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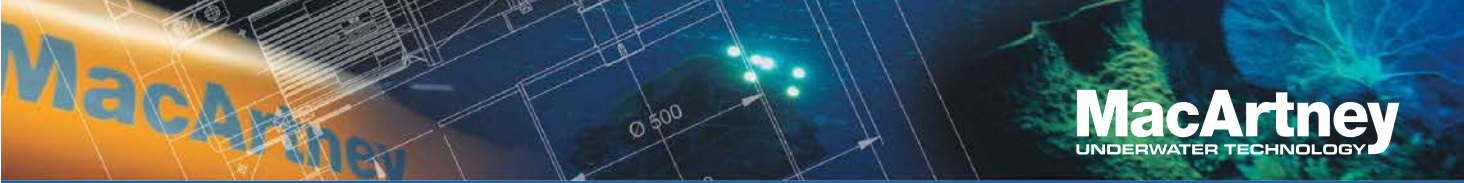
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Annual Review & Forecast / Buyers Guide/Directory

****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

SEPTEMBER

Ocean Resources Development & Coastal Zone Management

****Offshore Energy 2019**, October 7-9, Amsterdam, The Netherlands

****CLEAN GULF 2019**, October 28-30, New Orleans, LA

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

OCTOBER

Environmental Monitoring, Remote Sensing & Pollution Control

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

NOVEMBER

Undersea Defense/Antisubmarine Warfare

DECEMBER

Diving, Underwater Vehicles & Imaging

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1963 - 2019 Celebrating More Than 55 Years of Serving the Global Ocean Community

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Work-class ROVs are benefiting from Sonardyne's all-in-one SPRINT-Nav hybrid navigation instrument. (SPRINT-Nav not pictured.) (Credit: Stuart Slade/Sonardyne)

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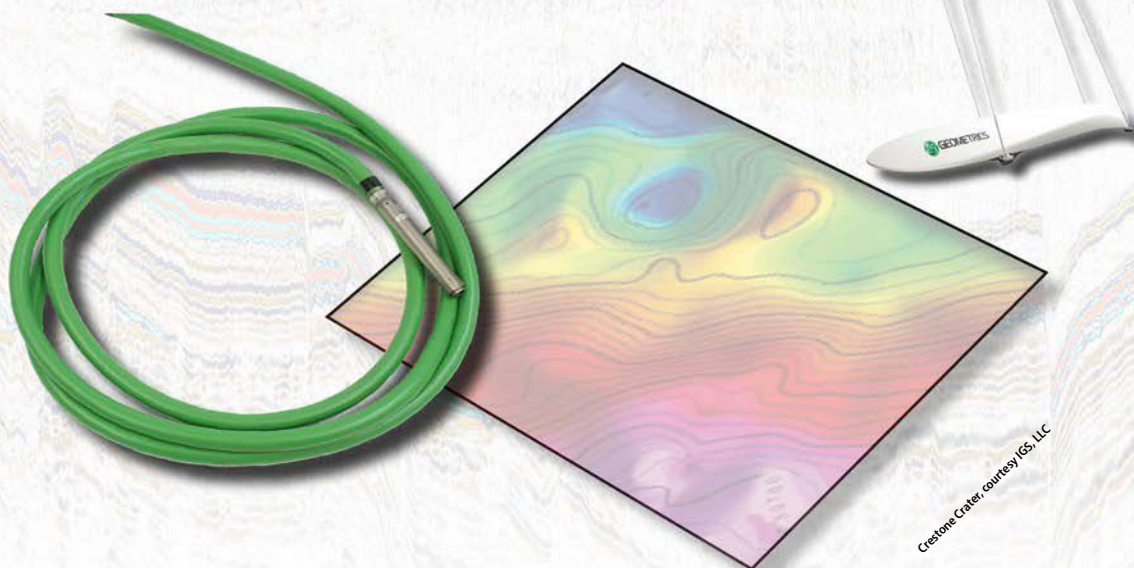
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Global Economic Snapshot: Mixed Mood for M&A

The mergers and acquisitions (M&A) market hit record volume in the first half of 2018 before a hiccup caused by tariffs, regulatory changes and Brexit. The M&A boom began in 2014, and analysts feel that buoyant M&A over five years is long in the tooth.

Global deals volume in the third quarter of 2018 was down compared to the third quarter in 2017, according to Dealogic, mostly because of a downturn in deals targeted at Asia-Pacific and Europe, the Middle East and Africa (EMEA). This was a telltale sign of buyers' dampening appetite.

However, the EY semiannual Global Capital Confidence Barometer suggests that 96 percent of the executives surveyed predict that the M&A environment will improve or remain the same. Looking beyond the surface optimistic global view held by most of the executives, only 46 percent plan to actively pursue an acquisition in the next year, the lowest percentage in four years.

Technology changes continue to be front of mind for CEOs across the globe, including in the blue economy. Fear and competitive advantage promote interest in M&A worldwide. The speed of change is relentless, and M&A has proven to be an effective means to move quickly to gain competitive advantage or defend against future disruptors. According to the Global Barometer, a notable portion of the executives surveyed cite "disruptive forces" as the greatest near-term risk to the growth of their core businesses, and many of these disruptions are related to new technologies.

More specifically, C-level executives expect to pursue transactions that provide access to new markets (26 percent); respond to changing customer behavior (21 percent); and acquire talent (19 percent). Other motivations include securing supply chain and acquiring technology, production capabilities or innovative start-ups.

In recent years, shipping lines began focusing on technology investments and started technology-focused venture capital funds. Traditional freight forwarders launched digital-only transaction portals. Designs for autonomous trucks and containerships were unveiled. Shippers migrated to truly automated procurement and transportation platforms. Forwarders began using artificial intelligence providers to analyze and predict customer behavior, and port authorities engaged visibility providers to speed container flows.

More recently, blockchain came into its own, impacting documentation collection and supply chain finance and enhancing data security in the collaboration process. Logistics managers expect distributed ledger technology (DLT) to have a positive effect on security.

Logistic tech start-ups have been acquired in record numbers in the past several years. Shippers, forwarders and nonvessel operators (NVOs), as well as carriers, have acquired start-ups that have promising technology. High-volume shippers, a bellwether of the industry at large, may be challenged by small shippers that deploy e-commerce platforms embracing the preference of consumers. However, consolidation in the container shipping sectors through mergers and acquisitions slowed in 2018, and the slowdown is expected to continue. Industry analysts suggest that mid- and large-range freight forwarders will acquire tech-savvy companies as a shortcut into the digital market.

Counterbalancing some negatives in 2019 is healthy liquidity that will advantage private equity's participation. A combination of historically low interest rates and cheap financing means hunger for good deals and heightened competition for assets.

Despite market or political noise, technology disruption and pursuit of growth will drive M&A. Before jumping into a deal, it is critical to evaluate strategic alternatives; develop key value drivers of the transaction; prepare detailed confidential offering materials; identify and qualify potential buyers or sellers, domestically and internationally; and drive the transaction to a successful close. **ST**

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)) EM 124 Multibeam Sonar Supports Five Deeps Expedition. Kongsberg Maritime's EM 124 sonar installed aboard the DSSV *Pressure Drop* played a key role in the deepest solo human submersible dive completed by the Five Deeps Expedition. Expedition founder and submersible pilot Victor Vescovo reached the bottom (8,376 m) of the Puerto Rico Trench in his private submersible the Limiting Factor following precision mapping of the ocean floor completed by the EM 124, a modular multibeam echosounder that performs from shallow waters to full ocean depths (11,000 m). Five Deeps is the first manned expedition in a commercially certified submersible seeking to reach the deepest points in the five oceans by the end of 2019. The journey will cover 40,000 nautical mi. through at least 72,000-m depths.

)) Launch of Initiative on Global Maritime Spatial Planning. UNESCO's Intergovernmental Oceanographic Commission (IOC) and the European Commission had launched MSPglobal, a new global project on maritime spatial planning. The project aims to promote better maritime spatial planning to avoid conflicts and improve the governance of aquaculture, tourism, marine energy and exploitation of the seabed. The three-year project will develop international guidelines on maritime spatial planning and regulate activities in coastal and marine waters, which have grown significantly in recent decades. Two pilot projects will create a repository of data, knowledge, policies and decision-making tools for maritime spatial planning, as well as strengthen local authorities' data management capacities. The first pilot project will be deployed in the Western Mediterranean (Algeria, France, Italy, Malta, Morocco, Spain and Tunisia); the second in the Southeast Pacific, with a specific cross-border exercise in the historic bay of Guayaquil (Ecuador and Peru). Parallel training activities will be organized with experts from Chile, Colombia, Ecuador, Libya, Mauritania, Panama, Peru and Portugal. The MSPglobal project, combined with the nine actions of the Joint Roadmap published by the IOC and the European Commission's Directorate-General for Maritime Affairs and Fisheries in 2017, aims to treble the area of territorial waters covered by a maritime spatial planning system by 2030.

)) Hurricane-Proof Window Development. The U.S. Department of Defense (DOD) has requested an additional \$395.6 million to aid in repairs from 2017's hurricane season. The DOD recognized an NRL-created material as a potential solution for hurricane-proof windows (bit.ly/2XjiuOQ). Spinel is a mineral that forms a transparent armor that is tougher, stronger and harder than glass, which provides more protection in hostile environments. Its integrity against sand, rain erosion and other aggressive environments could provide unbreakable hurricane-proof windows.

)) Boost for Autonomous Ship Tech Alliance. One Sea, the alliance that brings together leading exponents of autonomous ship technology, has secured new funding to support its role as business ecosystem and added Shipbrokers Finland as a new partner. An injection of public funds via Business Finland will contribute to the ecosystem's work for the next three years, as technology partners push forward with further sea trials and One Sea rolls out an autonomous shipping standards initiative. The One Sea ecosystem aims to enable autonomous maritime transport by 2025, and an array of new technologies and standards are on the horizon as momentum builds to exploit the potential of greater connectivity and digitalization. One Sea is led by DIMECC Ltd., the co-creation platform that seeks to drive digital transformation across European industry. Alliance members include ABB, Cargotec, Ericsson, Finnpiilot Pilotage, Rolls-Royce Marine, Tieto and Wärtsilä.

)) WWII Wreck Discovered. One of the most important aircraft carriers in WWII history has been located thanks to the crew of Paul Allen's RV *Petrel*. The discovery of the USS *Hornet* was made during *Petrel*'s first mission of 2019. The *Hornet* played a pivotal role in key moments in WWII naval history, including the Doolittle Raid and the Battle of Midway. The aircraft carrier was sunk during the Battle of the Santa Cruz Islands and lost 140 sailors from a crew of nearly 2,200. Wreckage of the USS *Hornet* was discovered in late January 2019 at 5,330 m (nearly 17,500 ft.) deep, resting on the floor of the South Pacific Ocean. "Paul Allen [who died in 2018] was particularly interested in aircraft carriers, so this was a discovery that honors his memory," said Robert Kraft, director of subsea operations for Vulcan.

)) Futuristic Subsea Tunnel, Ultraspeed Railway between GCC Countries and India. The National Advisor Bureau Ltd. in the United Arab Emirates (UAE) has announced the Fujairah-Mumbai Subsea Tunnel Project. Currently at the concept stage, it will connect the UAE and the other Gulf Cooperation Council (GCC) countries for the first time with India via a subsea tunnel and an ultraspeed subsea railway line to improve trade. Creating a vacuum in the tunnel will allow for tremendous speed for trains due to minimal air resistance. The project will enable: transporting passengers, tourists and workers between GCC countries and India; exporting oil and gas from Fujairah Port to India via a pipeline, and possibly China and Pakistan; importing water from Narmada River, north of Mumbai, to the UAE; transporting goods and commodities; and supplying bunker fuel to ships passing between the floating pontoons via a floating bunker fuel station. Future expansion may include China's One Belt One Road Initiative, linking the China-Pakistan Economic Corridor at Gwadar Port with GCC countries via Fujairah Port to complement the Chinese Silk Road. Future train stations may include the port city of Karachi in Pakistan and Muscat, the capital of Oman. **ST**

Hybrid Navigation Systems

Enabling Future Robotic Systems for Subsea Oil, Gas Production

By Ioseba Tena • Rolf Christensen

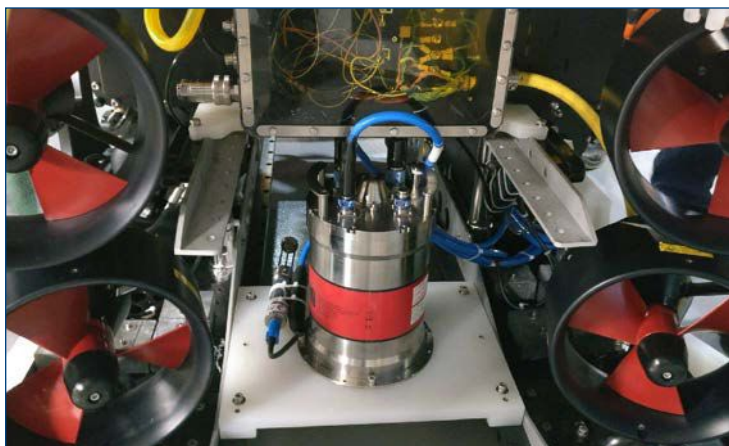
Recent vision statements from oil and gas exploration and production companies for subsea fields of the future agree that there is significant value to be had from permanently deployed or resident hybrid AUV-ROV systems. Based out of subsea docking stations or “garages,” these battery-powered subsea robots will autonomously inspect infrastructure across entire subsea fields while remaining in touch with shore-based operators, i.e., under supervised autonomy. When a task calls for intervention, they will be directly controlled by those same shore-based operators.

The first steps are being made toward this goal. Following a number of trials, Oceaneering’s E-ROV (electric ROV) is now working under a commercial contract with Norway’s Equinor, working subsea for extended periods on the Norwegian Continental Shelf, piloted from an onshore control center. Norwegian company IKM Subsea has also been operating its Merlin resident ROV for extended periods subsea, again, supported from onshore. This year, Norwegian start-up firm Eelume’s snake robot is due to be piloted on a deployment at Equinor’s Åsgard field, offshore Norway, while variants of Saab Seaeye’s Sabertooth are due on a pilot deployment at an offshore wind farm in the U.K., and alongside a wave-powered, satellite-connected buoy (providing power and communications) for Eni offshore Italy. Although the majority of these deployments will see the vehicles kept on a tether,

Run	Time (min.)	Distance	% distance
1	74	3.02	0.028
2	33.5	3.52	0.033
3	49.7	2.99	0.047
Mean	52.4	3.18	0.036
SPRINT-Nav 500 standard			0.060

SPRINT-Nav consistently performed beyond expectations during 2018 Plymouth trials. The table shows SPRINT-Nav DVL-INS dead-reckoning performance was better than the instrument’s standard specification.





there's a clear drive toward tetherless operations.

The motivation for this trend is clear. Having subsea resident vehicles is seen as a way to increase operational availability and efficiency and to reduce cost by not having to rely on ROV or inspection, maintenance and repair (IMR) support vessels—or the sometimes limited weather windows during which these vehicles can be launched and recovered.

