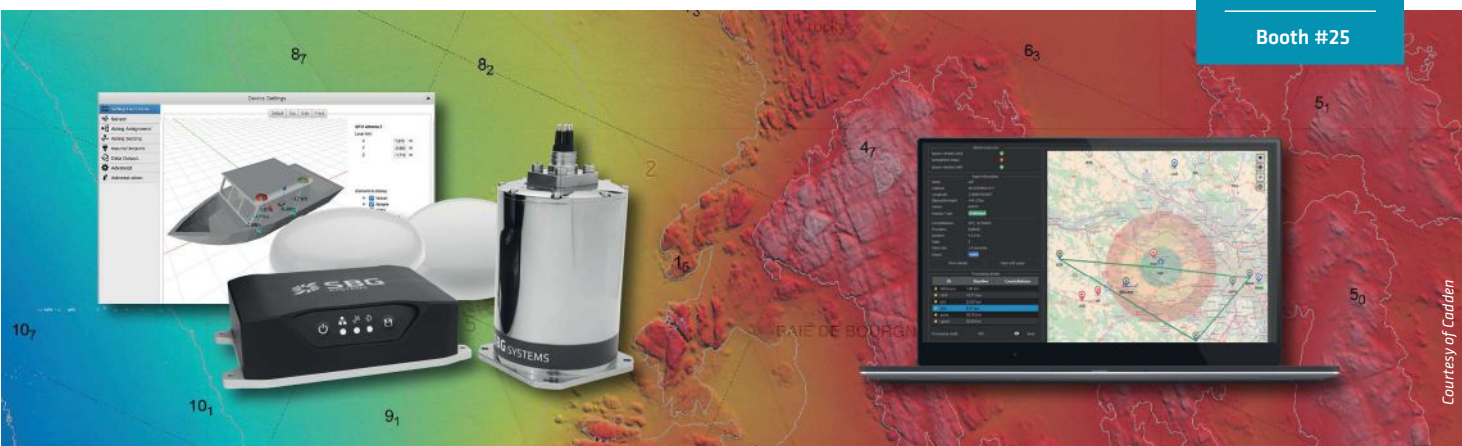
a rigid material but rather is viscoelastic, which means that biofilms will both stretch (like a rubber band) and deform (like clay) in response to shear forces, such as water flow, jet washing or toothbrushing. That means biofilms are resistant to removal by physical disruption. The viscoelastic matrix will stretch and ripple before breaking or dislodging from a surface, anchoring the microbes into a favorable growth environment.

The matrix also shields the microbes from chemical attacks by antibiotics or biocides, and that has been put forward as a contributing factor as to why slime grows on biocidal marine coatings. In some instances, substances in the matrix would directly sequester chemical agents, while in other cases, the matrix provides a simple physical diffusion barrier, where less and less of the chemical actually moves into the deepest areas of the matrix. Cells inside this most protected zone of the matrix may be effectively starving and fall dormant, because nutrients would also have to cross the diffusion barrier. However, these dormant cells are a kind of microbial reservoir, and should all the other cells die and the outer layers of the biofilm disintegrate, the inner cells may jump-start the community all over again and refresh the biofilm.

Slime and Ships

Bottom line: The amazing resilience of biofilms to physical and chemical stresses, combined with the diversity of marine microbes, is why biofilms will eventually grow on any immersed marine coating in real-world ves-

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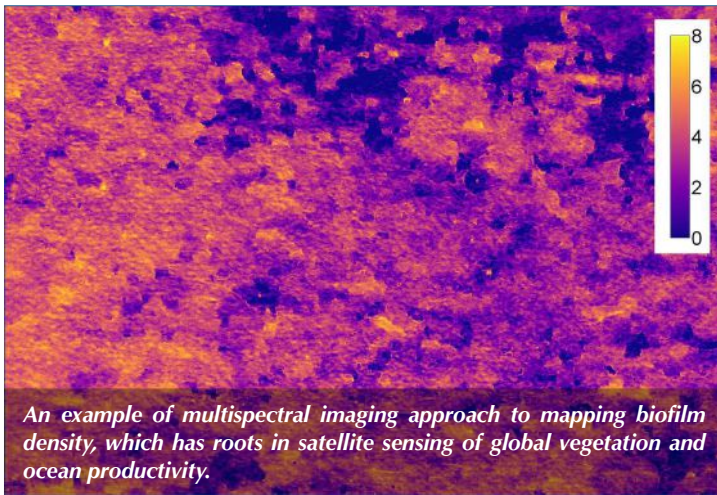


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sel operating conditions. The AkzoNobel fouling control marine biology, hydrodynamics and coatings research teams are incorporating investigatory methods from across the multidisciplinary fields of biofilm science to better understand the diverse properties of biofilms that form on marine surfaces, whether or not coated, and, in parallel, improve our coating development processes.

Diversity of Biofilms In Marine Industry

If you survey the hulls of newly drydocked ships around the world, or even the experimental coating

panels that have been immersed at our field testing sites, you would intuitively grasp that not all fouling biofilms are the same. They vary in color, texture, spatial coverage and thickness, and these visual cues suggest there might be further differences in slime microbial communities and in the frictional drag penalties attached to these different biofilms. So, our fouling control R&D teams have been asking whether we could develop a biological slime metric that was a robust predictor of the associated drag penalty.

Diatoms. For the biologists in the team, a natural first approach has been to look at the communities in fouling biofilms. Marine ship biofilms generally comprise both bacterial and microalgal populations, and one of the most recognizable constituent microbial groups are the diatoms. These single microalgal cells are encased in intricate silica shells and can be identified by shell morphology. We've used both environmental scanning electron microscopy and standard light microscopy on biofilm samples collected from ships and cataloged the slime diatom diversity at different hull locations, demonstrating that ship slime varies along and down the hull and varies from ship to ship and from coating to coating.

Pigments. Though diatoms are common in fouling marine biofilms, they are by no means the only microalgae present. All the microalgae contain pigments that they use to convert light to energy by photosynthesis and

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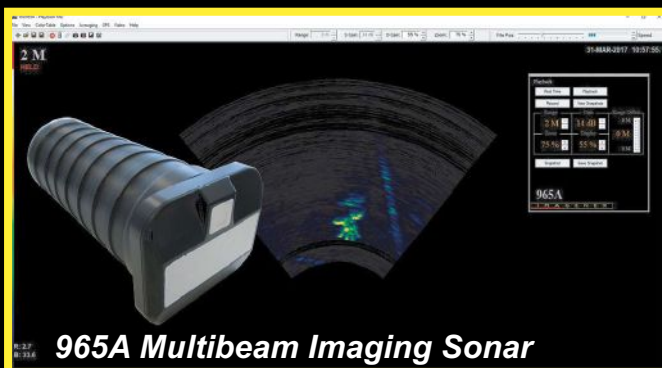
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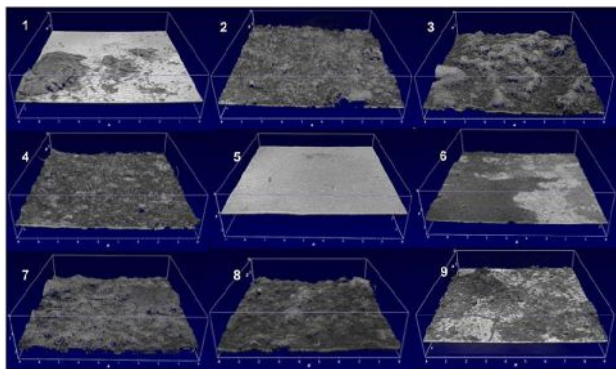
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OCT imaging reveals highly visible differences in slime topography for biofilms grown over 13 months on nine different coatings, including both biocidal and nonbiocidal coatings.

additional pigments, which play other associated roles and are often specific to a particular type of algae. The collections of pigments in microalgal samples are regularly used in oceanography as broad fingerprints of the different algal groups in those samples, and we've adopted the same approach to characterize slime. Biofilm pigment analysis by high-performance liquid chromatography (HPLC) has revealed that in at least some experiments, several coatings are well-colonized by a particular type of microalgae that is effectively absent from other coatings.

Fluorescent Microscopy. Another property of microalgal pigments is that they auto-fluoresce at different wavelengths—they capture short wavelength light (ultra-violets and blues), absorb some of the energy, and then re-emit the light at longer wavelengths (oranges and reds). We can examine slime auto-fluorescence by epifluorescence microscopy and identify the diatoms (deep red) and cyanobacteria (orange), confirming visually the output of pigment analysis by HPLC.

Metagenomics. Metagenomics is another way to get a broad view of the total community in a fouling biofilm. We've been partnering with university microbiologists and bioinformaticians to look at how bacterial diversity and total fouling community diversity reflect the influences of the underlying coating as well as biofilm maturity.

AkzoNobel biology team researchers have extracted DNA from hundreds of slime samples, and each new result offers an exciting insight as to how communities form.