However, if new resident ROV-AUV systems want to be accepted as the “norm,” they must overcome numerous challenges. Subsea infrastructure is exposed to extreme pressures, saltwater (and, consequently, corrosion), currents and marine growth. These conditions are partly why

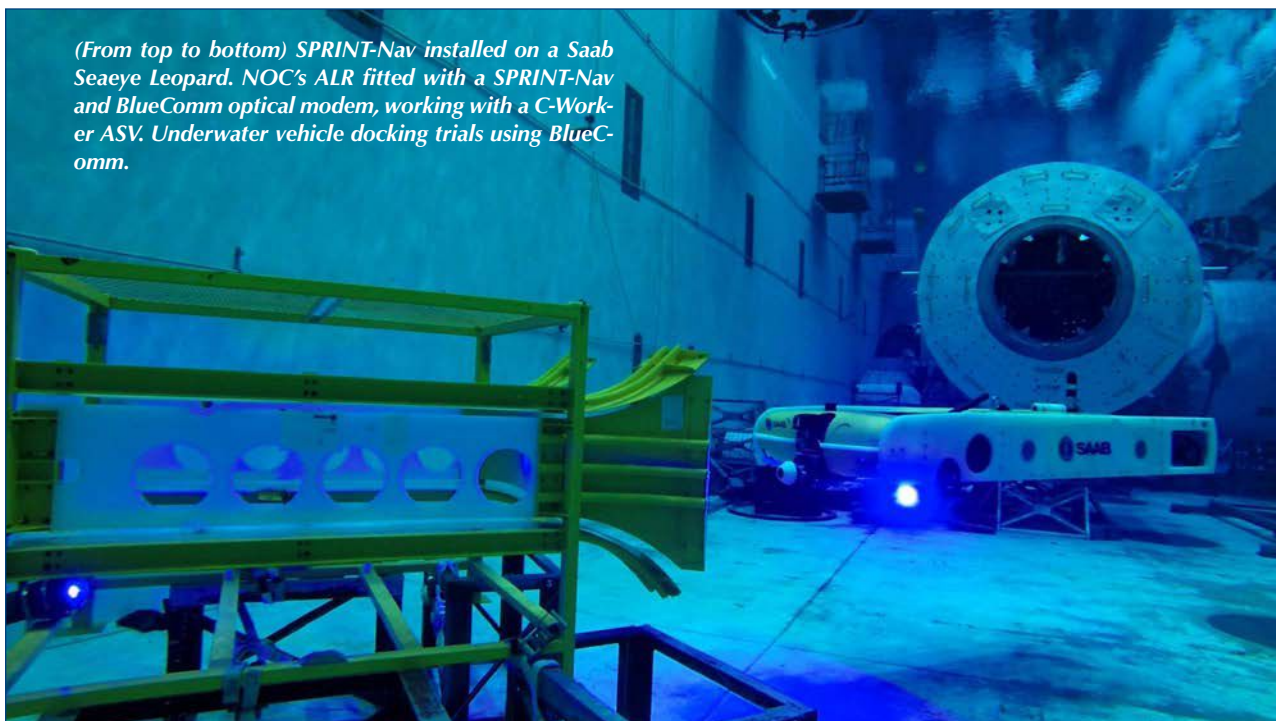


subsea robots have become such a popular tool; they remove the need to send divers into harsh environments to inspect and operate on subsea wells and pipelines. Countering the effects of this punishing environment is one hurdle for resident vehicles (which also suggests that long stints are more likely than permanent residency).

Another key hurdle is navigation and communication with onshore, in and from a very dynamic subsea environment. On land and inside buildings a lot of progress has been made in this area. Using simultaneous localization and mapping (SLAM), robots can autonomously create a map of a building and then use that map to navigate inside it. Knowing what buildings are meant to look like helps. For example, the Google car can combine GPS data with video-feed information and navigate using existing maps of roads.

Subsea, there are different challenges; robots must find their way without GPS and communicate through water to surface communications “gateways” that can then send the signals onward to shore. The good news

(From top to bottom) SPRINT-Nav installed on a Saab Seaeye Leopard. NOC's ALR fitted with a SPRINT-Nav and BlueComm optical modem, working with a C-Worker ASV. Underwater vehicle docking trials using BlueComm.



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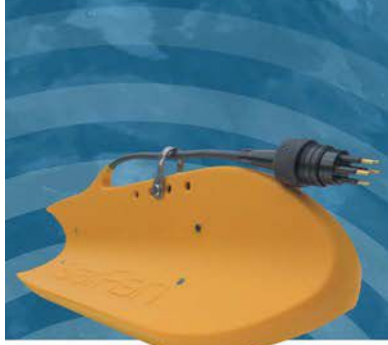
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“SPRINT-Nav’s performance is already being used to help push the boundaries of AUV navigation.”

is that the building blocks required to realize this exist today, enabling future subsea factories through a combination of inertial navigation systems (INS), acoustic positioning and communication systems and underwater optical modems.

Hybrid Subsea Navigation

All INS solutions require external aiding input to reduce drift. For subsea applications, this includes data from a variety of sources, including Doppler velocity logs, which estimate velocity relative to the seafloor, and pressure sensors, to estimate depth. At Sonardyne, we have taken this concept a step further and created a single integrated and intelligent solution, resulting in the world’s most accurate Doppler-INS by a large margin: SPRINT-Nav.

SPRINT-Nav is built around highly robust and accurate Honeywell ring laser gyro inertial sensors. It is tightly coupled with Sonardyne’s Syrinx DVL, as well as having an integrated high-performance pressure sensor. Tightly integrating raw sensor data from the inertial motion unit (IMU) and acoustic sensors at a low level means higher levels of accuracy and reliability are achieved. This enables AUVs, ROVs and hybrid systems to dead-reckon for longer and more accurately, drastically increasing operational scenarios.

A fleet of SPRINT-Nav systems are already out and working, from the North Sea to Brazil and Australia, and the results they are achieving are impressive.

Trials Results

Late last year, during a customer demonstration day in Freemantle, Australia, we decided to run an impromptu SPRINT-Nav test. At the end of an unplanned 20-km voyage, out of Success Harbour, we compared our position estimated by our SPRINT-Nav 500, using DVL-aiding

alone (i.e., with no GPS, USBL or LBL input) to the local RTK position. According to the SPRINT-Nav data sheet, INS drift while running on DVL-aiding alone would be about 0.06 percent, or 12 m over a 20-km journey. During the voyage, we asked the customers on board to guess the accuracy we would achieve. No one came close to the result, which was a position accuracy of just 3.2 m out, or 0.02 percent drift on distance traveled.

Acoustically aiding the SPRINT-Nav with ultrashort baseline (USBL) or long baseline (LBL) positioning systems would improve these impressive results even further, to a centimetric absolute position at full ocean depth. As a compact all-in-one solution, this opens the door for resident ROV and AUV applications.

SPRINT-Nav’s performance is already being used to help push the boundaries of AUV navigation. In an Innovate UK-supported project, led by Sonardyne in partnership with the National Oceanographic Centre (NOC), a SPRINT-Nav is being used to support a lower-grade INS sensor to improve AUV navigational accuracy and endurance. Initial trials of the Precise Positioning for Persistent AUVs (P3AUV) project were carried out in Loch Ness, Scotland, in winter 2018. The NOC’s Autosub Long Range (ALR, a.k.a. “Boaty McBoatface”) was fitted with a SPRINT-Nav to periodically mitigate the drift from the lower-grade sensor. Further trials are planned for later this year.

Commercial Applications

In the commercial world, SPRINT-Nav is already being used on work-class ROVs in offshore applications from subsea pipeline construction to subsea inspection, repair and maintenance and decommissioning operations. Having more accurate and reliable infor-

mation on where their subsea ROV systems are gives operators greater confidence in their operations. Recently, subsea services provider DOF Subsea equipped three of its ROVs on Brazil-based offshore construction support vessels with SPRINT-Navs. Meanwhile, global offshore heavy lift, pipelay and construction company Allseas will be using a pair of SPRINT-Navs to support work from its trenching support vessel *Calamity Jane*.

The track record being shown in projects like P3AUV, as well as through commercial offshore applications, day in and day out, is what is needed if the industry is going to have confidence in resident vehicles. Indeed, SPRINT-Nav is already supporting the development of resident vehicles and has been selected by leading resident ROV and AUV teams. For example, two in-field ROVs built by Norway-based IKM Technology for IKM Subsea are equipped with SPRINT-Navs that are helping to guide these vehicles during resident deployments offshore Norway.

Subsea GPS

There are other tools available to subsea robots. To further enhance their localization in the subsea environment, acoustic aiding using sparse LBL nodes can be used. Sparse LBL combines traditional LBL techniques, i.e., the deployment of seafloor transponders to create an acoustic positioning array with INS, which means fewer transponders are needed. In sparse LBL, the acoustic two-way travel time measurements taken from passing next to

a transponder on a linear trajectory automatically resets DVL-INS dead-reckoning drift. Vehicles can operate for longer without reducing their positioning accuracy.

During a demonstration project, we traveled using a SPRINT-Nav out of Plymouth, passing, after 3 km, a pre-placed transponder at Plymouth Sound breakwater. Then, we passed a second transponder placed a further 5.5 km out into Cawsand Bay. The SPRINT-Nav LBL-INS positioning, compared to the RTK GPS reference, was within a robust 2 m at all times and reduced to less than 0.5 m when passing a transponder.

Sparse LBL performance and range in the Plymouth Sound is severely compromised by the shallow water and highly complex and variable sound velocity profile. In a typical offshore environment, the realistic transponder maximum ranging distance would be 1 to 3 km, and SPRINT-Nav accuracy relative to a single transponder would be approximately 0.1 percent of slant range (1 DRMS), i.e., 1 m at 1-km distance when the vehicle passes a transponder at the right angle.

This technique is already well established in the ocean science and offshore sectors for mobile mapping operations, where the sparse LBL array acts as a reference and aids INS positioning for more accurate survey data. In 2014 and 2015, oceanographic research center Monterey Bay Aquarium Research Institute (MBARI), in California, used ROV mobile mapping techniques, supported by Sonardyne, and achieved angular accuracy below 0.5°. The level of accuracy achieved means that this is a fre-

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quently used technique. The reduction in the number of transponders makes sparse LBL viable for resident AUVs as part of a subsea field architecture; the nodes provide vehicles with a network that they can use to localize themselves to within a few centimeters, at distances spanning more than a kilometer (from each node).

Not Just a Positioning Network

A sparse LBL array, using our 6G acoustic Compatts and Wideband 2 signal architecture, can also be used to wirelessly transmit data over thousands of meters, which means AUVs can use these beacons to update their navigation computer and transfer status information.

Then, when close to a docking station or a structure with which they have to interact or download high-bandwidth data from, optical communications technology can be used. Our BlueComm high-speed optical modem can communicate with a vehicle that is as far as 150 m away to harvest large volumes of

data—up to 10 Mbps—or for live manual vehicle control through the optical link, i.e., using live video feed and control from onshore, when there's a hardwire link to the BlueComm node.

For remote locations, where there's maybe not a hardwire to a nearby facility, which itself is hardwired to shore, data buoys or USVs can be used as communications gateways, enabling live communication and control. In the final demonstration trials for the Innovative UK-supported Autonomous Surface and Sub-surface Survey System (ASSSS) project, led by ASV, now L3 ASV, part of L3 Group, this capability was demonstrated. Again in Loch Ness, project partner NOC's ALR transferred data acoustically through the deep and murky water, using Sonardyne's AvTrak 6G combined transponder, transceiver and telemetry instrument, which operates using our Wideband 2 signal architecture, to a C-Worker 5 USV, equipped with a Sonardyne USBL system. This project also saw the

ALR transfer high-bandwidth data to the C-Worker, using a pair of BlueComm modems. The data were then sent via radio to an onshore control room. In future scenarios, AvTrak could support AUV-to-AUV communication in the oilfield, enabling cooperative operations—a function which is already being used in the defense and ocean science sectors.

Future Data Pathways

Knowing the robot's location is one part of the puzzle. It's the part that we can solve. There's a lot more work that needs to be done. The operator needs to instruct the robot. Those instructions need to be downloaded into the robot, and they must be turned into a sequence of tasks or waypoints. The resident AUV must then control its actuators and thrusters to get to where it needs to be. That's a lot of moving parts. Fortunately, the teams addressing these challenges are building on years of experience. They combine AUV expertise with understanding of the domain gained from ROV operations. The progress being made is like at no other time in the brief history of AUVs.

Combining the acoustic beacon sparse LBL arrays with BlueComm generates a sparse network of underwater navigation and communication nodes. These nodes can be deployed permanently on a green field or ad hoc in a brown field to help provide a harness of navigation and communication beacons in aid of resident AUV-ROV hybrids. Indeed, any contractor arriving in field to perform any inspection, maintenance or repair operations will also have access to this infrastructure, and the operator could even use it as part of its "digital twin," i.e., digital models of the oil-field infrastructure.

Operators, contractors, manufacturers, start-ups and us, the instrument manufacturers, are all working on these solutions. **ST**



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Offshore Technology Conference

As it celebrates its 50th anniversary, the Offshore Technology Conference (OTC) has added many new, high-tech topics such as marine renewables, robotic technology and artificial intelligence. In addition to recurring topics, sessions will focus on business developments, the current state of the industry, reducing costs and improving overall value, breakthrough technologies in a low-oil-price environment, industry-leading safety practices, and more.

OTC 2019 will take place May 6 to 9 at NRG Park in Houston, Texas. It is sponsored by 13 nonprofit organizations in the energy industry that work cooperatively to develop the technical program. Revenue from the event directly benefits the membership of these societies.

OTC is where energy professionals meet to exchange ideas and opinions to advance scientific and technical knowledge for offshore resources and environmental matters. The conference attracts more than 60,000 at-



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tendees from 100 countries and more than 2,000 exhibiting companies.

Founded in 1969, OTC's flagship conference is held annually in Houston. OTC has expanded technically and globally with the Arctic Technology Conference, OTC Brasil and OTC Asia.

Celebrating the Golden Anniversary

At the general opening session, under the theme of "OTC: The Next 50 Years," industry executives will explore how companies are preparing for the brave new world of digitalization, automation and machine learning.

The following industry executives will speak at the general opening session: Arnaud Breuillac, president, Exploration and Production, Total; Doug Pferdehirt, CEO, TechnipFMC; Lisa Davis, CEO, Siemens Gas and Power, managing board member, Siemens AG; Susan Dio, chairman and president, BP America; Jannicke Nilsson, exec-





utive vice president and chief operating officer, Equinor; Maria Claudia Borrás, president and CEO, Oilfield Services, Baker Hughes, a GE company; Scott Tinker, director, Bureau of Economic Geology, The University of Texas; and special guest speaker, Malcolm Frank, executive vice president of strategy and marketing for Cognizant and co-author of “What to Do When Machines Do Everything.”

The 50th OTC Legacy Luncheon will celebrate the success of OTC and pay homage to the volunteers and exhibitors who have given their time and hard work throughout the years to make OTC what it is today.

OTC will feature a new program called the “Around the World Series.” Industry leaders from energy sector countries of interest will discuss new licensing and business opportunities, as well as recently introduced technologies. The latest information will come from principals representing Australia, Norway, Mexico, France, United Kingdom, Israel, Canada, Ghana and Guyana.

The Chairman’s Panel on Energy Transformation will discuss executives’ outlook and strategy regarding the transition from hydrocarbons to renewables, moderated by 2019 Board Chairman Wafik Beydoun.

Strategies for the Future

Advancements in marine renewables have impacted the offshore sector on a global scale. OTC has expanded its program content to offer technical sessions on wind, hydrokinetic and gas hydrate advancements. Robotic technology will also be covered, with programming to provide information on how it is impacting offshore projects and enabling safe operations at a low cost. Another focus will be deriving more benefit from data using novel artificial intelligence and machine learning to improve data management, visualization and interpretation.

OTC Energy Challenge

The OTC Energy Challenge is a semester-long high-school competition with a results presentation during

OTC. Teams from across Houston solve a real-world energy challenge, then present their findings to the OTC audience via an e-poster session and compete for a scholarship prize. Each team is supported by their teacher or “coach” and assigned an industry mentor(s).

Through this event, OTC and its sponsorship partners inform students of the wide range of STEM opportunities in the energy industry and learn more about what drives and motivates young STEM students.

OTC Energy Education Institute

The Energy Education Institute conducts two events: a high-school student workshop and a workshop for all-grade-level teachers.

Teachers and students participate in grade-appropriate, hands-on energy exploration experiments provided by the National Energy Education Development (NEED) Project.

The Energy Education Institute welcomes science teachers to this free, one-day workshop. Teachers receive hands-on training by qualified NEED facilitators and take part in a presentation from a prominent energy professional.

Both teacher and student groups tour the OTC exhibit floor.

Showcase of Emerging Energy Companies

The Rice Alliance Startup Roundup at OTC is a partnership between OTC and Rice Alliance. The showcase event on April 30 will present up to 50 emerging energy companies available for investment. It offers a great opportunity for OTC attendees to learn more about these evolving businesses and enable potential partnerships and investments.

Attendance is complimentary with your OTC registration.

Industry Awards

The conference will feature the OTC Golden Anniversary Gala Dinner at the Marriott Marquis Houston to recognize the OTC Distinguished Achievement Award recipients and raise funds for the 2019 beneficiary, Spindletop Charities.

The awards for innovative technologies are part of the Spotlight on New Technology program, which is exclusively for OTC exhibitors. The program showcases products that recently entered the marketplace and are already advancing the oil and gas industry. The awards will be presented on May 6.

To learn more about OTC, visit 2019.otcnet.org. **ST**

Underwater Glider Petrel-X

Glider Rated to 10,000 M for Hadal Zone Research

By Haozhang Li • Dr. Yanhui Wang • Dr. Shuxin Wang

The deep ocean plays an important role in the carbon cycle, climate change, biodiversity, marine ecosystems, tectonic plate movements and seismic activities. Theories of the deep ocean cannot simply be extrapolated from shallow-water observations.

Plenty of experiments have been conducted in the shallow ocean during the last few centuries, but only a few surveys have been conducted in the deep ocean and even less in the hadal zone. Depth and hydrostatic pressure present challenges for submersible platforms such as ROVs, AUVs and human-occupied vehicles (HOVs).