Biomass. While community is important, we also want to be able to pair the type of biofilms with reliable and objective measurements of quantity. To estimate total biomass, we've once again taken advantage of the fact that most ship slime contains photosynthetic, pigmented microalgae. In oceanography, the amount of chlorophyll in a body of water is a long-established proxy for how much photosynthetic microalgal biomass is floating in the sea. Chlorophyll absorbs red light and reflects green light, which is why it appears green, and it has similar characteristic absorption properties for other light wavelengths. If you can measure how much light is

absorbed and reflected by photosynthetic biomass, you can approximate how much biomass there is. Multispectral biomass imaging, as this approach is called, is how the global marine microalgal conversion of sunshine to biomass is mapped from space by satellites. We've been developing similar methods to benchmark coating performance in lab assays, immersion trials and on ships, and we think not only about how much biomass is in slime but how it is distributed across the surface of a ship.

Optical Coherence Tomography. How do biological properties pair up with physical properties, such as thickness, surface roughness, texture and viscoelasticity? As of a few years ago, it was a real challenge to measure the surfaces of biofilms—laser light reflected and scattered from the surface, indentation methods just deformed the surface, and microscopy could only image very small surface areas.

But in the last few years, biofilm imaging has opened up with the adoption of a technology called optical coherence tomography (OCT). OCT lets us image down through living biofilms over a surface area approximately the size of a penny. For the past three years, we've been using OCT imaging to get a closer look at the biofilms that grow on different coatings and developed methods to convert image data to biofilm topography, thickness, biovolume and surface roughness data. OCT imaging can also collect real-time video, and we're exploring how fouling biofilms on different coatings respond structurally to hydrodynamic shear.

Looking Ahead

One of our main objectives is to develop biological and physical predictors of biofilm drag, so as to incorporate those metrics into coating development. Biofilms are natural superstructures and are not an easy challenge to address, which is why we are actively applying the investigative methods outlined here together with techniques from across the diverse field of biofilm science in our development of next-generation slime-free coating technologies.

In parallel with biological method development, the hydrodynamics and marine biology research teams have been developing both in-house and collaborative approaches to measure the drag of slime on coatings. With flow cells and rotating disc systems, collaborative projects and in-house experiments, we are working to understand which methods are best suited to tie slime hydrodynamics and biophysical properties together. **ST**

Jennifer Longyear is a research biologist in the fouling control team within AkzoNobel's Marine and Protective Coatings business. Longyear earned her undergraduate degree at Cornell University before moving to Canada to study for a master's degree in oceanography at Dalhousie University. She leads the Marine Biology Research Project and was instrumental in developing a bioassay-based screening process to speed up fouling testing for AkzoNobel's Intersleek 1100SR project.

Marie Dale is a research biologist in the fouling control team within AkzoNobel's Marine and Protective Coatings business. She earned her undergraduate degree at Plymouth University before joining AkzoNobel. Dale designs new methodology to assess, predict and quantify the fouling control performance of surfaces against biofouling alongside research into characterization of marine biofilms.

international

New Software Distributors in UK and Ireland

Swathe Services will take on responsibility for sales and maintenance of HYPACK software solutions in the U.K. and Ireland after Del Norte Technology closes. The company will continue to run biannual multibeam echosounder HYPACK training courses to improve surveyors' knowledge and efficiency using HYPACK software. Swathe Services is a hydrographic survey company based in Cornwall, U.K., that specializes in multibeam echosounder (MBES) surveying.

Second ROTV Installed on Australian Vessel

MacArtney has supplied a second ROTV (remotely operated towed vehicle) system for the RV *Investigator*. The TRIAXUS E ROTV has a higher payload capacity and enables the installation of a wide range of sensors. RV *Investigator* has also been equipped with a CTD, a transmissometer, a fluorometer and a photosynthetically active radiation sensor.

Mooring Services Company Acquires English Grapnel and Chaser Company

InterMoor acquired all intellectual property of the BEL Grapnel & Chaser company, including drawings, designs and cast patterns for its anchor and chain-handling equipment. BEL is a manufacturer of grapnel and chaser

products integrated with Inter-M chain and wire-chasing and recovery equipment. Grapnel hooks are used in recovery of dropped components offshore; chasers enable steady and controlled lowering and raising during the installation and recovery of mooring system components.

Dredging in Ireland Monitored by Field Buoy

A turbidity monitoring buoy built by OSIL will be re-deployed by BAM Construction on a dredging project in Ireland. The buoy was originally purchased as part of the €8.5 million Bantry Inner Harbour Redevelopment. The 0.7-m small field buoy can be deployed from a small boat by hand, and it will monitor continuous dredging in a berthing pocket adjacent to the new quay at Cork Container Terminal. The buoy is equipped with a wiped turbidity sensor with a conversion factor to change side scatter output readings to total suspended solids in mg/L.

US and UAE Air Pollution Companies are Partners

Ship & Shore Environmental, a U.S. pollution abatement firm that specializes in capture and control of VOC emissions, announced a new partnership with UAE company Amerair International to increase their global market presence.

Ship & Shore has recently entered into the wastewater, oil and gas, and biogas industries.

The companies' joint effort aims to offer a variety of global pollution abatement technologies and engineering solutions.

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Imagery obtained with the ECA Group portable AUV A9-M equipped with the Klein UUV 3500 low power, light-weight, compact sonar payload.
Altitude 5m Depth 90m @ 3 knots



Italian and French Shipbuilding Associations Identify Key Future Innovation Areas

The Italian and French shipbuilding industry associations, ASSONAVE and GICAN, signed a research, development and innovation roadmap for shipbuilding and ship supply at Euronaval. The agreement seeks to identify the key technologies that the shipbuilding industry should develop in the next 10 years and beyond. They defined five key areas where major investments should be concentrated: green ships with low environmental impact, smart ships, autonomous vessels, smart offshore infrastructure solutions and smart shipyards.

UK Study Explores Smart Navigational Charts

The UK Hydrographic Office (UKHO) contributed to a U.K. government study on navigational requirements for autonomous maritime vessels. The UKHO worked with L3 ASV and the Maritime and Coastguard Agency to identify future data requirements for autonomous shipping and explore how navigational and wider geospatial data enable the safe navigation of smart and unmanned autonomous vessels. The study explored a smart chart system that incorporates data such as radio signals, regulations, tides and foundation navigational data.

RBR China Now Open in Qingdao

RBR China has been established to support collaborative business development activities in China. The coastal city of Qingdao is the hub of oceanographic research in China and home to Ocean University of China, First Institute of Oceanography, North China Sea Branch of SOA and the Institute of Oceanography of the Chinese Academy of Sciences. RBR China will continue collaborations with university and government offices and develop demonstration projects to introduce new products.

ROV to Explore Mineral Extraction Methods

The ¡VAMOS! project funded by the EU Horizon 2020 program includes 16 partners from nine EU countries and seeks to address the need for critical raw materials by making possible the extraction of mineral deposits from inland water-bearing areas. The partners have developed a system whereby a remotely operated mining vehicle is launched from a waterborne carriage.

The ¡VAMOS! partners met this fall with geologists, researchers and citizens at a technology demonstration day at the Magcobar flooded mine pit in Silvermines, Ireland.

Wind and Sun Power System for Ships Prepares for Sea Trials and Production

Eco Marine Power (EMP) has begun a collaboration with ClassNK to confirm design requirements and issues related to sea trials and commercial production of the EnergySail and Aquarius Marine Renewable Energy solution. The Aquarius MRE is an advanced integrated system of rigid sails, marine-grade solar panels, energy storage modules, charging system and marine computers that will enable ships to harness renewable energy from the wind and sun.

Ultrashort Baseline Equipment Sells Worldwide

Sonardyne reported new ultrashort baseline (USBL) equipment sales across Europe, Asia and the Americas. XPRIZE finalists TeamTao acquired a Ranger 2 GyroUSBL system for communicating between a swarm of underwater drones and an unmanned surface vessel. Thai company Beacon Offshore acquired a Ranger 2 survey package for the subsea support vessel SC *Sirapat*. Brazilian company Belov Engenharia acquired a Mini-Ranger 2 USBL system to track its ROVs during IRM work on floating production, storage and offloading vessels. Vietnamese company Greenstar Positioning acquired two Mini-Ranger 2 USBL underwater positioning systems.

Fugro and L3 Develop Autonomous Survey Tools

Fugro has signed a joint development agreement with L3 ASV, an unmanned and autonomous vessel technology company, to create the next generation of autonomous vessels for the commercial survey market. The partnership brings together the expertise of both companies for the development of a variety of fit-for-purpose USVs. Delivery of the first USV is scheduled for 2019.

Ballast Tech Co. Opens Asia-Pacific Subsidiary

BIO-UV Group has supplied its BIO-SEA ballast water treatment system to more than 100 vessels, with more orders in progress. Owners operating the UV-based BIO-SEA include Maersk Lines, MSC Cruises, CMA CGM and Louis Dreyfus Armateurs. BIO-UV has a network of sales and distribution agents in more than 65 countries. This year, it opened a subsidiary in Hong Kong: BIO-UV Asia.

America's Cup Racing Team Develops Simulator

Artemis Technologies, a spin-off from America's Cup challenger Artemis Racing, has developed a new fast craft simulator with Cruden. The simulator runs on Cruden's Panthera simulator software and features a bespoke top platform based on a key section of an F50 catamaran. The simulator will be used for engineering analysis of different designs, developing control systems and training crews for future race series.