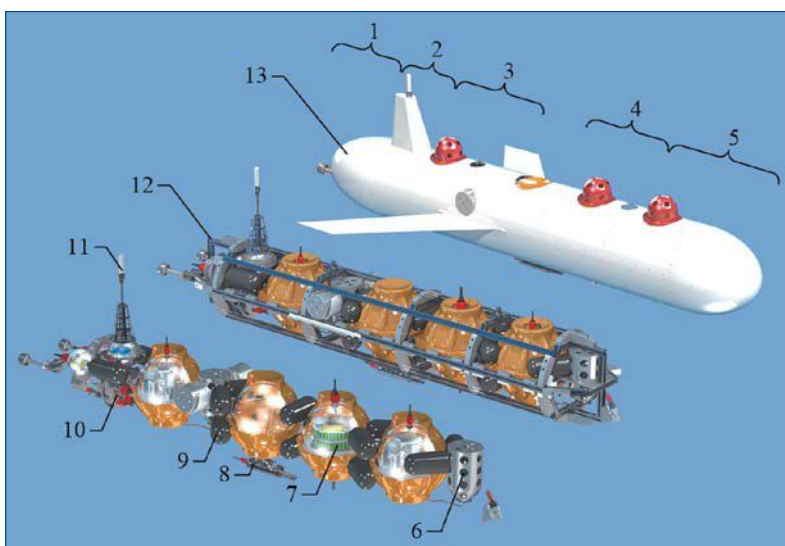
Underwater gliders are lightweight, autonomous underwater platforms that are propelled vertically by adjusting the net buoyancy. They have horizontal propulsion from hydrodynamic forces acting on the wings and the main body.

Typical underwater gliders such as the Teledyne Slocum glider, Kongsberg Seaglider, ALSEAMAR ALCEN SeaExplorer glider and Tianjin University's Petrel-II glider work to 1,000 or 1,500 m and can travel for several months and thousands of kilometers.

Several deep-sea gliders are in experimental stages. The Deepglider developed by the University of Washington and the Petrel-4000 glider developed by Tianjin University can dive to depths of 6,000 and 4,000 m, respectively. The maximum working depth of the UltraDeep Explorer developed by the European project BRIDGES is 5,000 m, not yet ocean tested.

At the moment, no existing underwater gliders can observe the hadal zone.

To fill this space, the Petrel-X glider, under development, aims to provide the oceanographic community with a platform that can operate at hadal depths for regular, cost-effective, long-term and large-scale observations of the deep ocean.



Schematic of the Petrel-X glider: 1) left and right propeller units, 2) communication unit, 3) aft hydraulic drive unit, 4) energy unit, 5) front hydraulic drive unit, 6) external bladder, 7) battery pack, 8) CTD sensor, 9) passive compensation bladder, 10) junction box, 11) antenna, 12) frame, and 13) fairing.

Modular Design

The Petrel-X glider is 4 m long, 630 mm in diameter and weighs less than 400 kg. It can dive to 10,000 m across 1,000 km in the span of more than 30 days.

The mechanical design of the glider is based on a frame that carries several units, including the dual hydraulic drive units, the compensation bladders, the dual propeller units, the energy unit, the communication unit, the onboard sensors and the fairing. These units are enclosed in pressure housings. The modular design of the mechanical structure makes it adaptable to maintain and update the units of the glider. The frame is assembled from aluminum profiles, and it is versatile and compatible with diverse payloads. High strength, high stiffness

and low linear density of the aluminum profiles make the frame reliable, stable and lightweight.

Glass spheres serve as the pressure housings that can withstand up to 114 MPa at the deepest ocean depth of about 11,000 m. With the same payload capacity, they are much lighter than the pressure housings made of metal. This reduces the weight of the entire glider significantly. Drilling multiple holes weakens the pressure resistance of the glass spheres.

The wiring scheme is optimized so that there is only one hole on top of each hemisphere for installing an underwater connector. A streamline fairing encloses the frame and the units. It protects the glass spheres and bladders from collision damage. The shapes of the front and aft parts of the fairing are optimized to reduce drag. The aspect ratio of the wings is optimized to increase the lift-to-drag ratio.

The electrical design of the glider is based on the distributed structure of the control system. The control system consists of the motion control module, the task sensors control module, the communication module and the servo control modules. They are designed to work in parallel for promoting operational efficiency and reducing risks. The module controllers that are not necessary



The Petrel-X glider deployed in the Marianas Trench.

at a given moment will be set to sleep for conserving energy.

The units and sensors of the glider are integrated easily with the extensible interfaces of the modules. A dual-element antenna consisting of active GPS and two-way passive Iridium is mounted on the titanium mast. It connects with the satellite transceiver enclosed in a small glass sphere housing with an outer diameter of 187 mm.

A compact pressure-balanced junction box connects different units together through underwater connectors. The modular design makes it convenient to maintain and update the units by simply pulling and mating the underwater connectors without opening other pressure housings.

The payload will include onboard sensors such as CTD and oxygen sensors, a current meter, lighting and cameras.

Operational Principles

Once the glider surfaces, it keeps level with the horizontal plane to make the antenna vertically stretch out of the sea surface. Measurement data are transmitted, and navigation commands are received. Then, the buoyancy of the glider is decreased by the dual hydraulic drive

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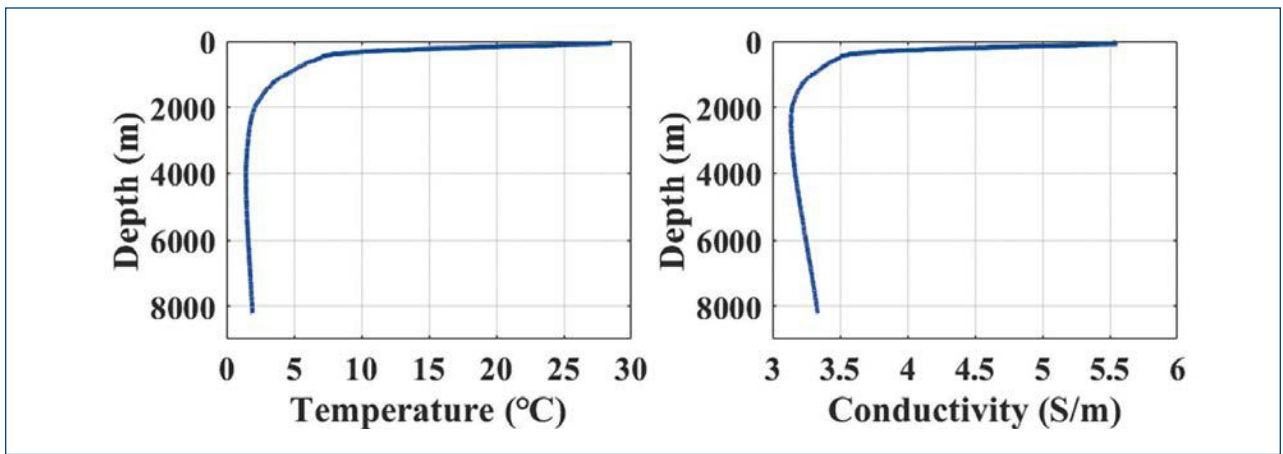


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Temperature and conductivity observed in the Mariana Trench.

units. The pitch angle is regulated by the hydraulic drive units at the same time. The net buoyancy provides the propulsion force for the glider in the vertical direction, while the lift acting on the wings and the main body moves the glider forward in horizontal direction. The dual propellers regulate the heading. When the dual hydraulic drive units increase the buoyancy of the glider, it begins to climb upward.

The motion control module and the servo control modules are in sleep mode when the glider is in a steady state. These control modules only wake up if the heading error exceeds the set value.

The task sensor control module works continually to guarantee that the task sensors acquire data at the set frequency.

The communication module only works at the sea surface.

Motion control of the glider is mainly implemented by its buoyancy adjustment subsystem and attitude adjustment subsystem. The buoyancy adjustment subsystem consists of the hydraulic drive units and the passive compensation unit. The front and aft hydraulic drive units adjust the buoyancy of the glider actively by operating the solenoid valves and pumps. When the glider prepares to dive, the solenoid valves are open, and the oil in the external bladders is driven into the internal reservoirs by the pressure difference between the seawater outside and the partial vacuum inside the pressure housings. Once the glider reaches the target depth, the oil in the internal reservoirs is pumped out in stages to keep the vertical ascending distance of the glider within the set range during a fixed time interval. This pump control strategy makes the glider climb upward in an energy-efficient way.

The passive compensation unit consists of several bladders filled with liquid whose compressibility is greater than that of seawater. These bladders are fixed outside the pressure housings and inside the fairing of the glider. Their volume can be altered significantly by the pressure and temperature of seawater, which adjusts the buoyancy of the glider passively to reduce energy consumption of the hydraulic drive units. The locations of passive compensation bladders are optimized to minimize their influence on the attitude of the glider.

The attitude adjustment subsystem consists of the dual hydraulic drive units and the dual propeller units. The dual hydraulic drive units adjust not only the buoyancy but also the pitch angle of the glider. Two external bladders are located at the front and aft of the glider, respectively. The target velocity and the target pitch angle can be achieved by setting the corresponding oil volumes in external bladders. This method makes full use of the dual hydraulic drive units to enlarge the ability of buoyancy adjustment and the range of pitch adjustment for the glider. The dual propeller units are used to regulate the heading of the glider. They are located on the left and right side of the glider, respectively. The glider turns to a specific direction when activating the propeller at the opposite side. Each propeller unit includes an actuator installed inside a glass sphere pressure housing with an outer diameter of 187 mm, a pressure-balanced motor with a gearhead, and a propeller. The propellers provide extra propulsion for the glider to pass through strong reverse currents and make it easier for the glider to get close to the ship during recovery.

Sea Trials

Pressure tests and functional tests of the glider's units were conducted in the laboratory before final assembly. Ballast weights were distributed on the glider in the test pool to keep it level with the horizontal plane and neutrally buoyant at the water surface.

The glider was tested in the coastal waters of Qingdao, China. In April 2018, the Petrel-X glider was deployed in the Mariana Trench to test its performance and monitor the temperature and conductivity of the seawater. The deepest dive of the glider was to 8,213 m.

In the deepest dive cycle, several findings were obtained from the data collected by the onboard CTD sensor. There was a sharp decrease in temperature from the sea surface to about 2,000 m, decreasing continually to 4,059 m at a slower rate. Then, the temperature slightly increased from 4,059 m to 8,213 m. The lowest temperature was 1.434° C at 4,059 m. Conductivity decreased at a steady rate from the sea surface to 2,514 m, then increased from 2,514 to 8,213 m. The lowest conductivity was 3.1354 siemens per meter at 2,514 m.

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Conclusion

The Petrel-X glider is intended to be a multiparameter platform for deep-sea observation with high spatial and temporal resolution.

The modular design of the glider makes it simple and reliable to maintain and update its units, such as battery packs, communication units, hydraulic drive units and oceanographic instruments, by simply pulling and mating the underwater connectors without opening the other pressure housings.

The displacement of the glider is decreased by the passive compensation unit spontaneously when diving downward and increased when climbing upward. This relieves the burden on the hydraulic drive units to conserve extra energy for expanding the endurance of the glider.

Dual hydraulic drive units regulate the buoyancy and pitch angle of the glider effectively at the same time under high pressure at hadal depths. The dual propeller units realize rapid adjustment of the heading and provide extra propulsion for the glider to sail across strong reverse currents.

At the moment, the Petrel-X glider's sole sensor is a CTD. In the future, other oceanographic instruments such as dissolved oxygen sensors, a current meter, deep-sea lights and cameras will be integrated on the glider to make it a versatile instrument platform able to detect the physical and biological characteristics of the deep ocean with high spatial and temporal resolution.

Upcoming work involves testing the Petrel-X glider to 10,000 m in 2019 or 2020 with more onboard sensors.

Acknowledgments

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We thank all the Petrel-X glider team members for their contributions.

References

For a list of references, contact Shuxin Wang at shuxinw@tju.edu.cn. **ST**

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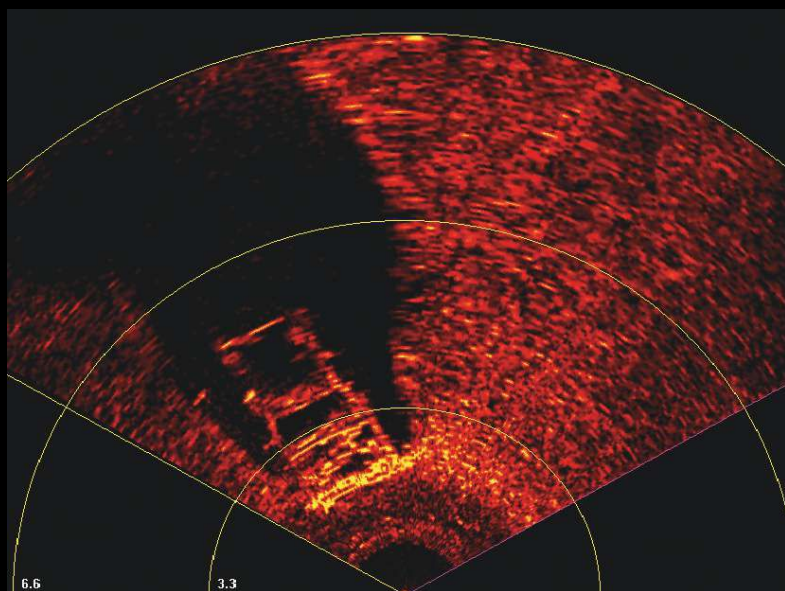
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UDT 2019

UDT 2019, the 32nd in the annual Underwater Defence Technology event series, will open in the Stockholmsmässan Exhibition Centre on May 13 and run through May 15. Stockholmsmässan is close to the city center, well served by regular metro trains, with several large hotels nearby. Stockholm Arlanda Airport is only 30 min. away by commuter train, which runs eight times per hour. The venue is the Nordic region's largest exhibition center and offers the exhibition plenty of room to expand while simultaneously hosting UDT's sister events: ITEC, which focuses on military training and simulation, and Electronic Warfare. 2019 is the first year that all three events are co-located, enabling attendees to spark new ideas, create new collaborations and partnerships, and extend networks. It also provides senior military personnel with a more efficient use of their increasingly precious time, thereby growing the number of officers in attendance.



'Total Defence'

The overall theme of UDT 2019 is "Total defence: undersea defence and security in a deteriorating global environment." Sweden's Defence Policy 2016 to 2020 establishes the Swedish approach to the deteriorating global security environment. It highlights that the underwater environment, specifically anti-submarine warfare (ASW), is an area in which Sweden is investing. Other nations are responding to the declining international environment in similar ways.

Responding to Sweden's "Total Defence" approach, UDT 2019 will examine how the underwater defense and security environment fits into a Total Defence architecture. The conference will examine how new and emerging technologies may be deployed. It will also consider how incremental developments in established technologies are enabling new approaches to traditional un-

derwater defense disciplines. UDT 2019 will look at technological developments, and adaptation of existing systems, to improve capability and performance. It will consider disruptive technologies and unique deployment strategies, with a focus on creating a Total Defence approach for military forces and civil marine security services.

UDT 2019 brings together professionals from the military, industry and academia to focus on the cutting-edge technologies and developments within

one of the harshest environments known to man. Sweden occupies a key geographic location in the Baltic Sea. Although the issues that the country faces are products of its geography, many nations tackle a similar mix of challenges. These include: proximity to a key global-trading artery; shallow littoral waters with many islands; critical national and international infrastructure in the maritime environment; complex maritime boundaries; and a need to operate in the global oceanic environment in order to assert national and international interests.

The core purpose of UDT 2019 is to empower those who serve their nations in joint, combined and distributed contexts by providing them with the most innovative strategies available in the undersea defense arena.

Nations have unique imperatives as well as those they share with others when considering national defense and the protection of civilian populations. These imperatives are driven by external and internal factors such as population, geography, climate, resources and the choices made by each society in response to both their national and international environment. The current international situation is causing many nations to re-evaluate their choices and to re-examine the models they have adopted for their military and civil forces. Sweden's Defence Policy 2016 to 2020 establishes the UDT 2019 host nation's approach to the deteriorating global security en-



vironment—that of “Total Defence”—in which linkages between all branches of national security are fully interoperable.

Military Diving Conference

The 2019 show will also host the Military Diving Conference, which was launched in 2018 to great acclaim. Focusing on the unique challenges of diving under hostile conditions, this two-day conference will share the latest technological developments aimed at improving the effectiveness, efficiency and safety of military divers across the spectrum of dive operations.

The conference will also provide a platform for inter-service and international diver elements to meet and discuss capabilities and requirements in the pursuit of greater cooperation and interoperability.