Tugboat Statistics Report Now Available

Marcon International's Tug Boat Market Report is now available online. The report contains summaries of data from Marcon's databases regarding tugs for sale in the U.S. and worldwide, compilation of news from vessel builders and operators, summaries of major economic influences on the market, and featured listings. Marcon reports 523 tugs officially on the market for sale out of 5,057 tracked. This is down 11.8 percent from a year ago, mostly due to scrapping of older, lower horsepower tugs.

Thordon Signs with Russian Distributor

Thordon Bearings signed distribution agreements with Industrial & Marine Projects (IMPRO) and Tallinn's Marine Ecology Equipment (MEE). The addition of distributors for Lithuania, Latvia, Estonia, Russia and Azerbaijan coincides with concerns about the impact of oil pollution in the ecologically sensitive Baltic and Caspian Seas. **ST**

FastBallast Technology Undergoes Canadian Ballast Testing

The Canadian government selected Chelsea Technologies' FastBallast compliance monitor for trials in a ballast water monitoring program conducted by Fisheries and Oceans Canada and managed by the Great Lakes Laboratory for Fisheries and Aquatic Science. The test will assess the technology's ability to prove compliance with the Ballast Water Management Convention (BWMC). FastBallast uses a single-turnover method to provide a lower detection limit of less than 1 cell per mL, and its statistical method generates an estimate of cell density that is independent of an assumed level of fluorescence per cell.

Local History Mapping Software Contributes to Better Navigation

A collaboration between FarSounder, the International Hydrographic Organization (IHO) and NOAA is assessing and producing new nautical charts. FarSounder has joined the IHO's Crowd-Sourced Bathymetry (CSB) initiative by becoming a "trusted node" with NOAA. The project enables mariners to contribute seafloor depths measured from their vessels to NOAA's data repository. Using FarSounder's local history mapping feature, data sets will be added to the IHO Data Centre for Digital Bathymetry (DCDB), allowing worldwide use of the data.

Caribbean Regional Comms Program Creates School and Government Networks

Deep Blue Cable, which is the developer, owner and operator of a state-of-the-art subsea fiber-optic system being constructed to provide connectivity across the Caribbean islands and to the Americas, will work to support CARCIP, a 15-year contract with the governments of the Caribbean nations of Saint Lucia, Grenada and Saint Vincent and the Grenadines. It will include a government wide-area network (WAN), a schools network and a submarine cable between Saint Vincent and Grenada with landings on five Grenadine islands.

Unused Vessels Removed from Columbia River

Global Diving & Salvage recently completed an environmental cleanup project for the Oregon Department of State Lands, removing 11 derelict commercial vessels from a state leasehold on the Columbia River. The project included project management, diving, salvage and environmental services, as well as coordination among multiple subcontractors, state and environmental agencies and the U.S. Coast Guard.

Maritime Payloads on Iridium Satellites to Expand

The government of Canada will make an investment of \$7.2 million over three years to support the expansion of exactView RT, a real-time satellite-AIS service. The investment is being made through the Strategic Innovation Fund, a program designed to encourage R&D that ac-



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celerates the commercialization of innovative products, processes and services. exactView RT consists of a system of more than 60 maritime satellite payloads hosted on board the Iridium NEXT constellation.

LNG-Powered Ship Added To Puerto Rico Supply Chain

Crowley Maritime Corp. christened its commitment-class combination container/roll on-roll off ship *El Coquí*, which is among the first of its kind to be powered by LNG. The ship is a key new component in Crowley's supply chain transformation in the U.S. mainland-Puerto Rico trade. The christening was held in October at the JAXPORT Cruise Terminal in Jacksonville, Florida.

Tidal Test Site to be Grid Connected

The Massachusetts Economic Development Bill includes \$205,000 to put the Bourne Tidal Test Site (BTTS) on the grid, allowing the site to be wired to shore so that its turbines and devices can receive shore power and produce power to the grid. A pilot license application required by the Federal Energy Regulatory Commission (FERC) in order to obtain grid interconnection is now in process.

AUV Company Expands Operations, Adds Training and Testing Vessel

AUV developer and manufacturer L3 OceanServer added 4,700 sq. ft. of space at its headquarters in Fall River, Massachusetts, which doubles its operational footprint and leverages its waterfront location for daily vehicle testing and operations. Additionally, a 46-ft. research vessel, *RV Cassiar*, has been dedicated to customer training and vehicle testing at L3 OceanServer's San Diego location.

Search Expands to SS North Carolina Wreckage

Blue Water Ventures and Endurance Exploration Group are expanding operations to include what is believed to be the wreck of the *SS North Carolina*. Endurance Exploration has been granted a custodianship of the vessel by the Middle District Court of Florida. Operations will begin by conducting an archeological study and survey of the area using advanced underwater sensing technology. The *SS North Carolina* is of interest because of its similarity to the recently located *Pulaski*: It sank in 1840, only two years after the *Pulaski*, it was of similar size and design, and it operated along the same routes along the East Coast of the U.S.

Towfish Products Optimized for Navigation

Klein Marine Systems has chosen Greensea Systems to provide SWaP-C optimized inertial navigation for its high-performance side scan sonar towfish products. The Greensea INSpect GS products utilize Greensea's heading alignment methodology and its open architecture operating platform, OPENSEA.

SonarWiz Used to Locate WWII Plane

Chesapeake Technology, the maker of SonarWiz software, renewed its partnership with the BentProp Project,

which uses SonarWiz to create and review sonar images to identify search targets. BentProp and Project Recover this summer located a B-24 airplane called *Heaven Can Wait* in Hansa Bay near Papua, New Guinea, using scanning sonars, high-definition imagers and unmanned aerial and underwater robotics to find the site.

Latest Coast Guard Cutter Delivered

Bollinger Shipyards delivered the USCGC *Terrell Horne* fast response cutter (FRC) to the U.S. Coast Guard. The 154-ft. patrol craft, the 31st vessel in the USCG *Sentinel*-class FRC program, has a flank speed of more than 28 kt., advanced command, control, communications and computer technology, and a stern launch system for the vessel's 26-ft. cutter boat. The newest USCG FRC vessels have been deployed as far as 4,400 nautical mi., a notable increase in operational reach.

Bathymetric Software Includes Softkey Licensing

Teledyne CARIS is moving to a new software licensing technology that will be implemented in conjunction with the release of Bathy DataBase 5.2, with integration into other CARIS applications to follow. Key benefits include softkey activation; elimination of hardware to reduce possible damage or loss; elimination of a separate licensing tool; faster software purchase and setup; and improved license usage transparency.

New East Coast Ferry Equipped with Interceptors and Active Ride Control

The newest addition to the Seastreak ferry fleet is equipped with interceptors and active ride control supplied by Humphree USA. *Seastreak Commodore*, which was put into service this summer, is the biggest and fastest passenger ferry in the Seastreak fleet. The 150-ft. catamaran can carry up to 600 passengers. The high-speed vessel makes daily commuter runs between Sandy Hook, New Jersey, and the East 35th Street terminal in New York City, with transit times of about 45 min.

Fairfield Seismic Tech Business To Operate as Magseis Fairfield

Fairfield Geotechnologies has agreed with Magseis ASA that Magseis will acquire the seismic technologies business from Fairfield comprising data acquisition, nodal and system sale, and rental activities, including all shares in Fairfield's wholly owned U.K. subsidiary WGP Group. The new business will be Magseis Fairfield.

Inaugural Maritime Nations Forum To be Held on Board Queen Elizabeth

A high-level maritime trade delegation is being led by Julian Clark, global head of shipping at the Hill Dickinson law firm, accompanied by Dr. Liam Fox, secretary of state for the Department of International Trade, and other maritime sector business leaders. Discussions will take place on board HMS *Queen Elizabeth*, which is currently in the U.S. for tests with the F-35 fighter jet. The British maritime leaders will meet with an American delegation at the inaugural Maritime Nations Forum between the U.K. and U.S. **ST**

JW Fishers Donates Tech to Communities

JW Fishers Mfg. Inc. takes pride in being a family-owned-and-operated business and believes in giving back to communities whenever possible. Over the past 50 years, it has donated equipment or gift certificates to many deserving organizations. The company has developed a complete line of underwater search equipment that has helped dive rescue squads, public safety dive teams, police departments and fire departments locate drowning victims and crime weapons.

This past year, a SAR-1 underwater metal detector was donated to New Jersey Historical Divers Association Inc. The SAR-1 was designed for use by dive teams attempting to locate objects in low-visibility environments. JW Fishers also donated a \$500 gift certificate to the annual Treasure Hunters Cookout held in Sebastian, Florida, this year.

Refining AI's Role In Oil, Gas Safety

As artificial intelligence (AI) systems begin to control safety-critical infrastructure across a growing number of industries, the need to ensure safe use of AI in systems has become a top priority.

DNV GL has launched a position paper, "AI + Safety," to provide guidance on responsible use of AI. The paper asserts that data-driven models alone may not be sufficient to ensure safety and calls for a combination of data and causal models to mitigate risk.

The operation of many safety-critical systems has traditionally been automated through control theory by making decisions based on a predefined set of rules and the current state of the system. Conversely, AI tries to automatically learn reasonable rules based on previous experience.