Industry will be on hand to demonstrate how their new solutions can solve these requirements and share how others are solving common problems faced by those working undersea.

Sweden has been leading the VIKING series of exercises since 1999, alongside participants from the United Nations, European Union, civilian authorities, police, military and representatives from humanitarian organizations. VIKING is a practical extension of efforts to improve mission readiness in a

time- and resource-effective manner to build interoperable military and civil defense and to build on work already undertaken by NATO to better connect joint forces within, across and among nations.

Summing up the value of UDT, Conference Chair Bert Johansson, director of business development and strategy at Saab Dynamics AB, Sweden, said, “This is a unique opportunity for defense forces around the Baltic Sea, and elsewhere, to look at new development in technology and share experience relevant to this region.”

Registration for the show is now open at udt-global.com. **ST**

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New INS/DVL tight-coupling for flexible subsea operations

Accurate positioning of subsea vehicles is critical for the success of underwater operations. GNSS signals being unavailable subsea, the vehicles deployed need to be equipped with performant and robust Inertial Navigation Systems (INS) to get reliable positioning information. However, when operating underwater during extended periods of time, a stand-alone INS will eventually accumulate navigation errors leading to drift. It is to limit this drift that INS use external aiding such as Doppler Velocity Logs (DVL), that will feed the calculated velocity of the vehicle to the INS to provide the most accurate and reliable positioning information.

To enhance the positioning performance of its INS, iXblue, a global leader in the design and manufacturing of advanced inertial navigation solutions, has thus partnered with DVL manufacturers Nortek and Teledyne RD Instruments.

Benefitting from iXblue's field-proven expertise in Fiber-Optic Gyroscopes (FOG), that have revolutionized navigation in the past decade, and from the latest DVL developments that Nortek and Teledyne RD Instruments have been working on, this new solution combines the best navigation technologies available today and offers a plug & play and scalable solution which performance and characteristics can best be suited to the user's need.

iXblue's INS/DVL tight coupling solutions cover a wide range of depths ratings and altitudes

Modularity and ease-of-use

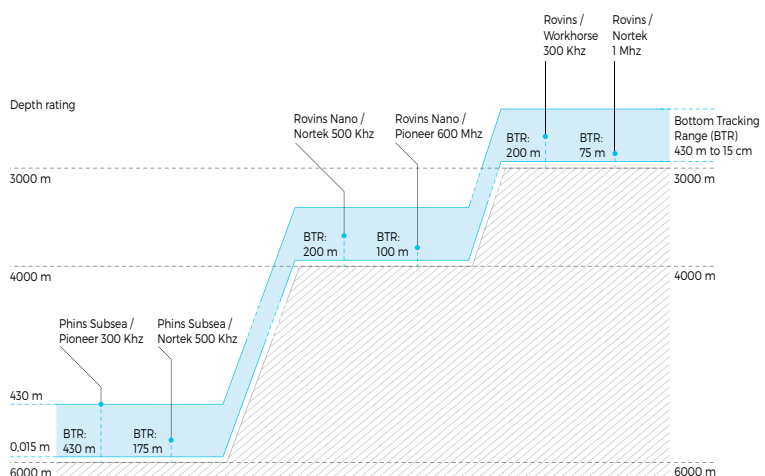
Offering modularity and flexibility, this new solution enables users to choose the INS and DVL combination the most adapted to their operation in terms of accuracy, volume, weight and altitude, with no compromise on the ease-of-use. Additionally, integration on the vehicle is made flexible thanks to the possibility to separate both the INS and DVL and individually place them anywhere and in any convenient orientation.

The risk of a damaged DVL is furthermore mitigated thanks to the ability to swap the DVL directly on the field without requiring further calibration. INS data logging capability also provides the ability to perform calibration in hidden time directly via Delph INS post processing suite or iXblue 24/7 support.

Increased position performance

Sea trials, that were conducted to qualify the characteristics of this new solution, confirmed the high position performance offered by iXblue and its partners. Following those trials and thanks to repeatable results, iXblue was able to review the position performance of its INS as follow:

- Rovins Nano or Phins Compact C3 tightly-coupled with DVL: 0,2%TD
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LEMON Lander

Pilot Frame to Accurately Position Long-Term Seafloor Observatory

By Dr. Jin-Kyu Choi • Dr. Tatsuhiro Fukuba

The Next-Generation Technology for Ocean Resource Exploration is a five-year project that was launched in 2014 as part of Japan's Cross-ministerial Strategic Innovation Promotion Program (SIP). This project involved the development of a standalone seafloor observatory, LEMON lander (Long-term Eco-system MONitoring lander), for environmental impact assessment to protect and preserve ecosystems and biodiversity on a site of ocean resource exploration and exploitation.

LEMON lander has environmental sensors to obtain biological, chemical, physical and video data on the seafloor and noncontact power and data transfer interfaces to add or interchange sensors and download stored data in situ for long-term observation in one location.

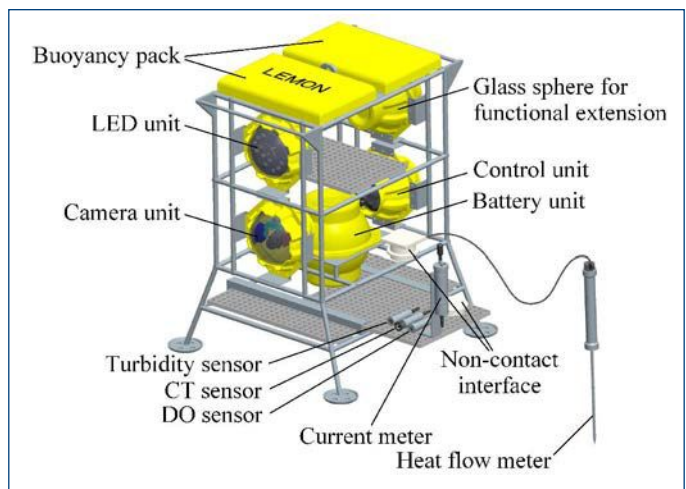
A new installation method was inspired by multiple corer design to deploy LEMON lander as close to a target location and as safely as possible. This method allows pinpoint, safe installation even if an observatory is light in water and vulnerable to shock. Two LEMON landers were developed and have been deployed successfully on the seafloor in the Okinawa Trough in January 2018.

Lander Design

LEMON lander consists of five hollow glass spheres (Okamoto Glass Co. Ltd., Japan), environmental sensors, and two noncontact power transmission and communication interfaces. Four hollow glass spheres respectively house the camera unit, LED unit, control unit and battery unit. The remaining glass sphere is for functional extension and buoyancy balance.

To obtain environmental physical and chemical data in addition to visual data, a turbidity sensor, conductivity and temperature (CT) sensor, dissolved oxygen (DO) sensor, current meter, and heat flow meter were installed.

The dimensions of LEMON lander are 1.7 by 0.81 by 1.1 m (H×W×D); the weight in air and water are respectively 291 and 40 kgf; and the depth rating is 2,000 m.

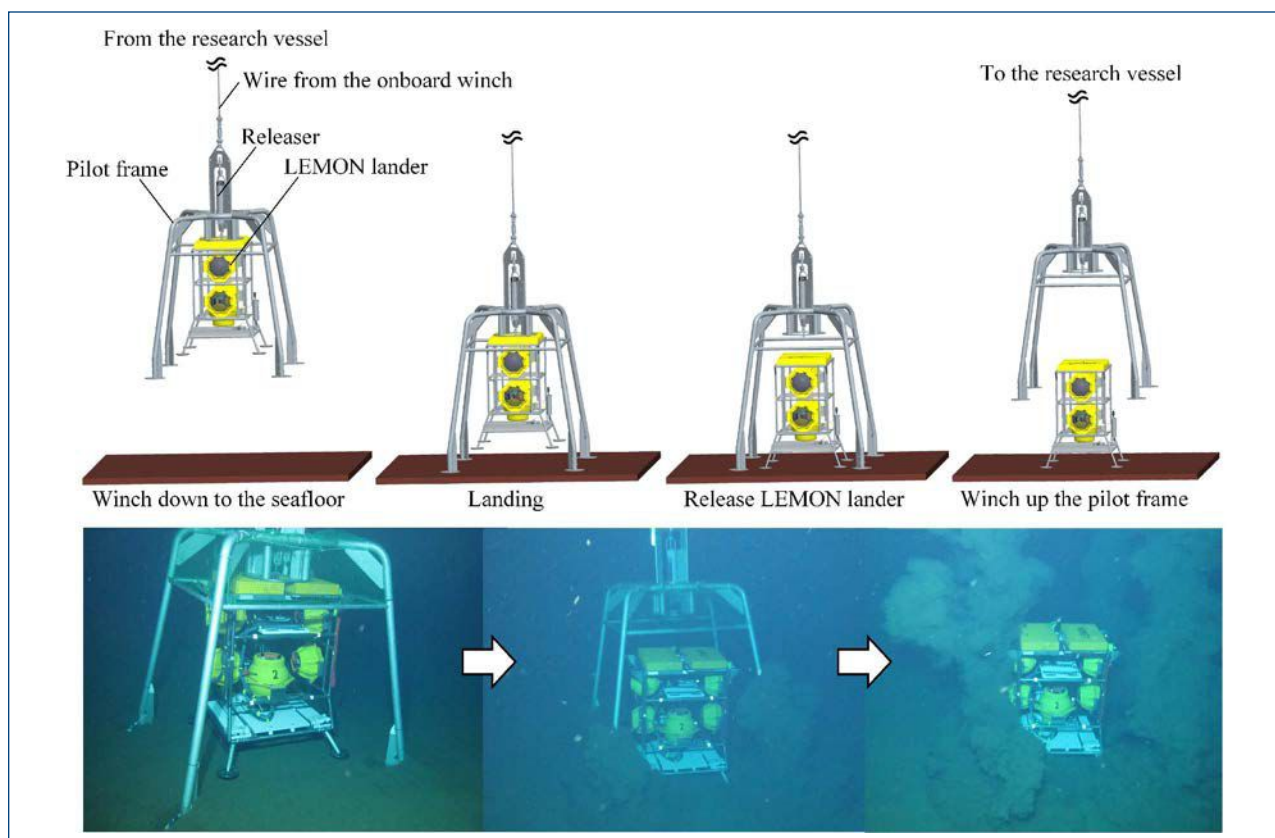


LEMON lander has sensors for environmental impact assessment and noncontact power supply and communication interfaces for long-term observation.

A grating for mounting the environmental sensors is designed to slide out from the body of the lander and frame like a drawer to minimize the influence of the body and frame on sensor performance; the current cannot be measured properly if the frame and current meter are too close to each other.

Noncontact Power, Data Transfer Interface

Long-term monitoring in one location is required for environmental impact assessment because the natural environment changes slowly in the ocean. A noncontact power and data transfer interface was adopted to allow for replacement of malfunctioning sensors, adding additional sensors, recovering stored data and checking operation in situ through an ROV. One of the two noncontact interfaces mounted on LEMON lander is used to connect with the heat flow meter, and the other is for downloading stored data and operational monitoring in situ. The noncontact interface was manufactured by B & PLUS K.



The heavy weight of the pilot frame and short falling distance from the frame to the seafloor enable pinpoint and safe installation.

K. in Japan and customized for LEMON lander. It utilizes electromagnetic induction and provides electric power supply from a 12- or 24-V DC power source and bidirectional RS-232 serial communication (9,600 bps). Since no drivers or specific software are necessary, any type of equipment or sensor can be connected. The transmission distance is 0 to 3 mm, and the power transmission efficiency for this range is approximately 80 percent.

The transmitter and receiver are enclosed in an oil-filled housing that can go to 2,000-m depth. They're dimensions are respectively 205 by 205 by 95 mm (H×W×D) and 225 by 255 by 135 mm. The weight of the pair is 13.4 kgf in air and 7 kgf in water.

A high-pressure test was performed in a test tank to evaluate the performance of the noncontact interface, and it was confirmed that the power transmission and RS-232 communication perform properly up to 20 MPa. A sea trial was also performed at 1,585-m depth in the Okinawa Trough in November 2017, verifying proper operation.

Installation

The weight in water of LEMON lander was adjusted to 40 kgf for allowing fine positioning and direction adjustment by an ROV if needed. An ROV can also be used to pull out the drawer-type grating where the environmental sensors are mounted and to insert the heat flow meter into the seafloor after the lander is positioned.

LEMON lander cannot be mounted onto a standard ROV owing to the size. The free-fall method usually used

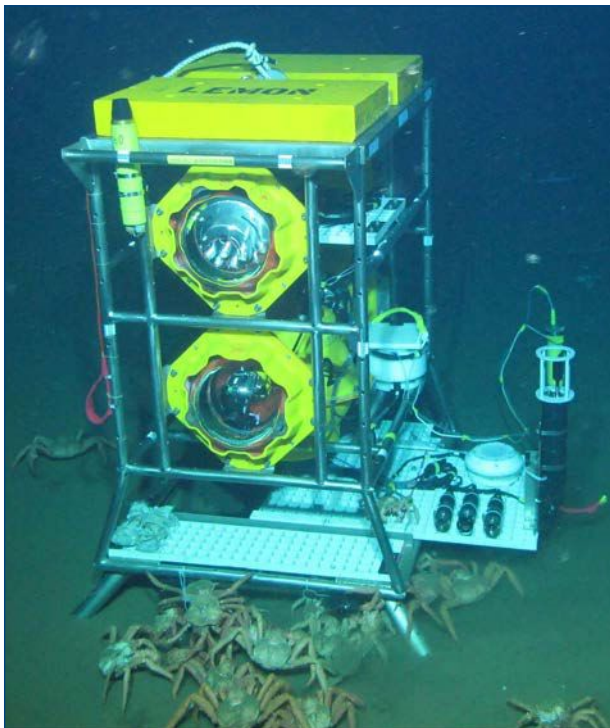
to deploy ocean-bottom seismometers and mooring systems can be considered, but the landing point with such a method can deviate far from the target point under current if the lander's weight in water is light. Moreover, the shock and the possibility of turnover during landing must be considered. The free-fall method near the seafloor using an onboard winch with an acoustic releaser faces the same difficulties.

To address these problems, a new installation method that uses a pilot frame was developed. The pilot frame is inspired by the operation principle of the multiple corer used for bottom sampling. LEMON lander is first attached to the pilot frame on deck, then goes down to the seafloor using an onboard winch. After the pilot frame touches down, LEMON lander is released from the frame.

The pilot frame is approximately 337 kgf in water, and the falling distance of LEMON lander from its position in the pilot frame to the seafloor is less than 30 cm; this distance depends on bottom sediment because the legs of the pilot frame are buried under the sediment when landing. The heavy weight of the pilot frame and the short falling distance make the lander less vulnerable to currents and assure safety during landing.

Mission Deployment

Two LEMON landers were deployed on the seafloor at a depth of 1,642 m in the Okinawa Trough on January 14, 2018. One lander is for monitoring the seafloor environment for environmental impact assessment, and the other is for comparison to those data as a reference.



(Top) LEMON lander deployed on the seafloor in the Okinawa Trough.
(Bottom) Camera image retrieved in situ through the noncontact power supply and communication interface.

The two LEMON landers are 80 m apart. The installation operations were conducted by RV *Shinnichi-Maru* and Hakuyo ROV owned by Fukada Salvage & Marine Works Co. Ltd., Japan. The gross tonnage is 997 t; the dynamic positioning system (DPS) K-Pos DP-11 manufactured by Kongsberg Maritime and differential global positioning system (DGPS) were used for position control; the main propulsion capability is 4,000 hp; and the R12K acoustic transponding release of Teledyne Benthos was used to drop LEMON lander from the pilot frame.

The wave height and wind were approximately 1.5 m and 8 m/s, respectively. Although the weather and operational conditions were not ideal, the two installation operations were conducted successfully. The research vessel moved a distance of 10.8 m when LEMON landed, and the ROV moved 12.6 m after landing for fine positioning. The two LEMON landers were checked through the noncontact interface after deployment.

Both LEMON landers were recovered safely via ROV on November 6, 2018, and the obtained data of approx-

imately 9.5 months will be used for environmental impact assessment.

The original concept of the pilot frame was to release LEMON lander automatically by using tension loosening like a multiple corer; however, an acoustic releaser was used to drop LEMON lander for the first time because the new installation method still needs to be developed for implementation.

The ROV observed the installation operation. It took a while to trigger the acoustic releaser, and this heightened expectations for employing the original release concept because the goal is to conduct the release as quickly as possible after landing to prevent a kink in the winch wire owing to the swings of the research vessel and to reduce the collision risk as the pilot frame winches up owing to the position changes of the research vessel.

Another reason to work toward using the new installation method is that the multiple corer method typically does not work well if the landing site is on a steep slope.