Since major incidents in the oil and gas industry are fortunately scarce, such scenarios are not well captured by data-driven models, so there are not enough failure data available to make such critical decisions. The position paper stresses that if the industry can supplement data-driven models by generating physics-based casual data, it will be significantly closer to the safe implementation of AI in safety-critical systems.

DNV GL has joined forces with Norway's largest universities and companies to establish the Norwegian Open AI to improve the quality and capacity for research, education and innovation in AI, machine learning and big data.

Miros Launches Real-Time Sea State Data Cloud Service

In an industry first, ocean surface measuring company Miros Group will make dry measurements of sea state available through the cloud as a service. For customers, this means flexible access to real-time data without hav-

ing to cover the investment in data collection and transfer equipment.

Energy major Equinor is the first Miros customer to take advantage of the cloud-based sea state data offering, using it to monitor wave conditions at its gas pipeline landfall on Norway's west coast. The pipeline requires regular inspection and maintenance performed by divers, and accurate monitoring of the nearshore sea state is crucial to diver safety.

Seabed Mapping to Support St. Lucia Marine Economy

The U.K. Hydrographic Office (UKHO) deployed a motorboat to survey the waters of St. Lucia in the fall as part of the Commonwealth Marine Economies (CME) Programme. Following a stakeholder meeting with the St. Lucia Air and Sea Ports Authority (SLASPA) and wider government earlier this year, priority areas were surveyed, capturing sonar data of St. Lucia's main ports and approaches. These include Castries to Marigot Harbour, Rodney Bay, Vieux Fort Bay and Soufriere Bay. The mapping equipment supposedly has no negative impact on the ecosystems and marine life.

Data from the survey will be used to update navigation charts of the region, as well as help St. Lucia to meet its international maritime obligations, including elements of the Implementation of IMO Instruments Code (IIIC). These updated charts will reduce navigational risk and improve the safety of ships, cargo and crew. Data will also support environmental and scientific applications, enabling St. Lucia to better manage its marine environment.

By supporting safe navigation in the region, the survey is expected to bring economic benefits to St. Lucia by encouraging access for its growing cruise ship sector and maximizing efficiency of trade by enabling ships to confidently increase cargo-carrying capacity.

Maritime Workforce Development Program

Four schools have enrolled in the "Fundamentals of Marine Service Technology" curriculum program by the American Boat & Yacht Council (ABYC), www.abycinc.org/marineservice. The program was built to help secondary and post-secondary schools easily implement a standards-based marine service curriculum, with an inland or coastal focus.

Additionally, a nationally recognized competency certificate is available for program completers who successfully pass an exam administered by the National Occupational Competency Testing Institute (NOCTI).

Schools currently enrolled with the marine service program include: Ocean County Vocational Technical School – Toms River, New Jersey; Portland Arts & Technology High School – Portland, Maine; Mount Desert Island High School – Bar Harbor, Maine; Center for Applied Technology – Edgewater, Maryland; Mid-Coast School of Technology – Rockland, Maine; North Providence High School – North Providence, Rhode Island; and Coconino Association for Vocations, Industry and Technology – Page, Arizona. **ST**

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LiDAR and Bathymetry Processing

Bathy DataBASE 5.2 introduces enhanced tools for validating and creating chart features from LiDAR surveys, as well as new bathymetry compilation techniques, an updated workflow process in BASE Editor and two new surface smoothing techniques. Teledyne CARIS.

Offshore Wind Excavation Tools



The T4000 ULD offers shallow-water excavation with a stable CFE system and single outlet. SP6000 ULD is a small, lightweight excavator. The expanded-range tools operate from 1 to 300 m in soils ranging from soft sand to clays, with shear strength of 300 kPa. James Fisher Subsea Excavation.

Expanded Software, Support

Along with SonarWiz 7.3, a new support platform called JIRA Service Desk (JSD) has been released that allows integration of bug fix and enhancement requests, speeds up testing and allows self-help and tracking of issues via a customer portal. Chesapeake Technology Inc.

Advanced Magnetometer

The MagArrow weighs 1 kg, has altitude-stable surveys and an increased sample rate with GPS timing. It is UAV deployable for data collection in nearshore or marshy environments. Geometrics Inc.

Portable UUV

Bluefin-9 has a high-performance Doppler velocity log and inertial navigation system, multi-aperture

side scan sonar, and a mission endurance of 8 hr. at 3 kt., with a top speed of 6 kt. General Dynamics Mission Systems.

Hybrid Underwater Lights

Sola lights have high CRI/TLCI ratings from a chip-on-board 5600-k LED array and flicker-free firmware. The Video Pro 3800 is optimized for wide-angle capture, with a dome port optic that provides a 110° beam angle. The ultracompact Stella 1000/2500UW provides 2,500 lumens. Light & Motion Industries.

Ship-to-Ship Oil Transfer Hose

Kleline STS oil transfer solution allows ship-to-ship oil transfer and consists of two carcasses made of steel cables to withstand kinks or crushing. It features a nippleless design with no metal connector between sections, a continuous inner liner and an integrated gasket. Trelleborg Group.

Vessel Surveillance System



The iSea-25HD is a gyro-stabilized surveillance system that uses a thermal imaging camera with a 3-5μ IR detector with a continuous zoom lens, a high sensitivity color day camera and an Eyesafe laser range finder. CONTROP Precision Technologies Ltd.

Dynamic Network Security

The DxOdyssey network security software is designed for hybrid and multi-cloud networking needs. It uses a software-defined perimeter to protect connectivity between on-premises sites and multi-cloud environments. DH2i Co.

Hi-Res Industrial Controllers

The eX700G series combines high-performance sunlight-readable displays with state-of-the-art connectivity for industrial controllers used in extreme environments such as marine and process industries. Controllers have a 7-in. wide-screen display, 800×480 resolution and run JMobile software. Exor International S.p.A.

Ultrahigh-Output LED Lights



The Dragonfish line offers three new 6,000-m units, including: Dragonfish II, a 30,000-lm dual-channel continuous dimmable torch; Fusion-4, a 120,000-lm strobe with a 2-Hz repetition rate; and Fusion 6, a 180,000-lm strobe. Also available is the Hammerhead pan and tilt. Arctic Rays LLC.

Sensor Transmitter Tag

The V7TP-180 kHz measures temperature/depth at 180 kHz and can investigate the behavior of small fish; precisely measure 2D, 3D position; and monitor movements of non-native fish to understand their ecosystem impact. VEMCO.

Communications Technologies

Agile Marine Solutions is a line of ruggedized, long-range, multi-SIM card, smart routing communications technologies to resolve issues related to congested marine Wi-Fi, spotty cellular connections or no connections offshore. Agile Interoperable Solutions.

Compact Ku-Band VSAT Antenna

TracPhone V3-HTS is 37 cm in diameter and weighs 11 kg, smaller than any Ku-band satellite communications antenna. It is designed to provide data speeds of 5 Mbps for downloading and 2 Mbps for uploading. KVH Industries Inc.

Remote-Sensing Wind Profilers

Lightweight sodar (sonic detection and ranging) meteorological instruments can be used to make point measurements along a forecasted wind energy site. Their unique software allows a precision of 0.25 m/s and 3° for wind speeds greater than 4 m/s. Remtech Inc.

Enhanced Lithium-Ion Batteries

LIB^{RT} lithium-ion batteries use electrochemistry and electronics that were specifically selected to work in an embedded system that maintains security during onboard fitting in a submarine. The result is an optimized immersion period and reloading time for subs. Naval Group.

Foul-Release Coating for Lights

Adapted from the Prospeed foul-release system for propellers and running gear, Lightspeed is a transparent foul-release coating specifically formulated for underwater lights. It will be distributed in the U.S. by West Marine and Land 'N' Sea. Oceanmax.

Emissions Reporting Software

ClassNK MRV Portal is a software service to report, monitor and verify shipping CO₂ emissions in line with the IMO DCS regulations coming into effect in 2019. It includes onboard data sending, an onshore data management system and annual fuel consumption report submission. ClassNK.

ROV for Law Enforcement

Phantom T5 Defender is an inspection-class ROV with a high thrust-to-dry-weight ratio, an HD camera and fiber-optic tether for rapid communication, and open architecture for integration of a variety of sensors. Deep Ocean Engineering Inc.

Container Strength Assessment

The latest SeaTrust-LS software incorporates new guidance for container stowage and lashing based on ship motion analysis, including nonlinear analysis to calculate accurate external lashing forces and computational fluid dynamics. Korean Register. **ST**

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A Brief History of Sonar

One of JW Fishers Mfg.'s first sonar-like devices was invented by naval architect Lewis Nixon in 1906. His vision was to design a system that would allow naval captains to detect underwater icebergs and other threats. This detection system became more important after the sinking of the *Titanic* in 1912. Then, after WWI broke out in 1914, there was an immediate need for submarine detection. The first active sonar was developed in 1915 through a collaboration between Russian engineers and French physicists.

Sonar systems were first developed for military applications and have since become very helpful in underwater exploration. Scientists use sonar to map the seafloor, scan reefs and measure water depths. Police and dive rescue teams use sonar to find missing persons and evidence. Treasure hunters use it to locate shipwrecks and other valu-

able objects. Among the users of JW Fisher's sonar tech today are the Fulton County Sheriff's Office and W.J. Castle of The Castle Group, comprising marine structural engineers and contractors.