Conclusion

A standalone seafloor observatory LEMON lander to enable long-term environmental impact assessment and a new seafloor observatory installation method have been developed.

The noncontact power and data transfer interfaces can extend observation time by allowing for replacement of malfunctioned sensors, recovery of stored data and operation monitoring in situ through an ROV.

The installation method using a pilot frame allows pinpoint and safe installation even if the observatory is light in water and vulnerable to shock; moreover, this method has no severe requirements on size, shape and weight balance.

The next steps involve addressing the challenges of in-situ replacement of the battery unit using the noncontact interface and working toward implementation of the new installation method that entails releasing the observatory automatically via tension loosening. **ST**

Dr. Jin-Kyu Choi was a research scientist with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and has been an associate professor with the Korea Maritime and Ocean University since April 2018. His research interests include underwater robots and cabled ocean observatory systems.



Dr. Tatsuhiro Fukuba is a research scientist with JAMSTEC. Since November 2018, he has been a project associate professor at the Institute of Industrial Science, The University of Tokyo, Japan. His research interest is in the application of microfluidic technology to underwater sensing.



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Thailand and Moldova Approved For Onboard Digital Publications

The U.K. Hydrographic Office (UKHO) announced that two more flag states have approved the use of ADMIRALTY Digital Publications (ADP) in place of their paper equivalents. Thailand and Moldova are two of six flag states that have approved the use of ADP in the last six months. They join most of the world's leading flag states in the use of digital versions of ADMIRALTY publications.

Ro-Ro Ships Save on Oil Costs

Shell Marine's recommendations on medium-speed engine oils selection have saved approximately \$123,000 annually for its customer Hainan Strait Shipping, a Chinese operator of ro-ro tonnage. The company switched its trunk piston engine oils to a combination of Shell Argina S3 40 and Shell Gadinia S3 40 for six ships operating in the South China Sea. With this change, Hainan Strait Shipping was able to reduce maintenance and lubricant costs while improving the efficiency and longevity of its MAN diesel and turbo engines.

James Fisher Expands in Middle East

James Fisher and Sons (JFS) has expanded its capabilities in the Middle East with the acquisition of Murjan Al-Sharq Marine Contracting LLC (MSMC), a service provider based in Saudi Arabia, with a record of projects with Saudi Aramco. The acquisition brings local expertise into the JFS group and adds nearshore marine construction and maintenance capabilities to the JFS offer, supported by new, high-quality vessels and equipment from MSMC and the group's existing shallow-water fleet.

MacArtney Opens Tech Workshop in Denmark

MacArtney headquarters has recently repurposed the old salmon-smoking facility in Hjerting to accommodate a new 2,500-sq.-m facility that incorporates workshop space for electronics, fiber optics, cabling and mechanics. Since moving into the new facilities in March 2018, the workshop has delivered a number of ROTVs to the oil and gas and ocean science markets, completed defense contracts, and provided civil engineering and renewable energy system solutions.

New Standards for Fukushima Cleanup Robots

The Department of Homeland Security's Science and Technology Directorate and the National Institute of Standards and Technology developed standard test methods for robots, which the Japanese government will apply directly to their Fukushima cleanup efforts.

The Japanese government plans to open a \$100 million research and development facility in 2020, called the Fukushima Test Field, dedicated to improving robotics aimed at the Fukushima cleanup effort. The facility will be centered on 20 different obstacles, terrains and other challenges, plus air and water navigation.

Asian Coast Guard Ships to be Equipped with Surveillance Gear

CONTROP Precision Technologies will equip an Asian country's coast guard with its iSea EO/IR maritime surveillance payloads. The systems will be deployed on several maritime vessels this year for territorial water protection missions. The systems include a long-range thermal camera, a visible surveillance camera and an eye-safe laser range finder, as well as advanced image processing and video enhancement algorithms, an automatic video tracker and automatic gain control.

Rotterdam Port Fund Invests in ExRobotics

The investment fund Rotterdam Port Fund has acquired a stake in ExRobotics. With locations in Breda and Delft in the Netherlands, the firm is a pioneer in the development of robots that can be used in environments with a high explosion risk. Its modular robots enable remote inspection of oil and gas facilities, and the technology will be further developed in cooperation with various institutes in the Netherlands and abroad.

Hamburg-Based Company Celebrates 140-Year History of Building Ship Systems

On Feb. 28, 1879, graduate engineer Robert Ferdinand Noske set up his metal workshop in Altona near Hamburg for the construction of ventilation and central heating systems. Noske made a name for itself with innovations and patents in marine systems. Early successes, such as outfitting the Imperial Navy's "Mars" troopship in 1880, solidified the company's reputation. NOSKE-KAESER Maritime Solutions, now turning 140 years old, is currently headquartered in Hamburg's Steilshoop district, with operations in Australia, India, Malaysia, New Zealand and Turkey.

Majority of UAE Business is Acquired

Horizon Geosciences announces a change in shareholding: Boskalis has acquired a 62.5 percent share in the United Arab Emirates (UAE)-based business. The balance 37.5 percent shareholding remains unchanged and continues to be held by the company managers. Horizon has an ongoing capital investment program, which includes the recent acquisition of the DP2 vessel *Horizon Nomad*, the construction of work-class ROVs and acquisition of additional geotechnical and survey equipment.

UK Cargo Ship Co. Passes Cybersecurity Audit

Korean Register (KR) has completed a comprehensive cybersecurity audit of Songa Shipmanagement and has certified the company to be fully compliant in all areas, the first company to achieve the certification. A formal presentation took place in February at Songa Shipmanagement's offices near Glasgow, Scotland.

Seismic Tech Installed at Norwegian Oil Field

Norwegian energy firm Equinor will deploy Sonardyne cabled subsea instrumentation to increase the accuracy of time-lapse seismic data at the Johan Sverdrup oil field. Equinor plans to use seafloor-based seismic cable

permanent reservoir monitoring technology to maximize recovery rates. Subsea 7 will install a Sonardyne pressure inverted echosounder instrument to measure the two-way travel time of sound waves propagated through the water column from the seabed to the surface as well as the pressure (depth) at the seabed.

South Korean University Installs Dynamic Positioning on Training Ship

Pukyong National University has chosen GE's power conversion business to provide the SeaStream dynamic positioning (DP) system for their training vessel for fisheries industry training. The system will enable the ship to control horizontal movement and hold position against harsh wind and in choppy waters for long periods of time. SeaStream DP is a smart system that will contribute to the ship's efficiency and operational effectiveness.

Propulsion Provider Opens Australian Office

Marine Jet Power (MJP) established a new sales office for Asia-Pacific (APAC), headquartered in Perth Hender-son, Western Australia. The new MJP APAC headquarters is ideally situated in the Henderson Industrial area, offering close proximity to a number of shipyards and fleet operators. The new office, led by Regional Director Paul Hague, will offer customer support, from parts fulfillment to a local phone service for builders and operators in Australia and Southeast Asia.

Russia Calls for New, Giant Icebreaker

The Russian Zvezda shipbuilding complex located in the Far East will be rebuilt to accommodate construction of a giant icebreaker ship ordered by the government. The icebreaker project is in response to a Kremlin order last year to increase shipping across the Northern Sea Route to 80 million t by 2024, *The Barents Observer* reported. The shipyard reconstruction will be managed by Rosneft together with Rosneftgaz and Gazprombank.

Association Invites Pledge To Support Women in Maritime Industries

The Women's International Shipping & Trading Association (WISTA) has launched an inclusion pledge that addresses the underrepresentation of women in the maritime industry through a series of statements aimed at embracing diversity through individual action and personal responsibility. Individuals are encouraged to sign the pledge in support of a diverse and inclusive maritime sector at wistainternational.com/pledge.

Students Challenged to Build Plastic-Collecting ROV

Students from All Saints Catholic High School in Sheffield have been crowned champions of the Subsea UK 2019 STEM Challenge, which saw five teams from the U.K. compete to design an ROV to collect ocean plastic. The STEM challenge, led and organized by Subsea UK, saw more than 50 teams of secondary-school students compete in regional heats to earn their place. The winners from each regional heat traveled to Subsea 7 in Aberdeen in March to take part in the competition. **ST**



General Oceanics, Inc. introduces its **new model 8050 autonomous pCO₂ monitoring system**. Continuous measurement, recording and transmission of sea surface CO₂ levels.

- **Efficient equilibration of sea water and confined air head space.**
- **Infrared analysis of CO₂ concentrations.**
- **Automatic calibration.**
- **Integrated computer and control software.**
- **Integrated GPS location and atmospheric conditions.**
- **Satellite data transmission.**

<http://generaloceanics.com/home.php?cat=69>

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Student Mentorship Program Educates About Pollution Control Technology

Ship & Shore Environmental Inc. launched an engineering mentorship program for high-school, undergrad and graduate students interested in careers in engineering, environmental or other STEM-related fields. The program will continue throughout 2019 and aims to raise environmental awareness, educate youth about the importance of pollution control technologies and offer opportunities to gain real-world and practical experience.

Secure Satellite Network Operational

The final satellite is in place linking the Iridium Certus NEXT constellation together, and COMSAT now offers this service to aero, land-mobile, IoT and maritime users. The U.S.-based satellite connectivity business is the exclusive service provider for Air Force Space Command's (AFSPACE) Enhanced Mobile Satellite Services (EMSS) program. The multi-service platform supports connectivity needs regardless of location, terrain and weather.

Project Allows Use of DAT in Shallow Water

Logan Industries successfully completed a reduced bore direct acting tensioner (RB-DAT) project to enable the use of the DAT in shallow water. The project required making an existing deepwater DAT suitable for shallow waters using the existing rod and barrel, external footprint and interface points, while maintaining the same pressure rating and tuning the operating characteristics from deepwater to shallow water.

Deep Ocean Engineering Receives USV Order

Three USVs have been ordered with request of full autonomy through waypoint navigation and a mission planning system. Two Phantom H-1750s and one I-1650 are integrating this technology for features such as obstacle avoidance, malfunction correction, dealing with unexpected events and return-home functions. The waypoint route is continuously modified to plan around obstacles detected with long-range sensors.

Pollution Control Tech Installed on Newbuilds

Viking Jupiter, the 47,800-gt cruise ship built at Fincantieri's shipyard in Ancona, Italy, for Viking Cruises, has been delivered with a Thordon Bearings seawater-lubricated propeller shaft system. It is the sixth Viking cruise ship to be fitted with the COMPAC bearing arrangement.

Two 930-passenger sisterships, *Viking Tellus* and *Viking Venus*, slated for delivery in 2021, have also been specified with the pollution-free Thordon system. Newbuilds of the same class have also been ordered for delivery between 2022 and 2027.

Luxury Polar Cruise Ships Equipped with Sonar

FarSounder's forward-looking sonar will be included on the new luxury expedition cruise vessel by Mystic Cruises, the *World Explorer*. This latest technology in navigation and obstacle avoidance will be a welcome addition to this state-of-the-art vessel, as the *World Explorer* will embark on a variety of unique voyages to include exploring to the polar regions and many out-of-the-way places all around the world.

Ballast Treatment System Reduces Holding Time

Optimarin Ballast Systems (OBS) have gained approval from the U.S. Coast Guard (USCG), reducing the required holding time from 72 to 24 hr. for all salinities. The certification means the systems are optimized for short shipping routes in the U.S., with reduced time between ballast water treatment and de-ballasting.

USCG requires a holding time post-treatment for environmentally friendly UV systems to ensure all cells are inactive before testing. With increased UV doses by OBS 35-kW lamps, the holding time can be reduced.

KVH Reaches Milestone For Broadband Systems Shipped

KVH Industries recently shipped its 9,000th mini-VSAT Broadbandsm system. KVH's TracPhone V-series antenna systems are designed to provide satellite broadband connectivity to commercial vessels and leisure yachts around the world by utilizing advanced satellite technology, including high-throughput satellites (HTS).

Kraken Earns \$2.3 Million From Ocean Infinity Warrants

Kraken Robotics has received \$2.3 million from Ocean Infinity from the exercise of 5,760,000 warrants. The warrants were issued in connection with the company's private placement of units to Ocean Infinity in June 2018. The warrants expire in June 2021 and had an exercise price of \$0.40. Kraken's board of directors has also approved the issuance of 500,000 options to certain external consultants. These options will have a three-year term, and the exercise price was set at the company's closing stock price on the TSX-V as of March 5, 2019.

Phoenix to Build a Variety of Submarine Rescue Tools for Australian Defense Department

The Commonwealth of Australia Department of Defence has awarded Phoenix International a contract for a submarine rescue service, to include the acquisition and support of the SEA1354 Ph 1 Submarine Escape, Rescue, and Abandonment System (SERAS). The SRS will be delivered on a four-year acquisition schedule, and the contract includes design and construction of a submarine rescue facility, a 600-m-capable remotely operated rescue vehicle, a shallow-water submarine rescue bell, a launch and recovery system, a hyperbaric suite for decompression of rescued submariners, and an ROV.

LNG Dual-Fuel Conversion Dredger Launched

Nineteen months after the contract was awarded, the conversion of a dredger to dual-fuel capability combining LNG and MGO is close to completion. This is the first conversion of its kind to take place in Europe. Damen will deliver a turnkey package that includes engineering, procurement and support. The previous propulsion sys-

tem of Dragages-Ports' *Samuel de Champlain* was diesel-electric-burning MGO, and the contract included the change of generators to dual-fuel models and the installation of onboard LNG storage facilities.

Pipelay Barge Fleet Doubles in Size

Chet Morrison Contractors has acquired two pipelay/construction barges and a saturation diving system, effectively doubling the size of its pipelay barge fleet and increasing its saturation-diving capabilities. The acquisition includes: LB *Super Chief*, a 265-ft., pipelay barge with a 100 KIP pipe tensioner; DLB *Subsea Vision*, a 415-ft. pipelay and construction barge with a PDI large-diameter pipelay system and a 300-t crane and a moonpool; and a 12-man ABS-classed portable IMCA-compliant diving system capable of diving to depths up to 1,000 ft.

Alaska Pilot Boat Fitted with Stabilization System

The new pilot boat for the Southwest Alaska Pilots Association has a vessel stabilization system supplied by Humphree USA. The new 75.7-ft. aluminum *Galveston*-class pilot boat was designed by C. Raymond Hunt and built by Gladding-Hearn Shipbuilding, Duclos Corp. It is powered by twin 1,400-hp. EPA Tier 3 diesels with water jet drives, with a top speed of 28 kt.

New COVE Tenant Works on Big Ocean Data

IBM Canada has joined the ocean business park at the Centre for Ocean Ventures and Entrepreneurship (COVE). IBM is one of Canada's top 10 private R&D investors and last year contributed more than \$478 million to Canadian research activities. IBM, along with COVE, Dalhousie University, the Ocean Frontier Institute, the government of Canada, local industry and the province of Nova Scotia, is collaborating on the rollout of DeepSense, a big ocean data innovation environment.

US Icebreaker Returns after Antarctic Mission

The crew of the Coast Guard Cutter *Polar Star* returned to its home port in Seattle, Washington, after supporting the annual delivery of operating supplies and fuel for National Science Foundation (NSF) research stations in Antarctica. The *Polar Star* crew departed Seattle November 27, 2018 to assist in the annual delivery known as Operation Deep Freeze, the logistical support provided by the U.S. Armed Forces to the U.S. Antarctic Program. The crew supported the NSF by cutting a resupply channel through 17 mi. of Antarctic ice in the Ross Sea to escort a supply vessel to the continent.

iXblue Supplies Tech for New York Yacht Club

iXblue is now the official supplier of New York Yacht Club American Magic, a professional sailing team seeking to win the America's Cup.

iXblue has provided the team with Hydrins inertial navigation systems and Quadrans gyroscopic compasses. Using iXblue's fiber-optic gyroscope technology, Quadrans compasses and Hydrins inertial navigation systems are solid-state and well suited for the harsh environment of a racing yacht. **ST**

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Digital Chart System



eGlobe G2+ is a 4K electronic chart display and information system, displaying chart data in ultra-high definition on a 32-in. touchscreen. It uses rugged processors to provide improved ECDIS visibility, safety, route-planning capability and overall situational awareness. ChartWorld GmbH.

CTD Measurement Tool

RBRlegato³ for gliders and AUVs is optimized for flow dynamics and

supports passive acoustic monitoring and turbulence studies with silent operation while measuring CTD, salinity and sound velocity. It has optimized flow dynamics, so no pump is necessary to obtain fine structure measurements. RBR Global Ltd.

Updated Software Modules

SonarWiz 7.4 side scan updates include automatic processing and real-time directory monitoring and two new bottom-tracking algorithms designed to work in noisy environments. Chesapeake Technology Inc.