AUV Prototype Progress

Autonomous Robotics Ltd. (ARL) has reported successful autonomous sea trials of a prototype "flying node" AUV at a location offshore Plymouth Harbour. The trial demonstrated the AUV autonomous navigation and seabed landing and take-off operation. The AUV demonstrated exceptionally stable flight and accurate navigation during the trial. This is a major milestone in the development of the flying node concept.

ARL is a U.K. marine robotics company that aims to offer a swarm of novel AUVs carrying industry-proven sensor packages that are autonomously deployed, positioned

on the seabed and recovered, creating a new drone market.

Grant to Help Fund Innovative Propulsion System

Whiskerstay Ltd. is planning a new development in electric marine vessels, with the help of a Rapid Innovation Grant from Marine-i.

There is much interest in the marine sector for electric and hybrid propulsion systems that can deliver good performance while being quiet and environmentally friendly. However, to date, the pace of development has been relatively slow.

Whiskerstay has devised a new propulsion solution for commercial and leisure marine vehicles. The Rapid Innovation Grant will be used to purchase the computer equipment needed to carry out vital system design and simulation work.

CSIRO Training for Falcon

Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) has begun training students to operate its new Saab



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Seaeye Falcon underwater robotic vehicle. This follows Falcon training for CSIRO staff at the organization's facility in Hobart, Tasmania, by BlueZone, Saab Seaeye's distributor in the region.

The course was adapted to give hands-on practical training for CSIRO staff in a week-long training program that includes theory and practical sessions.

The CSIRO Falcon includes high-intensity dimmable LED lighting, Tritech Super SeaPrince sonar and a Kongsberg OE14-502 HD zoom camera.

Satcom Chosen for Ocean Cleanup

Iridium Communications Inc. has been selected as the preferred provider of satellite communications services for The Ocean Cleanup, the nonprofit organization deploying advanced technologies to rid the world's oceans of plastic. The Ocean Cleanup's work will start with the Great Pacific Garbage Patch. Iridium L-band satellite broadband services will be delivered in partnership with Iridium service provider The AST Group.

By creating a system of 600-m-long floating plastic collectors with a 3-m-deep skirt, The Ocean Cleanup collects plastic pollution through a combination of wind, waves, currents and floating screens that capture trash. Each system is equipped with two Iridium broadband terminals. Upon full deployment of a fleet of 60 floating screens, there will be 120 Iridium broadband terminals relaying critical systems data, including compartment flood detection, position and location information, pictures, video and system performance data.

Kongsberg Upgrades Stena Drillship Systems

Stena Drilling contracted Kongsberg Maritime to deliver a complete upgrade of its systems aboard the *Stena Carron* DP Class 3 drillship. The vessel was due to dock in November for scheduled 10-year maintenance, during which new K-Pos Dynamic Positioning, K-Chief Automation, K-Thrust Thruster Control

and a Kongsberg riser management system were to be installed. Kongsberg's Kognifai digital platform will securely host the Kongsberg information management system (K-IMS), a decision support tool.

The Future of Seafarers

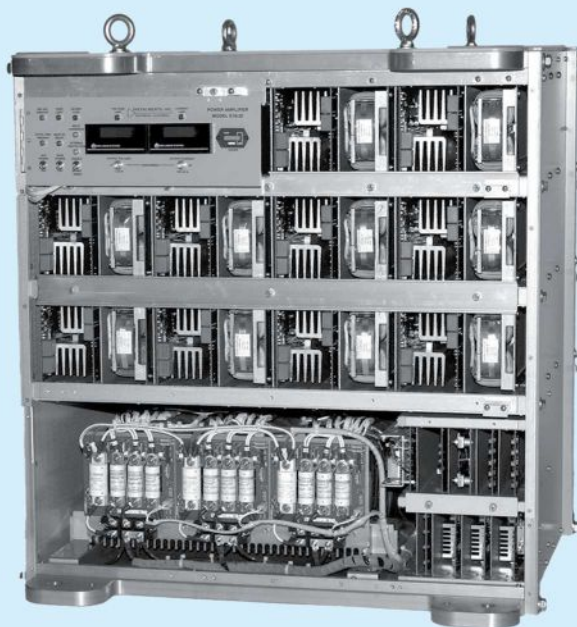
The International Chamber of Shipping (ICS) has released a study on the potential effects of autonomous ships on the role of seafarers

and the global shipping industry. With more than 1.6 million seafarers estimated to serve on merchant ships, the impact of autonomous ships requires thorough consideration.

The study indicates there will be no shortage of jobs for seafarers, especially officers, in the next two decades. The role of personnel on board and ashore will need redefinition. **ST**

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NOAA Award for Teledyne

Teledyne Webb Research has received an indefinite-delivery/indefinite-quantity contract from NOAA for the provision of Slocum gliders, sensors and service components. The award has a maximum value of \$7 million over five years.

MARAD Looking for Vessel Construction Manager

The U.S. Maritime Administration (MARAD) released a request for proposal at <https://bit.ly/2Q1hejh> to solicit for a vessel construction manager (VCM) to deliver a new class of training ships referred to as a national security multimission vessel (NSMV).

The VCM selected will contract with a qualified shipyard to ensure that commercial best practices are utilized in delivering the NSMV on time and on budget.

US Coast Guard Releases Strategy on Maritime Commerce

The U.S. Coast Guard announced its Maritime Commerce Strategic Outlook, the service's long-term vision to support and grow maritime commerce in the U.S.

Maritime commerce accounts for \$4.6 trillion in annual economic activity.

The strategy includes three lines of effort: facilitating lawful trade and travel on secure waterways; modernizing aids to navigation and mariner information systems; and transforming workforce capacity and partnerships.

To support this vision, the Coast Guard will accelerate integration of modern navigation systems into an existing network of buoys and beacons.

Aquaculture Research Awards

NOAA Sea Grant announced 22 aquaculture research projects totaling \$11 million in federal funds. The projects were selected through Sea Grant's 2018 national aquaculture research initiative.

The projects will address specific priorities of the 2018 Sea Grant National Aquaculture Research Initiative, including: supporting the development of emerging systems or technologies that will advance aquaculture in the U.S.; developing and implementing actionable methods of communicating accurate, science-based information about the benefits and risks of U.S. marine aquaculture to the public; and increasing the resiliency of aquaculture systems to natural hazards and changing conditions.

Congress Members Call on EPA To Maintain Independent Science Advisor

U.S. Reps. Suzanne Bonamici (D-Ore.) and Don Beyer (D-Va.) led 96 of their colleagues in calling on Environmental Protection Agency (EPA) Acting Administrator Andrew Wheeler to abandon his plans to dissolve the agency's independent office for scientific analysis.

"At a time when the world is facing the consequences of climate change and extreme weather patterns and tox-

ic substances continue to challenge access to clean air and water, it is striking that the EPA would even consider shying away from the use of robust science," wrote the members in a letter.

The Office of the Science Advisor is charged with providing objective advice to the administrator and implementing the EPA's scientific integrity policy.

WRDA Officially US Law

The Water Resources Development Act (WRDA) of 2018, included as Title I of the America's Water Infrastructure Act of 2018 (S. 3021), was signed into law. The new law will provide for investment in harbor, waterway, flood protection and other water infrastructure improvements throughout the U.S.

This critical legislation authorizes water infrastructure projects developed by the U.S. Army Corps of Engineers that will strengthen ports, harbors and waterways, and will create and sustain jobs.

US Highway Administration Recognizes 3D Echoscope

Coda Octopus Group Inc.'s real-time 3D Echoscope was identified by the U.S. Department of Transportation's Federal Highway Administration (FHWA) as the highest class of sonar for underwater bridge inspections exhibiting "the most desirable qualities" for such applications.

The FHWA study, including field trials, commenced several years ago using Coda Octopus's second generation (2G) of the technology. Since then, Coda Octopus has launched its fourth generation (4G), which has addressed a number of areas including size, weight, power and cost.

The FHWA report estimates that, according to the 2011 National Bridge Inventory data, there are approximately 500,000 bridges in the U.S. that span waterways. State highway agencies oversee approximately 31,000 bridges with submerged substructures that require underwater bridge inspection. Bridges and ports present the challenge of aging infrastructure across the U.S.

Grants for 2018 National Coastal Resilience Fund

The U.S. National Fish and Wildlife Foundation (NFWF), NOAA and their partners announced \$28.9 million in new grants for the restoration or expansion of natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, mangroves, forests, coastal rivers, and barrier islands that help minimize the impacts of storms, rising sea levels and other extreme events on nearby communities and infrastructure in 22 states and Puerto Rico. The 35 grants will generate \$38.3 million in matching contributions for a total conservation impact of \$67.2 million.

Congress provided funding for Title IX of the National Oceans and Coastal Security Act, allowing grants to be awarded through a partnership between NFWF, NOAA, Shell Oil Co. and TransRe. These grants were then awarded through the newly created National Coastal Resilience Fund. **ST**

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Molluscs Unaffected by PETM Climate Change

The impact of global warming on shallow marine life approximately 56 million years ago is the subject of a new paper by researchers at Syracuse University. This research is the first to address the effects of the Paleocene-Eocene Thermal Maximum (PETM)—a relatively brief period of global climate change, spanning 200,000 years—on marine invertebrates, including molluscs. Invertebrates now account for more than 98 percent of all animal life.

The research found that any potential selection pressure imparted by global warming was weak, taxon-specific, short-lived and ultimately inconsequential to overall molluscan evolutionary history. Their adaption to the prevailing warm conditions at the time, coupled with the slow release of carbon dioxide relative to the time scale of

ocean mixing, likely mollified the impact of global warming; a “best-case scenario.”

Coral Bleaching Can Increase Disease Risk

Bleaching events caused by rising water temperatures could increase mortality among staghorn coral, already threatened by disease, says new research by Mote Marine Laboratory and Penn State. The study emphasizes the need for maintaining genetic diversity while increasing species resilience.

Once prevalent throughout the Florida Reef Tract, staghorn coral has suffered substantial declines over decades due to increasing ocean temperatures and disease outbreaks. The Florida Reef Tract is estimated to be worth more than \$6 billion to the state economy. Ecosystem services will be lost if the living coral is not restored.

eDNA Potential Tool For Beach Safety

A collaboration between researchers from UC Santa Barbara and the U.S. Geological Survey, with colleagues from California State University Long Beach and Central Michigan University, will enable detection of the presence of white sharks in beaches through developments in environmental DNA (eDNA). Scientists can extract and amplify specific genes in the DNA fragments found in water samples and determine if the DNA is from a specific species.

“One of the goals of this research is for a lifeguard to be able to walk down to the shore, scoop up some water, shake it and see if white sharks are around,” said researcher Kevin Lafferty.

White sharks had been declining due to overfishing but have lately been experiencing a comeback along the California coast due to the success of state and federal protections from fishing, recovery of marine mammal populations and

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better fisheries management. However, white shark population recovery has co-occurred during a period when more people than ever are using the coastal ocean for recreation, ultimately increasing the likelihood of interactions. White sharks don't feed on humans, but they have been known to bite out of defensiveness, curiosity or mistaken identity.

eDNA monitoring could help public safety officials with clues as to when to be extra vigilant and also help marine biologists understand how well white sharks are recovering in response to protection.

AGU Says Economy Relies on Ocean Research, Education

The American Geophysical Union (AGU) announced a revision to its position statement "Ocean Research and Education Are Foundations for Economic Growth." The revision calls upon public and private entities to "forge cooperation and make bold investments that enable scientific discovery and solutions in ocean science to support the global economy."

In 2016, 52 percent of the U.S. population lived in coastal watershed regions generating nearly 57 percent of U.S. GDP. Commercial fishing generates more than \$36 billion in income. Recreational fishing supports \$14 billion in income. In 2015, more than 22 percent of U.S. domestic oil was produced from coastal and offshore waters.

The statement asserts that "science provides the new knowledge we need to respond to rising sea levels and ocean temperatures, the decline of fisheries, expansion of low-oxygen zones, and changes in the chemistry of the ocean caused by increased carbon dioxide such as ocean acidification."

VIMS Takes Delivery of RV

The 93-ft. RV *Virginia* successfully completed sea trials and will be home ported in Virginia. It was built by Meridien Maritime Reparation. JMS Naval Architects designed the RV and provided technical support during construction and sea trials. The *Virginia* will support the Virginia Institute of Marine Science's

(VIMS) fisheries research projects and increase the capability to perform general oceanographic research in the Chesapeake Bay and mid-Atlantic coastal waters.

AZFP to Detect Fish, Plankton In Arctic Marine, Lagoon

The North Slope Borough Department of Wildlife Management deployed a multifrequency ASL Environmental Sciences' acoustic

zooplankton fish profiler (AZFP) in the nearshore Beaufort Sea at an Arctic lagoon pass this summer. Data will be recorded continuously for a year to determine the presence of fish and plankton under ice and their movements between marine and lagoon environments, especially during freeze-up and break-up seasons. Arctic cod and neritic plankton are critical to the Arctic marine food web. **ST**

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Testing of Integrated Subsea Cable Monitoring System

An Innovate UK-funded project focused on developing a smart integrated monitoring system for offshore energy subsea cables has drawn to a close following successful tests at the European Marine Energy Centre (EMEC) in Orkney. The novel technology will ultimately lead to better maintenance and repair of underwater cables, reducing costs in the offshore energy sector.

The 12-month, Innovate UK-funded CLEMATIS (Cable Lifetime Enhancement via Monitoring using Advanced Thermal and electrical Infrastructure Sensing) project demonstrated the technical and commercial viability of a new multifunctional distributed sensor system for the monitoring of subsea cable infrastructure in the offshore renewable energy sector.

Site Investigation of Baltic Eagle Wind Farm

Fugro has commenced a marine site characterization program at Iberdrola's Baltic Eagle offshore wind farm in German waters of the Baltic Sea. Fugro will undertake a UXO survey to clear the investigation sites, followed by a geotechnical seabed investigation and borehole drilling.

The workscope also includes a program of standard and advanced laboratory testing. The fieldwork is taking place between August 2018 and February 2019 from Fu-

gro vessels. Fugro will deploy the proven Geobor-S piggy back drilling system, and its team of geophysical, geological and geotechnical experts will complement and optimize the final deliverables.

The data will inform the design of the foundations for the wind turbines and offshore substation, which will be installed in water depths of up to 45 m.

With a total capacity of up to 476 MW and spanning an area of 35 sq. km, the Baltic Eagle wind farm is located 30 km off the coast of the German island of Rügen.

Canada Strengthens Support For Marine Renewable Energy

The government of Canada has made a major new investment in marine renewable energy at the G7 Summit in Halifax: \$29.8 million for a 9-MW tidal stream project in Nova Scotia, under development by Haligonian Tidal Energy Ltd.

The project will combine both floating and submerged turbines, incorporating five Andritz Hydro Mk1 1.5-MW seabed-mounted tidal turbines and a single Scotrenewables Tidal Power SR2-2000 floating turbine. Both these technologies have successfully generated power in Scotland.

A first of its kind in Canada, the project will demonstrate the capability to extract energy in both shallow and deepwater. At full capacity, the project will generate energy to power more than 2,500 homes and will provide valuable experience managing electricity generation

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NSRI Highlights Wave, Tidal Challenges and Opportunities

The necessary steps to ensure the U.K. remains at the forefront of wave and tidal energy sectors have been outlined in the National Subsea Research Initiative's (NSRI) Wave & Tidal Transformation report. The report highlights the opportunities and challenges for technology developers and subsea supply chain companies looking to do business in these sectors and the requirements for industry-driven research.

To date, more than £450 million has been spent across the U.K. wave and tidal supply chain, and the global industry is forecast to be worth up to £76 billion by 2050.

NSRI has identified the need for a dedicated task force, supported by industry and government, to drive forward technology development, knowledge sharing and stewardship for strategic direction and industry-wide promotion.

Floating Wind Turbine Installation off Portugal

Bourbon Subsea Services has been selected by Windplus to install three floating wind turbines of 8.3 MW, 20 km off Viana do Castelo, Portugal. The workscope includes project management, engineering and the procurement of the complete mooring system (supplied by Vryhof).

The mooring systems with three sets of three mooring lines will be pre-laid in the first phase. The wind turbines will be then towed to the offshore site and hooked up in a second phase, which will include the installation and hook up of the inter-array electrical cables. BOURBON will provide a variety of assets for the different phases of the operations, including AHTS, tugs and ROVs.

Optimizing Floating Offshore Renewable Energy Devices

Being able to understand and predict the behavior of offshore floating structures under typical or extreme environmental loads is central to being able to assess their viability. This is particularly important in the case of offshore renewable energy where devices are intentionally placed in highly energetic marine sites.

New research at HR Wallingford in collaboration with the Coastal and Hydraulics Laboratory (CHL) in the U.S. has developed a toolkit to optimize the design of floating offshore renewable energy devices by accurately simulating the response of these floating structures under realistic sea states.

The research shows that by combining open-source numerical tools, there is potential to simulate with accuracy the response of complex offshore floating structures to environmental loads in the marine environment.

The toolkit comprises two main components: computational fluid dynamics (CFD) using Proteus open-source software and multi-body dynamics (MBD) using the Chrono open-source solver. Both models have been thoroughly validated separately and together. **ST**



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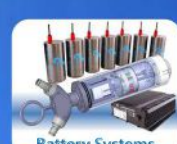
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Sonardyne Nav Tech For Offshore Brazil Ops

International subsea services provider DOF Subsea has chosen acoustic and inertial navigation technology from Sonardyne Brasil Ltda. to support its deepwater operations from three vessels offshore Brazil. The vessels will be equipped with Sonardyne's SPRINT-Nav subsea navigation instrument for underwater vehicles. An ROV on one of the vessels will also be fitted with a Sonardyne Syrinx DVL.

DOF Subsea's multiple SPRINT-Nav systems will be used to support ROV operations, as part of construction, inspection, maintenance and repair work in Brazil's deep-water pre-salt oil fields, in depths down to 3,000 m.

LARS Floating Garage For AUV Fleet

UTEC successfully commissioned its new launch and recovery system (LARS) for the fleet of seven AUVs it uses for seabed surveys in the oil and renewables industries.