Petroleum Drum Pump

336PF3-S moves 28 oz. of fluid per stroke and comes with a 2-in. IPS fine-thread bung for simple attachment. Its 38-in.-long, 1.5-in. diam-

eter intake hose reaches the bottom of 55-gal. drums. Beckson Marine Inc.

Air Defense Module

SPIMM (self-protection integrated mistral module) is an all-in-one air defense module based on the SIMBAD-RC system and designed to equip ships of all types, particularly those without a combat system such as supply ships. The module consists of an automated naval turret equipped with two missiles and a 360° infrared system. MBDA.

Military Inflatable Boats

Constructed of high-spec Hypalon material to provide increased abrasion and UV resistance, GPM series boats are rugged, robust and lightweight. Survitec Group.

Lifeboat Off-load Hooks



Cranston-Eagle Marine off-load hooks have a locking mechanism that prevents release while the boat is suspended, and they open only when all weight is removed and the cable pulled. They are available in 2- to 12-mt capacities in davit, crane fall, boat roof and open-boat configurations. Delta "T" Systems Inc.

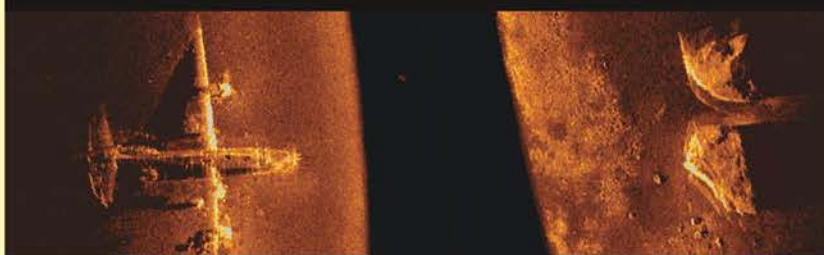
Atmospheric Diving System

HARDSUIT ADS is a one-man, one-atmosphere suit that is depth-rated to 1,200 fsw. It features joint flexibility, hand pod dexterity and the ability to use a variety of conventional diver tools and equipment. Phoenix International Holdings Inc.

Next-Generation Radar

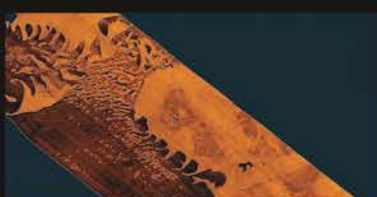
The FAR22X8BB radar series is available in 12-kW or 25-kW X-band, 30-kW S-band, or 250-W

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- ▶ New bottom tracking algorithms for first return detection
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- ▶ Greatly reduced export times for large hi-res mosaics
- ▶ Upgraded 3D viewer for viewing, easy to drape sidescan image over bathymetry
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solid-state S-band configurations. It has automatic clutter elimination and fast target tracking for up to 10 targets. Signal processing is performed directly in the gearbox, where the analog signal is converted and digitally transmitted to the processor via Ethernet connection, for reduced noise and higher sensitivity. Furuno USA Inc.

Foul-Release Coating



Propspeed has an ultraslick top coat that does not allow marine growth to grip, with a strong chemical and physical bond between the metal substrate, the primer and the top coat. Also available is Lightspeed, an anti-fouling coating for underwater lights. Oceanmax International Ltd.

Multibeam Imaging Sonar

Gemini 720im is ideal for ROV and AUV navigation, and it has an increased depth rating to 750 m and the same dimensions and weight as the 300-m model. Tritech International Ltd.

Fleet, Facility Security Tools

The KeyWatcher Fleet system tracks unauthorized booking attempts and expired licenses and generates reports and insights. KeyWatcher Touch key management has a desktop fingerprint reader and multiple copies can be used with a single SQL database. Morse Watchmans.

Robotic Inspection Crawler

MagghD is a miniature magnetic crawler that allows detailed remote visual inspection. It has a 360° continuous tilt camera with full 1080p video and 10x optical zoom. It uses IM3 (Inuktun multimission modular) technology designed to withstand the hazards associated with pressure vessels. Inuktun Services Ltd.

Jump-Starting Power Pack

Weego's Crankenstein provides 1,200 cranking amps and 5,000 peak amps for 12-V systems and 600 cranking amps and 5,000 peak amps for 24-V systems. It can jump-start vessels over 30 ft. Paris Corp.

Ultraviolet LED

OD-265-003 is a narrow-spectral-output ultraviolet light-emitting diode (UVLED) that features a narrow radiation pattern and total power output up to 0.58 mW. Opto Diode Corp.

Safe Tension Tool

ProTension safety tool eliminates the potential for loss of well control when pulling a tubing string into tension and helps set tubing anchors and other downhole tools in tension. D&L Oil Tools.

Modular Offshore USV

A modular, accession-class USV allows a vessel to increase its base length from 3.5 m to a maximum of 5 m for more payload equipment

or endurance. Unmanned Survey Solutions.

Maritime Compliance Service

MCaaS delivers customized sanctions screening that works alongside an existing compliance program to avoid false positives. It extracts hidden or unmatched data, validates against relevant documentation and applies extra scrutiny on problematic data points. The Marcura Group.

Crew Service Package

Crew Xpress includes a managed Wi-Fi solution, leased antenna, business-use data package, automated billing and usage revenue recovery scheme to incentivize ship managers to invest in crew connectivity. Inmarsat.

Subscription Data Service

ABB Ability Wellhead Manager is a cloud-based service based on SCADA. It provides access to data, alarms and call-out notifications. ABB Ltd. **ST**

ROS L300 LED Spot or Floodlight Offers Full-Range Dimming and Deep Water Brilliance

A rugged new housing design features a 42 LED array and produces 7,500 lumens illumination. The L300 is depth rated to 6000 meters.



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Oyster Aquaculture Can Limit Spread of Disease

A study initiated by Dr. Ryan Carnegie of the Virginia Institute of Marine Science has found that oyster aquaculture operations can limit the spread of disease among wild populations of oysters, contrary to long-held beliefs that diseases are often spread from farmed to wild populations. The study is based on mathematical modeling using data from the Gulf of Mexico through the Atlantic.

Diseases are a primary limiting factor in wild oyster populations. Dermo, for example, is caused by a single-celled parasite occurring naturally in the environment and proliferates in the tissue of host oysters, which spread the parasite to other oysters when they die and decay. It takes two to three years for the parasite to kill the oysters. As long as the oysters are held on farms long

enough to filter disease-causing parasites from the water, but not so long that parasites develop and spread to wild oysters nearby, aquaculture operations can reduce disease in wild populations.

Spitzer Trust Grant to Expand EESI's Work on Resilience

The New York-based Bernard and Anne Spitzer Charitable Trust has awarded a \$300,000 grant to the Environmental and Energy Study Institute (EESI) to showcase resilience as a major component of climate change adaptation in federal policy, with a focus on coastal communities and nature-based solutions.

The 2017 disaster season was the costliest on record, with more than \$300 billion in damage.

Wealth of Potential for Aquaculture in Caribbean

A team led by researchers at UC Santa Barbara's Bren School of

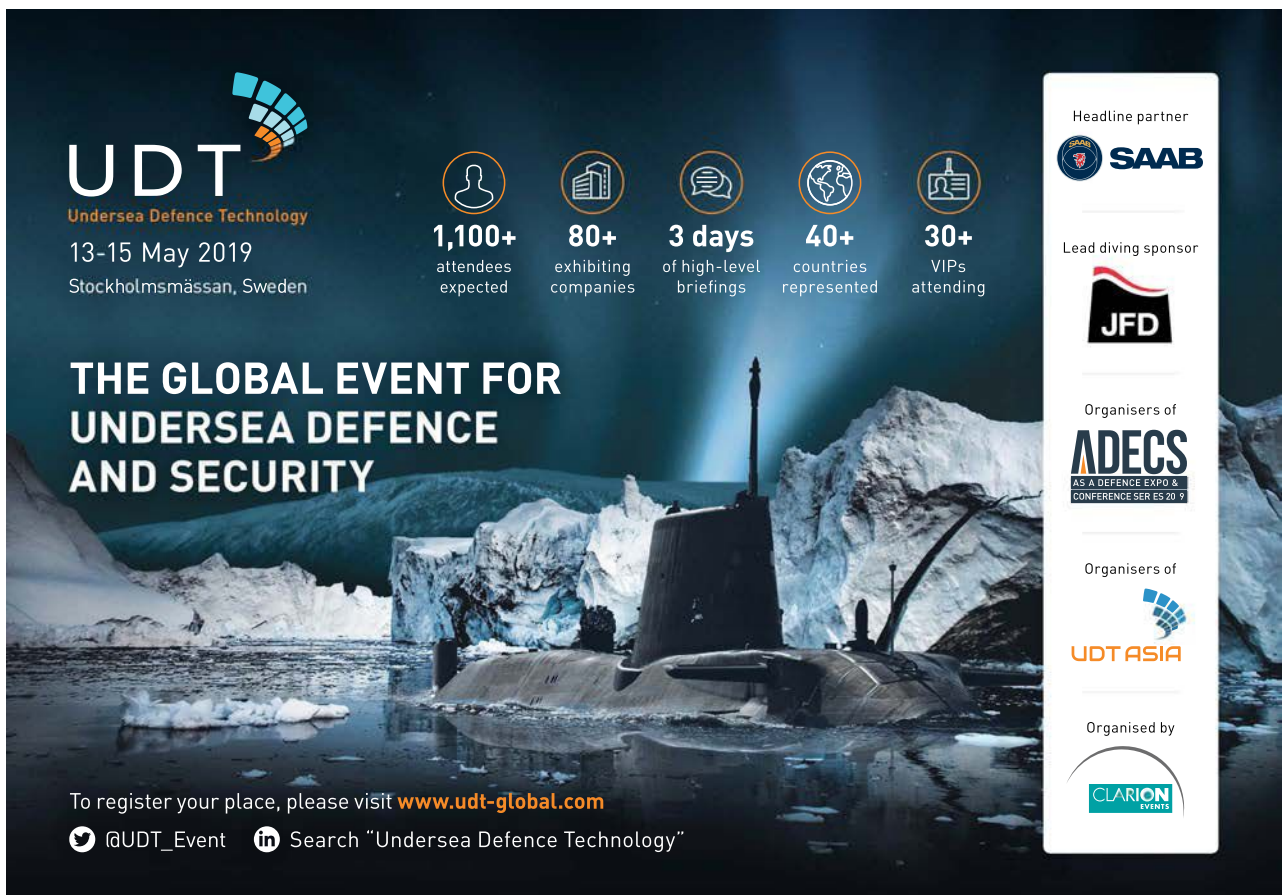
Environmental Science & Management and the Marine Science Institute (MSI) looked at the feasibility of aquaculture in the Caribbean, focusing on offshore mariculture, which offers a promising alternative to land-based and coastal aquaculture, where space is limited and environmental impacts are often high.

Even under conservative estimates, the region could produce more than 34 million metric tons of seafood per year, larger than two orders of magnitude of the region's current seafood production.

eDNA for More Efficient Alaska Salmon Count

Researchers from the University of Alaska Southeast, Auke Bay Laboratories, Oregon State University, the U.K. and China have found that salmon DNA collected in water samples from Auke Creek can be used to infer the number of salmon passing upstream to spawn.

Environmental DNA (eDNA) can be collected from water samples that are then filtered and probed





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using molecular genetic techniques to quantify the amount of DNA belonging to each salmon species.

Salmon entering Auke Creek were counted by hand. Water samples were then collected from Auke Creek, and the eDNA from coho and sockeye salmon in water samples was quantified to see whether it predicted the number of hand-counted salmon. Simple models combining eDNA counts and stream flow accurately detected pulses in coho and sockeye salmon as they migrated upstream to spawn.

eDNA collection from water samples may provide a cheap means to track the abundance of salmon returning to spawn in creeks where other survey methods are logistically challenging or prohibitively expensive. Future efforts will expand location testing.

Oceana Investigation Pins Countries, Vessel to IUU List

Following an investigation by Oceana using the Global Fishing Watch mapping platform, the South Pacific Regional Fisheries Management Organization (SPRFMO) decided to keep the fish factory vessel *Damanzaihao* (now named *Vladivostok 2000*) on its list of illegal, unreported and unregulated (IUU) fishing vessels and issued warnings to China, Panama and Cook Islands against providing assistance to the vessel. The SPRFMO's Compliance and Technical Committee found that these three countries were not in compliance with conservation and management measures to combat IUU fishing and issued them a "priority non-compliance" status.

Battery Parts from Plastic Bags

Researchers have a new method to convert plastic bags, often ending up as ocean waste, into carbon chips that could be used as anodes for lithium-ion batteries.

Vilas Pol and colleagues immersed polyethylene plastic bags in sulfuric acid and sealed them in a solvothermal reactor, which heated the sample to just below polyethylene's melting temperature. This caused sulfonic acid groups to be added to the polyethylene car-

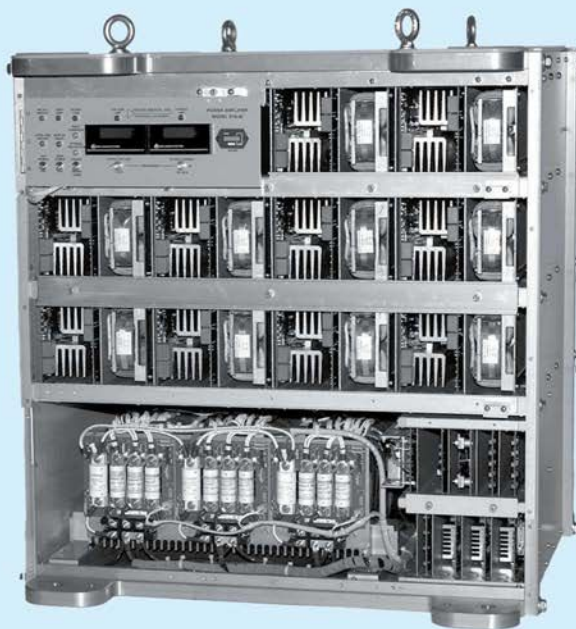
bon-carbon backbone so that the plastic could be heated to a much higher temperature without vaporizing into hazardous gases. They removed the sulfonated polyethylene from the reactor and heated it in a furnace in an inert atmosphere to produce pure carbon, then ground into a black powder to make anodes for lithium-ion batteries, with comparable performance to commercial batteries.

Mariners' Museum Library Houses Lighthouse Collection

The Mariners' Museum and Park was chosen as the new caretaker of The United States Lighthouse Society Wayne Wheeler Library collection of books, journals and lighthouse reports, which holds 4,000 volumes. The Mariners' Museum Library holds the largest maritime history collection in the Western Hemisphere. **ST**

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Funding to Demo Europe Ocean Energy

A new Interreg NWE project, Ocean DEMO, has been launched, with €12.8 million in funding to demonstrate ocean energy farms. Ocean DEMO will help finance developers of marine renewable technologies to test their products or services in real sea environments, specifically targeting multimachine ocean energy installations. This will allow developers to move closer to market by demonstrating their technologies at full commercial scale.

Ocean DEMO will release a first call for applications this year, and devices will be installed from 2020 to 2022.

Ocean DEMO will ease the transition toward pilot farms by providing free access to Europe's open-sea test centers: EMEC - European Marine Energy Centre, U.K.; DMEC - Dutch Marine Energy Centre, Netherlands; SEM REV, France; and SmartBay, Ireland.

Tekmar CPS for Northwest 2 Offshore Wind Farm

Jan De Nul Group has selected the Tekmar cable protection system (CPS) TekLink mechanical latch for the Northwest 2 offshore wind farm.

Northwest 2 will be the sixth wind farm in the North Sea off the Belgian coast, comprising 23 turbines, and

will provide a total of 219 MW from its location off the coast of Zeebrugge, in water depth of approximately 40 m. The project is set for completion in 2020.

Tekmar will supply the latest TekLink Generation 8 CPS for all inter-array and export cables.

Automated Technical Concept For Wind Turbine Maintenance

MacArtney has secured an order from Shanghai Electric Wind Power Group to develop an automated concept for a hub generator tightening tool (HGT) to improve mechanization and reduce human interaction in wind turbine maintenance. MacArtney supplied an automated technical concept to the Shanghai Electric Wind Power Group. The HGT tool comprises a Turner tool that creates the rotation of the generator and an automatic bolt tool for torquing. Prior to torquing each bolt, the hub/generator is positioned with an optical sensor system that ensures the correct location under the nacelle. The tightening of the bolts is then carried out in two stages.

The automated process of the HGT tool reduces human exposure and, thereby, improves safety.

Wind Turbine Assembly Contract for Hywind Tampen

Gulen Industrial Harbour has been awarded the contract for assembly of the floating Hywind Tampen wind turbines before they are transported to the field in the North Sea. No work will commence prior to an invest-

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ment decision for Hywind Tampen. Hywind Tampen could become the world's first project to use wind turbines for electrification of oil and gas installations. Reduction of CO₂ emissions from the five oil and gas platforms at the Snorre and Gullfaks fields is estimated at more than 200,000 tonnes per year. With a combined capacity of 88 MW, the 8-MW turbines will meet around 35 percent of the annual power demand of the five platforms.

The contractor will provide onshore and inshore areas for storage, assembly and commissioning of all components for the floating wind turbines, as well as necessary infrastructure and facilities. The floating wind turbines will be towed to the field, where they will be anchored, connected and put into operation.

Cable Protection for Scottish Offshore Wind Farm

Trelleborg's applied technologies operation delivered a range of cable protection solutions for the Kincardine offshore wind farm and the 2-MW turbine that started producing power in October 2018. Trelleborg manufactured and delivered distributed buoyancy modules (DBM), bend stiffeners and Uraduct cable and flow-line protection.

Once complete, Kincardine will feature seven floating turbines with capacity of 9.6 MW each and total installed capacity of 50 MW. The remaining five turbines are scheduled for installation about 15 km southeast of Aberdeen, Scotland, through the first half of 2020.

Subsea electrical power cables are used to interconnect floating structures on offshore wind farms and run between the substation (electrical hub of the wind farm) and the shore. Trelleborg's DBMs and bend-limitation products are designed to secure, guide and protect these power cables from excessive movement or bending that can potentially cause fatigue damage.

Total Bids Jointly on Wind Farm off Dunkirk

Total, Ørsted and Elicio announced the creation of an industrial consortium to submit a joint bid for the Dunkirk offshore wind farm project for a power capacity of up to 600 MW.

"Total's participation in this offshore wind bid is in line with our strategy to develop low-carbon electricity business in Europe," said Philippe Sauquet, president of Gas, Renewables and Power at Total.

Magallanes Installs ATIR Tidal Turbine at EMEC

The European Marine Energy Centre (EMEC) welcomed Magallanes Renewables to the tidal test site at the Fall of Warness in Orkney, Scotland. The successful installation of the second-generation 2-MW tidal platform ATIR marks a major milestone in the Ocean_2G project, which aims to test, validate and precertify Magallanes's device. The ATIR will undergo commissioning on site prior to connection to the national grid.

Led by SAGRES, Magallanes's parent company, the Ocean_2G project consortium brings together EMEC, Leask Marine and IM FutuRe, with funding from the EU's Horizon 2020 research and innovation program. **ST**

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US Senate Confirms Andrew Wheeler as EPA Chief

The U.S. Senate has confirmed Andrew Wheeler as the 15th administrator of the Environmental Protection Agency (EPA). President Donald Trump had announced his appointment as the acting EPA administrator in July 2018. Wheeler had previously been confirmed by the U.S. Senate as the EPA deputy administrator in April 2018.

Wheeler began his career during the George H.W. Bush Administration as a special assistant in EPA's Pollution Prevention and Toxics office. He has worked at the Energy and Environment Practice Group at FaegreBD Consulting; the Energy and Natural Resources Industry team at Faegre Baker Daniels law firm; the Senate Committee on Environment and Public Works; and the Senate Subcommittee on Clean Air, Climate Change, Wetlands and Nuclear Safety. Wheeler is a former chairman of the National Energy Resource Organization.

Door Opens for Tech Updates To Classic S.O.S. Signal

After 100 years, the marine S.O.S. visual distress signal will change colors in the U.S. In December 2018, the U.S. Coast Guard (USCG) issued a policy letter accepting red-orange/cyan as official colors to be used in maritime electronic visual distress signal devices (eVDSs).

The new standard on eVDSs published in June 2018 by the Radio Technical Commission for Maritime Services opens the door to permit a new type of LED-based visual distress signal with advanced technology that is both safer for the user and environmentally friendly.

Manufacturers should plan according to the most recent USCG policy letter.

USCG "recognized that pyrotechnic distress signals are old technology. Existing distress signal requirements and electric distress signal specifications need to be revised to match the advanced technology and performance capabilities of newer devices," according to staff engineer Martin Jackson on the Coast Guard blog.

An initial field study report was issued in the Long Island Sound. To assist with the research, Sirius Signal funded an additional 2017 field study in the San Diego Bay. The research confirmed that the S.O.S. signal is still being taught and that a red-orange/cyan light flashing the S.O.S. pattern is most recognizable while on the water.

S.O.S. became the universal standard to summon help (most frequently in maritime settings) on July 1, 1908.

Launch of Marine Minerals Information System

The U.S. Bureau of Ocean Energy Management (BOEM) has launched the Marine Minerals Information System (MMIS) to assist decision makers in managing coastal recovery and planning coastal resilience projects.

This marks a big step forward in BOEM's efforts to build a National Offshore Sand Inventory, providing

offshore sediment data, including data and information from 30 years of BOEM-funded research and data from more than 40 partner organizations. The information on offshore sand and gravel covers resources throughout the U.S. Atlantic, Gulf of Mexico and Pacific Outer Continental Shelf (OCS).

AAPA Selects Rep. Díaz-Balart As 2019 'Port Person'

The American Association of Port Authorities (AAPA) has selected U.S. Congressman and House Transportation, Housing and Urban Development (T-HUD) Subcommittee Ranking Member Mario Díaz-Balart (R-Fla.) as 2019's Port Person of the Year for his stalwart advocacy of the port industry.

Rep. Díaz-Balart, who also co-chairs the Florida Ports Caucus, is serving his ninth term representing Florida's 25th Congressional District. In the fiscal 2019 T-HUD appropriations bill, he negotiated language that resulted in nearly \$293 million in first-ever funding being appropriated for the Port Infrastructure Development Program within the U.S. Department of Transportation's Maritime Administration. The program's goal is to fund infrastructure improvements that enhance U.S. port competitiveness and the ability of coastal seaports to effectively handle the movement of goods in the U.S. supply chain.

House, Senate Bill to Protect Science from Politics

Rep. Paul Tonko (D-N.Y.) and Sen. Brian Schatz (D-Hawaii) introduced the Scientific Integrity Act in the U.S. House and Senate, respectively.

This legislation would protect public scientific research and reports from the influence of political and special interests.

"Independent, rigorous scientific research is one of the most powerful tools we have for advancing the public interest and keeping the American people safe," said Tonko. "President Trump's multi-agency assault on environmental standards has hinged on efforts to distort, bury and even rewrite credible public scientific findings, including his absurd denial of the growing climate crisis and efforts to cover up evidence that the American people are being exposed to dangerous toxins. Protecting the integrity of that science is one of the most important ways we can hold this president and his administration accountable."

"Our bill would protect government science from political interference," Schatz said. "It would make data and findings off limits for political appointees and managers and make sure scientists follow careful processes for review."

The Scientific Integrity Act formalizes and reinforces policies that require federal agencies that conduct or fund scientific research to maintain clear scientific integrity principles; affirms that science dictates policy and that scientific research should be free from the pressure of politics, ideology or financial influence; and holds public scientists to high standards and guarantees their rights and protections under the law. **ST**

oceanresearch

Neumayer Station III Now 10 Years in Antarctica

The Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) operates a research station in Antarctica where researchers live and work year round. The Neumayer Station III on the Ekström Ice Shelf is the primary base of operations for German Antarctic research activities. This year marks its 10th anniversary.

Antarctica is home to the Earth's largest ice masses, and the Antarctic Ocean absorbs tremendous amounts of CO₂ and heat. In order to better grasp global changes, data at the Neumayer Station III are gathered over extended time frames, from minute-to-minute weather observations to exploring the planet's climatic history based on ice cores. The station also provides support for observations of biological diversity.

For more than 3.5 decades, AWI

has maintained a research station staffed year-round in the Antarctic. Named in honor of the German polar researcher Georg von Neumayer, the Georg-von-Neumayer Station commenced operations in 1981. In 1992, it was replaced by the Neumayer Station. The current Neumayer Station III is the largest and most comfortable station in the history of German Antarctic research, with an expected service life through at least 2035.

Deep-Sea Microbes May Hold Key to Extraterrestrial Life

Far below the ocean floor, sediments are teeming with zombie-like microbes that grow in slow motion. It can take decades for a single cell to divide. A new study from the Woods Hole Oceanographic Institution (WHOI) is examining their source of "food"—nearby molecules of organic carbon. This helps understand the limitations of life on

Earth and could help inform how life might exist on other planets.

WHOI scientists examined long core samples taken aboard the RV *Knorr* and RV *Revelle* in the middle of the north Atlantic and south Pacific oceans. Analyzing the core's sediments using high-intensity X-rays, the researchers found that they contained low levels of organic-carbon molecules preserved in sediment up to 25 million years old.

The presence of carbon is unusual because the sediments contain oxygen as well. Usually, the types of microbes that thrive there would use both chemicals, but the balance between the two is lopsided in the deep sediments.

It's unclear why excess organic carbon remains. A plausible answer is: "From a microbe's point of view, the carbon may be just out of reach. When you're living in a state without much energy to spare, like these organisms, it may just be too difficult to swim or crawl around to find it," said Colleen Hansel, a microbial geochemist at WHOI.

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Waters off Western Europe Affect Climate

A new study has revealed that a deep-ocean process playing a key role in regulating Earth's climate is primarily driven by cooling waters west of Europe. These findings will help scientists better forecast changes to the weather and climate by improving understanding of the influence of the ocean upon them.

The study focused on part of the Atlantic meridional overturning circulation (AMOC), a system of ocean currents in the North Atlantic responsible for the transfer of heat from the ocean to northwest Europe, for a relatively mild climate.

U.K. National Oceanography Centre (NOC) scientists collaborated on this study alongside colleagues from 16 research institutions across seven countries.

The prevailing scientific view is that most of the AMOC's overturning and variability occurs in the Labrador Sea, off Canada. This new research shows the overturning and

variability actually happens in regions between Greenland and Scotland. There, warm, salty, shallow waters are carried north from the tropics by currents and wind, sink and convert into colder, fresher, deep waters moving south through the Irminger and Iceland basins.

Ocean overturning carries vast amounts of atmospheric carbon from human activity deep into the ocean, helping to slow global warming. The largest reservoir of this carbon from human activity is in the North Atlantic.

Funding for Baltic Sea Pollution Research

Marcelo Ketzer, professor of environmental science, and Mats Åström, professor of environmental geology, have been granted 760,000 and 375,000 SEK by SGU, Geological Survey of Sweden, for a new research project and a continuation project at Linnaeus University.

The impact of metals on the water and sediment of the Baltic Sea is a major environmental problem. The

new project will study arsenic, mercury and cadmium in sediments, in collaboration with Geological Survey of Sweden. The project will contribute to monitoring of Baltic Sea sediments and knowledge on how metals behave in the Baltic Sea due to climate change and factors like influx of oxygen-rich seawater.

The continuation project will study geochemical, mineralogical and microbiological characterization of acid sulfate soils to improve water quality in coastal plains.

'Love Your Lagoon' Sold-Out Event

Once again graduate student research on the Indian River Lagoon will continue, thanks to proceeds from the Harbor Branch Oceanographic Institute Foundation's "Love Your Lagoon" event.

Proceeds from the eighth annual, sold-out event will fund the 2019 Indian River Lagoon Graduate Research Fellows program. Fellows will present research at the 2020 Indian River Lagoon Symposium. **ST**

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Norway Oil Major Cuts Emissions from Ops

Since 2011, Equinor has reduced CO₂ emissions from its logistical operations for the Norwegian Continental Shelf (NCS) by 600,000 tonnes. The company's ambition is to halve emissions in the NCS supply chain by 2030.

In January, NorSea opened a shore-to-ship power supply station at the Dusavik supply base by Stavanger. This base is the latest in a row of supply bases where vessels on Equinor contract are offered shore power while at berth and charging of their onboard batteries.

Shore-to-ship power supply is one of several measures to reduce emissions in logistics. Thirteen supply vessels on long-term contracts with Equinor have installed shore power systems on board, and a further five vessels in the contract portfolio will be prepared for shore power supply during 2019.

DSM Mooring Contract For Diamond Rigs

Vryhof and its mooring business, Deep Sea Mooring (DSM) have signed a multi-year agreement with Diamond Offshore. DSM will provide mooring and related equipment to several of Diamond's rigs and will work closely with Diamond in developing Diamond's mooring integrity management system (MIMS) for offshore operations.

Diamond's MIMS covers procurement standards, inspection and maintenance standards, certification requirements, risk exposure and protocols, design and assessment standards, and operational practices.

Science, History on Transition Of Rigs to Reefs

Offshore oil platforms have an immense presence, physically, financially and environmentally. Some 6,000 rigs pump petroleum and natural gas worldwide. A growing number of decommissioned rigs have found new purpose as human-made reefs.

Researchers at UC Santa Barbara have published a comprehensive study of the history, ecology and pragmatics of rigs-to-reefs efforts in the journal *Ocean and Coastal Management*. The scientists hope the study will help California make an informed decision on how to handle platforms slated for retirement off its coast.

JIP to Facilitate Sustained Safe Production for TTRs

2H Offshore announced the launch of the TRACS (tensioned riser assessment for continued service) joint industry project (JIP). 2H Offshore will work with operators to develop top tension riser (TTR) reassessment and life-extension guidance.

The JIP's participants include Anadarko, Shell and BP. The project's objectives are to develop a road map to assess issues relating to the fitness for service of TTRs and provide recommendations for the mitigation of potential issues. The JIP will then use data from participant-supplied case studies to validate the methodology and provide documented examples for future guidance.

Currently, there is no single guideline in the U.S. that addresses TTR reassessments and life-extension programs in detail. The JIP will bridge the Bureau of Safety and Environmental Enforcement and American Petroleum Institute frameworks and achieve industry consensus on the analysis and inspection data and documents required to assess the feasibility of an extended service life.

The JIP will address issues including fatigue, corrosion and change of service. Recommendations for mitigation measures will be developed that take environmental and operational histories into account. The latest refined analysis, inspection and monitoring tools will be evaluated to help provide an accurate assessment of equipment condition that is a key component of continued service-assessment programs.

Planet Ocean Becomes UK, Ireland Rep for EOM

Planet Ocean Ltd. and EOM Offshore LLC has formed a strategic relationship; Planet Ocean will now serve as an exclusive representative for EOM Offshore in the U.K. and Ireland.

Planet Ocean represents a broad range of oceanographic instruments, and the addition of EOM Offshore's specialized mooring equipment to its portfolio will strengthen the company's capabilities.

EOM Offshore is a Woods Hole Oceanographic Institution (WHOI) spin-off that was established to commercialize its patented stretch EM cable, along with its electro-mechanical chain and its marine recovery systems. The stretch EM cable solves problems commonly associated with traditional catenary mooring systems, and it provides an ideal platform for real-time acoustic monitoring due to its ability to isolate ambient noise from acoustic sensors that are on the mooring.

EOM Offshore was recently awarded a Small Business Innovation Research grant to develop a version of its stretch cable carrying fiber optics, and it has developed a prototype for a conservation mooring that will be used to restore sea-grass meadows in ports and harbors.

Completion of Texas Colt Offshore Route Investigation

TDI-Brooks International Inc. has completed the geophysical and geotechnical phases for the Texas Colt Pipeline. The scope for the offshore pipeline route investigation was from the HDD/DP exit near-shore Freeport at 20-ft. depth to the proposed offshore platform at Block BA466 in 110-ft. depth at a distance of approximately 31 mi.

TDI-Brooks' vessel RV *Brooks McCall* was deployed to complete phase one to perform the pipeline route geophysical (hazard/arch/bathymetry) survey.

TDI-Brooks vessel RV *Proteus* was deployed to complete phase two of the project, which consisted of 6- and 9-m piston cores, box cores and piston cores, JPC and gCPT. **ST**

ABB to Power Iceland's First Electric Ferry

ABB will supply integrated power and electric storage solutions to the Icelandic Road and Coastal Administration's new ferry that will take 3,600 annual trips in the rough waters between Landeyjahöfn on the mainland and Westman Island, covering 13 km in about 45 min.

The ferry is due for delivery in 2019. The vessel will feature a large battery pack (3,000 kWh) and is designed to operate primarily in a fully electric mode, with onshore charging.

New Initiatives to Support IoT, big Data Start-Ups

Inmarsat has joined forces with Rainmaking's Trade and Transport Impact (T&TI) and Bluetech Accelerator to create initiatives that directly support start-ups focused on IoT and big data innovation in the maritime, ports and logistics supply chain. The programs will fund, support and mentor start-ups developing applications that aim to harness the power of IoT and big data to enhance safety, efficiency and sustainability. Inmarsat will collaborate with those start-ups to find a route to market via its global, high-speed satellite communications infrastructure that connects more than 160,000 ships and yachts, as well as ports, road and rail networks across the world.