The LARS is a floating garage that enables an AUV to be launched and recovered without needing a small boat, thereby simplifying operations and improving safety. It also increases efficiency and reduces costs by enabling AUV surveys in parallel with construction or laying activities, as the LARS can be deployed from the same work vessel.

The LARS was first used on a pipeline inspection offshore West Africa.

Tentative Approval for Alaska Oil, Gas Facility

The U.S. Bureau of Ocean Energy Management (BOEM) issued conditional approval to Hilcorp Alaska LLC for its Liberty Project oil and gas development and production plan. If developed, the facility would be the first oil and gas production facility in federal waters off Alaska.

Hilcorp proposes to build a 9-acre artificial gravel island in

the shallow waters of the Beaufort Sea, about 20 mi. east of Prudhoe Bay and about 5 mi. off the coast. The facility would be similar to the four oil-and-gas-producing artificial islands currently operating in the area's state waters: Spy Island, Northstar Island, Endicott Island and Oooguruk Island.

Decom Project Complete Offshore Middle East

Unique Group and Innovo have successfully completed a decommissioning contract for Saipem on a key offshore platform in the Middle East.

Internal and external dredging tools, diamond wire cutting tools and internal cutting tools based on abrasive water jet technology, operating at 1,500 bar, were provided for the project, along with skilled operators to support the operation.

Forssea, GMS Joint Lab

Forssea Robotics chose GMS as the main technical partner to certify its real-time visual positioning technologies. A joint laboratory will be created to develop a common offer covering camera calibration, subsea image treatment and innovative photogrammetry solutions.

Forssea Robotics' V-LOC (Visual LOCALization) technology has been designed for quick and operational use. One operator sticks the marker on the structure, and the camera computes the 6° coordinates in real time on the user screen. Following offshore tests last April, Forssea decided to increase the initial performance prior to commercialization; to cover more applications, operators quickly asked Forssea to improve its system down to 0.1° and 1-mm positioning accuracy at 3-m ROV flying distance.

Conversation Series to Open Oil Industry to New Audience

Attollo Offshore has released the first of its Attollo Conversation series to help open a discussion to improve offshore operations for a new

era through constructive disruption and change. The series wants to address key issues of technology and innovation within the offshore energy industry, including the growing use of smarter technology, the future of work and big data.

One of the most powerful messages that came across during the filming of the series is the need to find ways of transferring the knowledge held by the current generation to the next generation while encouraging change, still controlling major accident hazards, being safe and protecting the environment with improved methods.

To take part in future interviews, contact: info@attollo-offshore.com.

Permian Token Brings Blockchain to Oil, Gas Sector

PermianChain Technologies is introducing the Permian Token (XPR), a crypto asset-class that will underpin holding rights to the value of potential but undeveloped oil and gas reserves. XPR is expected to eliminate the layers of bureaucracy and dramatically reduce broker and administrative fees. It will also make it simpler to pinpoint and alleviate delays, improve investment efficiency, and open the sector to a swathe of potential new investors.

Trading oil and gas is currently complex, slow and fundamentally inefficient. Agreements are cumbersome and difficult to transfer without adding costs, and there are so many different steps involved in the process of getting oil and gas from upstream to downstream, that the knock-on effect of delays can be significant and costly. The levels of complexity and inefficiency mean that many potential investors are reluctant to involve themselves in the market, reducing the sector's potential liquidity and value.

The Permian Token's system of smart contracts would replace these complex agreements using the PermianChain, a blockchain network being developed by Canada-based PermianChain Technologies. There are already approximately 250 million barrels of potential oil and gas reserves planned to be listed on the PermianChain network. **ST**

people

Nor-Shipping has recruited its first head of sustainability and technology, **Silje Bareksten**. The development marks another step in an evolution that aims to realign the Nor-Shipping event to support, serve and enable a future-oriented maritime industry. Nor-Shipping 2019 takes place in Oslo and Lillestrøm, Norway, in June.



Sonardyne International Ltd. appointed **Elizabeth Paull** as business development manager to support and develop the firm's business within the growing aquaculture and renewables industries. Paull, who joins Sonardyne from subsea instrumentation and systems company Aquatec Group, will also focus on other developing ocean industry markets, such as subsea mining.

Canada's Ocean Supercluster appointed **Kendra MacDonald** as CEO to help build Canada's ocean economy into one of the country's most significant and sustainable value-creating economic segments. MacDonald has led projects in a wide variety of industries, including telecommunications, the public sector, power and utilities, marine transportation and seafood.

Bjørn T. Akselsen is joining MacArtney Underwater Technology as managing director of MacArtney Norge AS. Akselsen brings extensive international business development and management experience. He recently served nearly a decade in Houston, Texas, as the director of Innovation Norway and consultant to Norwegian oil and gas companies establishing a presence in the Gulf of Mexico.

GreenSteam appointed **Mathias Nyman Rasmussen** as head of sales. Rasmussen comes from a position as head of global sales at COACH Solutions, which is a part of Clipper Bulk Shipping Ltd. Prior to that, he held various positions within COACH Solutions and Clipper Group. Rasmussen will be based in the Copenhagen office.

Claudia Grant, deputy director general of the Maritime Authority of Jamaica (MAJ), has been elected chairman of the Sub Committee on Implementation of IMO Instruments of the International Maritime Organization (IMO). An experienced maritime professional, Grant has served as president of the Women in Maritime Association Caribbean (WiMAC) since its inception in 2015.

The Atlantic States Marine Fisheries Commission presented **Roy W. Miller**, former director of Delaware's Division of Fish and Wildlife, with the Captain David H. Hart

Award, its highest annual award, at the commission's 77th annual meeting in New York City. Miller has served the state of Delaware and the commission since 1978.

The International Marine Contractors Association (IMCA) has appointed **Margaret Fitzgerald** as its head of policy and regulatory affairs. She will represent the association on all regulatory matters and lead its involvement with the International Maritime Organization (IMO). Fitzgerald has more than 20 years' experience in shipping, and she previously worked for the IMO Secretariat. **ST**

contracts

Metal Shark Alabama, Bayou La Batre, Alabama, has announced its entry into the towboat market with a contract to build three 120-by-35-ft. river towboats. Each boat is a four-decked, welded-steel, USCG Subchapter M-compliant towboat. Florida Marine Transporters Inc.

Tuco Marine Group, Faaborg, Denmark, signed the contract on a multi-mission boat designed for first responders of Greater Copenhagen Fire Department. The advanced responder equipment on board includes communication and firefighting equipment and an onboard crane system. Hovedstadens beredskab I/S.

Kongsberg Digital, Horten, Norway, has landed its largest ever simulator contract in an SGD 21.2 million deal including delivery in 2020 of four advanced K-Sim Tactical Boat Handling and Firing Simulators with a 10-year comprehensive maintenance agreement to the Singapore Police Coast Guard. Singapore Ministry of Home Affairs.

Poseidon Navigation Services Ltd., Moray, Scotland, will supply fleet-wide chart management services that include Challenger software to provide weekly updates for all paper and digital Admiralty products. Hapag-Lloyd.

ChartCo, London, England, has chosen a partner to deliver the weather routing technology services in its OneOcean e-navigation and passage planning platform, which, under the arrangement, will be combined with weather analysis and route optimization for lower fuel consumption. MeteoGroup.

Chelsea Technologies Group, Surrey, England, received an order for its Sea Sentry wash water monitoring system for ship exhaust gas cleaning systems. The order, for 26 units to be installed on 13 vessels, comes during a period of industry-wide acceleration in the global scrubber market. Fuji Electric Co. Ltd.

General Atomics Electromagnetic Systems, San Diego, California, has been awarded a contract to develop and deliver a prototype lithium-ion fault tolerant (LiFT) battery system for manned undersea vehicles. U.S. Special Operations Command. **ST**

meetings

JANUARY

January 8-10—Challenge of Science Leadership training course, Exeter, England. info@scienceleadership.co.uk or www.scienceleadership.co.uk.

January 8-11—HYPACK Hydrographic Training Event, Corpus Christi, Texas. 860-635-1500, Brittany@hypack.com or www.hypack2019.com.

January 15-17—SNA Annual National Symposium, Arlington, Virginia. 703-960-6800, navysna@aol.com or http://navysnaevents.org/national-symposium.

January 16-18—The Unmanned Systems Expo, Rotterdam, Netherlands. +31 (0)6 19791096, info@tusexpo.com or www.tusexpo.com.

January 23-24—Coastal Futures, London, England. bob.earll@coastms.co.uk or http://coastal-futures.net.

January 28-30—International LiDAR Mapping Forum, Denver, Colorado. wemison@divcom.com or www.lidarmap.org.

January 29-30—ADECS, Marina Bay Sands, Singapore. +44 (0)20 7384 7808, misha.agarwal@clarionevents.com or www.asia-decs.com.

FEBRUARY

February 4-6—EUROMARITIME, Marseille, France. anne-charlotte.micca@gican.asso.fr or www.euro-maritime.fr.

February 4-7—Gulf of Mexico Oil Spill & Ecosystem Science Conference, New Orleans, Louisiana. gulfconference@oceanleadership.org or https://tinyurl.com/y998tjr6.

February 5-7—Deepwater Operations and Topsides, Platforms & Hulls, Galveston, Texas. www.offshore-event.com/index.html.