T&TI will help connect established players, such as Inmarsat, Cargotec and Wärtsilä, with innovative start-ups to work collaboratively to address the biggest commercial and operational challenges facing the global supply chain.

The Bluetech Accelerator, sponsored by the Portuguese government, will take on six business partners, including Inmarsat, to help select and finance the first batch of winning start-ups.

Emerging digital technologies will be increasingly important to shipping and logistics and vital to improving throughput at the world's largest ports.

Autonomous Profiling Winch Developed by OSIL

Ocean Scientific International Ltd. (OSIL) has produced an innovative and compact autonomous profiling winch that will operate unmanned for 30 days at 10 profiles per day with a 15-kg payload.

The winch has 200-m drum capacity using 3-mm-diameter Dyneema and is equipped with a level wind to prevent entanglements and ensure the cable spools evenly onto the drum. The winch drum is also fitted with an encoder for pay-out readings and an internal brake that operates automatically.

LUMA Enables 0.5-Sec. Data Update Underwater

Hydromea's LUMA, a wireless high-speed underwater communication system, was successfully deployed by a subsea operator in a subsea manifold installation project in the North Sea in November 2018. LUMA was integrated with Ashtead Technology's AMS+ (autonomous monitoring system) to deliver fast, reliable remote communication of heading, pitch, roll and other essential data in real time via a work-class ROV to the construction vessel.

Typically, wide-band acoustics can provide 5-sec. data update. With the LUMA optical modem, the client obtained reliable data updates every 0.5 sec. without delay in what was deemed poor visibility by the ROV operators. Reliable data throughput was achieved with the WROV monitoring from a distance of 3.5 m from the AMS+ sensor.

Companies Merge to Form Hatteland Technology

Hatteland Display is merging with Elektronik. The two subsidiaries of the EMBRON group will become a single entity: Hatteland Technology.

As a provider of advanced technology solutions in industrial computing, security and surveillance, and industrial networking, the Elektronik portfolio complements Hat-

teland Display's maritime display and computer systems.

Underwater Robotics Tracking Proven in Aquaculture Trial

Joint trials by Norwegian research institute SINTEF Ocean and Sonardyne International Ltd. have proven that an acoustic positioning system can track underwater robots moving through industrial-scale fish pens. A Micro-Ranger 2 USBL positioning system was used to track an Argus mini-ROV through a pen containing an estimated 150,000 to 200,000 salmon.

Being able to accurately track ROVs in aquaculture operations will help operators to increase efficiency and productivity and reduce the need for divers.

Chesapeake Workshops

Chesapeake Technology Inc. will hold several training workshops this spring, summer and fall.

Spring training will be held May 14 to 15 at Stockton University, Atlantic City campus in New Jersey. It will cover new features in SonarWiz 7.4 and side scan, sub-bottom, bathymetry and mag processing.

Summer training will be held August 14 to 15 in Port Coquitlam, BC, Canada, at Kongsberg Mesotech offices. It will feature the latest version of SonarWiz and focus on side scan, single-beam and multibeam bathymetry.

Fall training will be held December 10 to 12 at a location in the eastern U.S. It will cover side scan, sub-bottom, bathymetry, magnetometry processing and a data collection day on the water.

Swivels for Oil, Gas Field In Norwegian Sea

A floating storage and offloading project in the Norwegian Sea will benefit from data and process control products from MacArtney and Moog Focal. MacArtney has secured a contract from APL Norway AS to supply a Moog Focal low-voltage electrical optical swivel (LVEOS) and a medium-voltage electrical swivel (MVES) for the Equinor Njord Bravo FSO project in the Norwegian Sea. **ST**

people

Kongsberg Digital Senior Vice President for Maritime Simulation **Tone-Merete Hansen** has been added to the list of Norway's 50 most powerful tech women. The Norwegian trade association Abelia and the ODA network for women in tech emphasized her leadership in the digital transformation of training tools for the maritime industry.



ROVOP has appointed **Lee Wilson** as head of technology. Lee will establish a detailed vision for ROVOP and lead the company's technology development, as well as all business applications and IT aspects. Lee has an extensive engineering background in subsea robotics. He joins the company from Subsea 7 where, as ROV and autonomy program manager, he led several remote technology programs, including the development of a state-of-the-art autonomous inspection vehicle.

Addleshaw Goddard hired **Ton van den Bosch** to join the firm's Singapore office. He joins from Ince & Co, where he was counsel and headed its global terminals and maritime infrastructure practice and its energy and projects team in Asia.

Sequoia Scientific Inc. announced **Ole Mikkelsen** as its new president and CEO. Mikkelsen holds a Ph.D. from the University of Copenhagen and has two decades of experience in sediment transport, particle measurements, instrument design, sales and marketing. He comes to Sequoia from a position as system sales manager with MacArtney Underwater Technology Group at its Danish headquarters.

Sensor Technology Ltd. hired **Geoff MacIntyre** as head of business development. MacIntyre has almost 20 years of experience in the ocean technology industry, most recently with Sea-Bird Scientific and Satlantic Inc.

Qassim Abdullah, Ph.D., CP, PLS, received the American Society for Photogrammetry and Remote Sensing (ASPRS) Lifetime Achievement Award to recognize his service in advancing the science of remote sensing, photogrammetry and related disciplines. He is a chief scientist and senior associate at Woolpert.

The Marine Technology Society appointed **Kathleen Herndon** as executive director. A graduate of the College of William and Mary and a Monroe Scholar, Herndon earned a Ph.D. in psychological research and program evaluation from Walden University. She has also served

as managing editor of multiple trade publications. With an extensive background in research and program evaluation, as well as more than 10 years of experience in the nonprofit sector, Herndon is committed to promoting MTS as the leading authority and advocate for marine technology and resources, while promoting member success and public understanding. MTS is uniquely positioned to foster cooperation between ocean engineers, technologists, policy makers and educators.

Applied Acoustic Engineering hired **Hollie Moran** as sales manager for the EMEA region. Moran will focus on expanding sales of USBL positioning and tracking systems and sub-bottom profiling equipment, and support the distributors in Europe, the Middle East and Africa.

Høglund Marine Solutions hired **JJ Ha** as managing director for Korea, to be based in Høglund's Busan office. He is responsible for driving the adoption of LNG and electric hybrid propulsion. Ha joins Høglund from MTS Cooperation, where he was managing director. Prior to that, he was sales manager for Rolls-Royce Marine Korea.

ASL Environmental Sciences hired **Martin Taillefer** as senior project manager. Taillefer has worked in oceanography, hydrography, ocean acoustics and underwater warfare for more than 25 years. A naval officer for more than 20 years, he served as underwater warfare director and oceanographer for the Pacific Fleet. **ST**

contracts

Kongsberg Digital AS, Asker, Norway, has signed a contract with a company in Belgium for the delivery of a K-Sim full-mission fishery simulator for beam trawling. VDAB, the Flemish service for employment and vocational training.

iXblue SAS, Saint-Germain en Laye, France, will equip three lightweight AUVs in Portugal with Phins C3, a scalable system designed to offer a choice of inertial navigation system adapted to the vehicles. Ocean-Scan-MST.

Damen Shipyards Hardinxveld, Hardinxveld-Giessendam, Netherlands, is contracted to build the first diesel-electric Damen Shoalbuster 3514 SD DP2, named "*Brutus*," which is scheduled for delivery by the first half of 2020. Herman Sr.

TCarta Marine, Denver, Colorado, will provide a baseline data set of water depths and seafloor classification around the Republic of Kiribati in the Pacific Ocean, which is threatened by rising sea levels. United Kingdom Hydrographic Office.

CR Ocean Engineering LLC, Parsippany, New Jersey, will bring its exhaust gas scrubber cleaning systems into commercial operations during 2019. More than 35 units have already been installed. Undisclosed.

Ampelmann Operations BV, Delft, Netherlands, has secured its first contract in Mexico for an A-type system, which has been mobilized on a flotel and will operate for two months, enabling the installation of an oil and gas platform. Undisclosed.

Enpro Subsea, London, England, supplied its flow access module technology on the Kepler K3 project in the Gulf of Mexico, enabling project-specific technologies to be added to standard subsea trees and manifolds. BP.

L3 Technologies, Fall River, Massachusetts, has been awarded a contract for an Iver3 EP UUV, to be used at the only interdisciplinary undergraduate program with a sole emphasis in hydrography in the U.S. University of Southern Mississippi.

JMP Marine LLC, Miami, Florida, will provide its JPR-ME5000 keel cooler pump for seven heavy- and continuous-duty engines. Mitsubishi Turbocharger and Engine America Inc.

Twin Disc Inc., Racine, Wisconsin, will integrate a BAE Systems HybridDrive with energy-efficient hybrid technology for a new 600-passenger, 128-ft. excursion vessel, *Enhydra*. Red and White Fleet. **ST**

meetings

MAY

May 6-9—Offshore Technology Conference, Houston, Texas. 972-952-9494, meetingsotc@otcnet.org or <http://2019.otcnet.org>.

May 8-9—Unmanned Maritime Systems Technology, London, England. +44 (0)20 7827 6000, events@smi-online.co.uk or www.smi-online.co.uk/defence/uk/Unmanned-Maritime-Systems.

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

May 14-15—UK Ports Conference, London, England. conference@thewaterfront.co.uk or <http://bit.ly/2QY1F7X>.

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

May 16-18—OceanTech, Zhoushan, China. katherinelee@together-expo.com.

May 21-22—Fish, Flows and Cli-

mate Resilience, York, England. info@ifm.org.uk.

May 23—Pioneering Ocean Energy Innovation in New England: Wind & Water, Fall River, Massachusetts. cie@umassd.edu or www.uma-ssd.edu/innovate/events/marine-renewable-energy-conference-2019.

JUNE

June 4-5—BlueTech Expo, Washington, D.C. 772-485-0333, mj.mcduffee@iostia.org or www.bluetechexpo.org

June 4-6—Capitol Hill Ocean Week, Washington, D.C. <https://marinesanctuary.org/capitol-hill-ocean-week>.

June 12-14—International Conference on Marine Navigation and Safety of Sea Transportation TransNav, Gdynia, Poland. +48 58 5586136, transnav@am.gdynia.pl or <http://transnav2019.am.gdynia.pl>.

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—CLEAN PACIFIC Conference & Exhibition, Vancouver, Canada. www.cleanpacific.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 24-26—Anti-Submarine Warfare, London, England. Victoria.Smart@iqpc.co.uk or www.defenceiq.com/events-antisubmarinewarfare.

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

JULY

July 10-12—Offshore Energy and Storage Summit, Brest, France. rupp@uwindsor.ca or www.osessocty.com/oses2019.

July 23—Arctic Day, Washington, D.C. meetings@navalengineers.org or www.navalengineers.org/Symposia/Arctic-Day-2019.

July 23-25—HydroVision International, Portland, Oregon. www.hydroevent.com.

AUGUST

August 20-21—AUVSI Unmanned Systems, Washington, D.C. 571-858-4364 or ehallberg@auvsi.org.

SEPTEMBER

September 1-6—European Wave and Tidal Energy Conference, Naples, Italy. ewtec2019@ewtec.org or <https://ewtec.org>.

September 3-6—SPE Offshore Europe, Aberdeen, Scotland. www.offshore-europe.co.uk.

September 8-11—SMM Hamburg, Hamburg, Germany. +49 (0)40 3569-2445 or nora.ebbinghaus@hamburg-messe.de.

September 9-13—London International Shipping Week, London, England. +44 1295 814455, sales@shippinginnovation.com or <http://londoninternationalshippingweek.com>.

September 16-20—NMEA and RTCM Marine Electronics Conference and Expo, West Palm Beach, Florida. 410-975-9425, mreede@nmea.org or www.expo.nmea.org.

September 16-20—OceanObs'19, Honolulu, Hawaii. 202-448-1245, cyanoff@oceanleadership.org or www.oceanobs19.net.

OCTOBER

October 2-3—OilComm, Houston, Texas. 484-869-2378, dmuirhead@accessintel.com or www.oilcomm.com.

October 3-5—INMEX SMM India, Mumbai, India. nora.ebbinghaus@hamburg-messe.de.

hamburg-messe.de or www.inmex-smm-india.com.

October 6-9—Teledyne Marine Technology Workshop, San Diego, California. 508-563-1639, Margo.newcombe@teledyne.com or www.teledynemarine.com/tmtw2019.

October 7-9—Offshore Energy Exhibition & Conference, Amsterdam, Netherlands. +31 10 209 2600, marketing@offshore-energy.biz or www.offshore-energy.biz.

October 8-10—PACIFIC 2019, Sydney, Australia. +61 (0)3 5282 0500, expo@amda.com.au or www.pacificexpo.com.au.

October 27-31—OCEANS 2019 Seattle, Seattle, Washington. info@oceans19mteeseattle.org or <https://seattle19.oceansconference.org>.

October 28-31—CLEAN GULF Conference & Exhibition, New Orleans, Louisiana. 713-343-1878, cbuchholtz@accessintel.com or 2019.cleangulf.org.

NOVEMBER

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

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

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

2020

FEBRUARY

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

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Let's Talk About the Future of Offshore Energy—Ben Moore

Ben Moore is the managing director of Attollo Offshore, focusing on innovation, pushing boundaries and improving offshore operations. He is dedicated to achieving the sustainability and competitive advantage of the North Sea offshore energy industry and aims to ensure a positive future for the communities in which Attollo operates. Moore seeks to uncover unrealized potential in offshore operations.



The offshore energy industry is highly dynamic in nature; technology and knowledge are always progressing, and the need for innovation and change as the industry matures is unavoidable.

Leading offshore marine operator Attollo Offshore has stepped up to the mark when it comes to addressing key issues of innovation and technology within the offshore energy industry by rolling out a conversation series focused on exactly that.

The motivation behind commissioning the series is to help open the discussion on improvements within offshore operations, readying it for a new era through constructive disruption and change.

The growing use of technology within all industries is a key topic throughout the series, which examines how cross-sector advances have the potential to provide smarter offshore operations.

From the future of working patterns to big data, Attollo has brought together some of the brightest minds across a range of industries to give their opinions on a variety of topics. The company hopes that this will ignite further debate and provide food for thought to the offshore energy industry.

The series consists of short videos of discussions from a scope of industry professionals. The first conversation went live in Decem-

ber 2018, and the series is ongoing, with a release once every six weeks. Topics that have been addressed so far include: talent; engineering and risk; digital transformations; purpose, values and culture; and corporate innovation.

Attollo chooses conversation leaders among people who have made an impact in technology and innovation, whether in or out of the offshore and general energy sectors. Risk management directors, human resource officers and engineers are just some of the groups in the target audience.

Issues under discussion include the generational changes occurring with the rise of the digital era and the importance of relationships to help transfer the fundamental ethos of a business to a future generation. The series also brings to light the importance of merging technologies and industries to further innovation. Another key issue that will be raised in the series relates to being strategic about moving toward the future with regard to calibrating old techniques with new ones.

The catalyst behind the series is the current era of the offshore energy industry. This is one of the most exciting times to be in this industry, and the goal of the series is to open people's eyes to see where new technology and ways of working can take offshore operations into the future.

Opportunities are changing and the challenges are considerable; for example, management of change, including technology adoption and addressing workplace resentment that may arise from the process of change.

The technology to propel the offshore industry forward is probably the simplest piece of the puzzle because it already exists. New technology and mindsets have the power to improve the ways we work offshore more than current thinking allows.

Old ways of working have led to shadows and inefficiencies, and hide opportunities. This new era will allow for extreme transparency and hyperefficiency on a level that has never been achieved before. The hope is that Attollo's conversation series accelerates the debate and assists with the pace of change.

One of the ways to move the offshore energy industry into the future is to increase collaboration within the industry and with other sectors. This will result in innovative procedures, methods and technological advances.

Among the most powerful messages that have arisen so far during the filming of the series is the need to find ways of transferring the knowledge held by the current generation—the "soul" of the business—to the next generation, while encouraging change and still controlling major accident hazards, promoting safety and protecting the environment—with improved methods.

Offshore businesses that can make this shift in their operations will clearly see the opportunities for growth and can execute on an ever more ambitious vision and scale.

Oil and gas will unlikely be the sole career path of people just entering the workforce. So, in order to attract them as well as retain them, the oil and gas sector needs to use new technologies and teach young people skills that can be used outside the industry.

To be clear, the purpose of the conversation series is not to try and tell people what to do. The goal is to ignite ideas on innovation and transformations, realizing there is not one technology that will change the entire industry. A culture change is required, valuing innovation more than tradition.

The series can be viewed at attollo-offshore.com/insights and on social media at [linkedin.com/company/attollo-offshore](https://www.linkedin.com/company/attollo-offshore). **ST**

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