February 5-7—Subsea Expo, Aberdeen, Scotland. rebecca.cox@bigpartnership.co.uk or www.subseaexpo.com/conference.

February 5-7—Underwater Intervention, New Orleans, Louisiana. 703-259-6118, ui@naylor.com or www.underwaterintervention.com.

February 25-27—Oceanology International Americas, San Diego, California. sara.andrade@reedexpo.co.uk or www.oceanologyinternationalamericas.com.

MARCH

March 5-7—World Ocean Summit, Abu Dhabi, United Arab Emirates. oceansummit@economist.com or www.woi.economist.com.

March 10-13—IEEE/OES Currents, Waves, Technology Measurement and Applications Workshop, San Diego, California. 508-289-2456, jrizoli@whoi.edu or cwtm2019.org.

March 13-15—World Congress on Maritime Heritage, Singapore. WCMH2019@worldexpress.com.sg.

March 18-21—U.S. HYDRO, Biloxi, Mississippi. 832-687-5570, melissa@thsoa.org or https://thsoa.org/US-Hydro-2019.

APRIL

April 1-3—Waterpower Week, Washington, D.C. 918-831-9560, andrea.harner@clarionevents.com or www.waterpowerweek.com.

April 8-11—SubOptic, New Orleans, Louisiana. 703-444-0845, knielsen@stfevents.com or www.suboptic2019.com

April 9-10—Intelligent Ships Symposium, Philadelphia, Pennsylvania. asnehq@navalengineers.org or www.navalengineers.org/Symposia/Intelligent-Ships-Symposium-2019.

April 9-11—Ocean Business, Southampton, England. +44

(0)1453 836363, hdavis@divcom.co.uk or www.oceanbusiness.com.

April 10-11—Offshore Survey, Southampton, England. +44 (0)1453 836363, info@oceanbusiness.com or https://bit.ly/2Q735Bj.

April 15-19—MTS International Buoy Workshop, Hobart, Australia. MTSevents@mtsociety.org or www.whoi.edu/buoyworkshop/2019.

April 29-May 2—AUVSI XPONENTIAL, Chicago, Illinois. 571-255-7786, tmcMahon@auvsi.org or www.xponential.org.

MAY

May 13-15—UDT, Stockholmssmäs-san, Sweden. +44 (0)20 7384 7808, misha.agarwal@clarionevents.com or www.udt-global.com.

May 14-16—IMDEX Asia, Singapore. +65 6542 8660, enquiries@imdexasia.com or www.imdexasia.com.

JUNE

June 17-19—MAST Asia, Tokyo, Japan. +33 663 232 473, eike.eickhoff@mastconfex.org or https://mastconfex.com/asia2019.

June 17-20—OCEANS 2019 Marseille, Marseille, France. Technical Chair@oceans19mtsieemarseille.org or www.oceans19mtsieemarseille.org.

June 18-20—Technology, Systems, and Ships, Washington, D.C. asnehq@navalengineers.org or www.navalengineers.org/Symposia/Technology-Systems-and-Ships-2019.

June 29-July 10—La mer XXL, Nantes, France. +33 7 69 01 95 65, c.deschamps@ilago.eu or www.lamerxxl.com/en.

AUGUST

August 20-21—AUVSI Unmanned Systems, Washington, D.C. 571-858-4364, ehallberg@auvsi.org or https://bit.ly/2rxCAq8.

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

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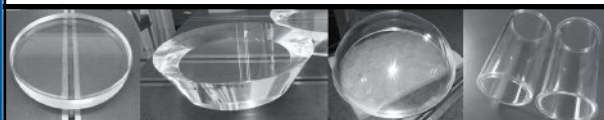
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 **IOSTIA**
ADVANCING THE BUSINESS OF OCEAN TECHNOLOGY

Bill Dobie is the founder and CEO of SEDNA. He has been building software since 1984 and has been doing so specifically for the shipping industry since 2000, when he co-founded Navarik. In 2010, he founded Stage 3 Systems, which runs software as services, including SEDNA, that have revolutionized the way that shipowners, ship agencies, charterers and ship brokers communicate with each other.



What's been the most frustrating thing in your inbox: a "reply-all" thread that just won't die; spending hours everyday filing messages into folders; searching for an email you desperately need but cannot find; or a big threat to your business that goes unnoticed?

While they are not as eye-catching a topic as autonomous shipping or artificial intelligence-based vessel optimization, there are threats to productivity, trust and security hidden away in plain sight within inboxes throughout the shipping industry.

As such, businesses are coming to realize that we need to re-examine how we handle email and transactions. Companies including NORDEN, Glencore, Seaspan, Monson Agencies and Sturrock Grindrod are now adopting a different way of handling email—opting for team-based transaction management platforms that will enable them to have a better handle on the many threads of business communication.

So, what are some of the issues that companies face when it comes to how they use email, and what can the industry do about them?

One problem is that email takes up too much time. Email is already recognized as a productivity killer in many fields. For instance, a study published in *Harvard Business Review* analyzed 60,000 hr. of CEO

time and found that 24 percent of CEO time was taken up emailing people, with email also listed as the main source of distraction.

This effect is compounded in our industry, as shipping organizations manage thousands of messages each day involving complex transactions among internal and external teams across multiple offices. The most common tools we use to handle emails, such as Outlook and Gmail, were never meant to be used by teams. This means that team members spend inordinate amounts of time manually tagging, filing or searching for emails. For many companies we engage with, these administrative tasks take up to 2 hr. per day, per employee. The time spent managing email has outpaced the time spent communicating with it.

Not only can email be a waste of valuable time, often for highly skilled and well-paid individuals, but email can slow down the overall response rate to new business inquiries.

In shipping, with very low margins, businesses compete on how agile they are and how rapidly they can respond to a commercial opportunity. If there's a way that transactions can be negotiated more quickly, isn't that exactly the kind of advantage a shipping company needs? As much as anything else, time is shipping's most valuable commodity—and anywhere it's being lost is a problem.

Another issue is that email is not fully secure. Recent cyberattacks have laid bare the scale of the challenge that this presents for shipping. The insurer Munich Re has warned that losses expected from cyberattacks are greater than those expected from natural catastrophes.

Email is a particular weak point that hackers can exploit, and phishing attacks are becoming more sophisticated. As hackers learn better ways to impersonate people inside

an organization, the security risk increases when people are handling thousands of emails a day. It's easy for employees to miss something crucial or be misled by a hacker. This is why in the latest version of the SEDNA transaction management software, we've included a new sign-in system that leverages multiauthentication (MFA) to enhance communication and document security along with message identification that highlights approved senders, making it harder for hackers to use phishing to infiltrate shipping organizations.

In an industry that remains so fragmented, no piece of technology is going to take away the need for two parties to agree on the vocabulary of a transaction, how they are going to speak to each other, and how they'll ascertain whether the other has done what they said they would do.

So, even though we can scarcely go a week without a headline detailing how AI and autonomous processes are going to reshape our industries, we cannot forget that when it comes to managing a shipping transaction, it is an agreement of trust between parties, and building that trust is essential. Technology will continue to have a role to play in establishing trust within business relationships.

While it's hard to predict exactly how digitalization is going to affect transaction management, right now there are huge efficiencies to be gained by making sure that companies are managing their transactions correctly—whether that's with automated tagging or automated email composition. Software that handles some of the tedium of transaction management gives people the time, trust and control to do what they are good at, so that they can spend more time responding to and managing transactions thoughtfully, instead of wasting time wrestling with their email. **ST**

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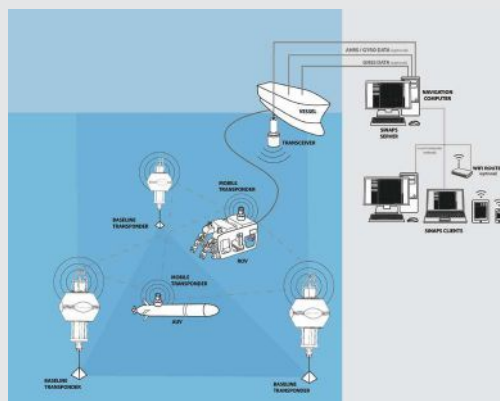
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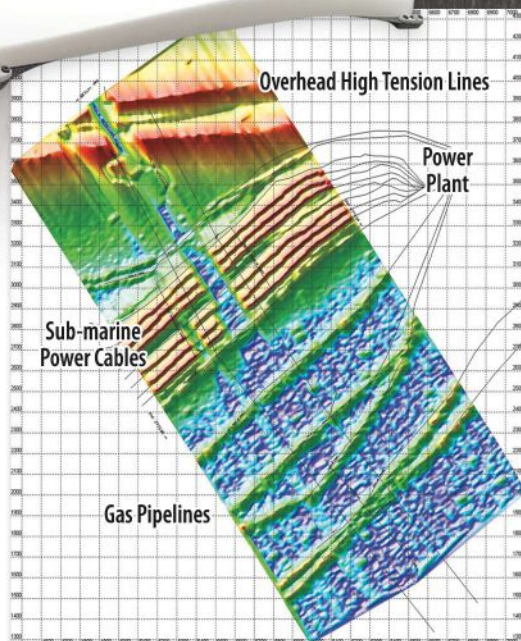
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