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**How Google And Other OTTs Are
Redefining The Subsea Cable Market**

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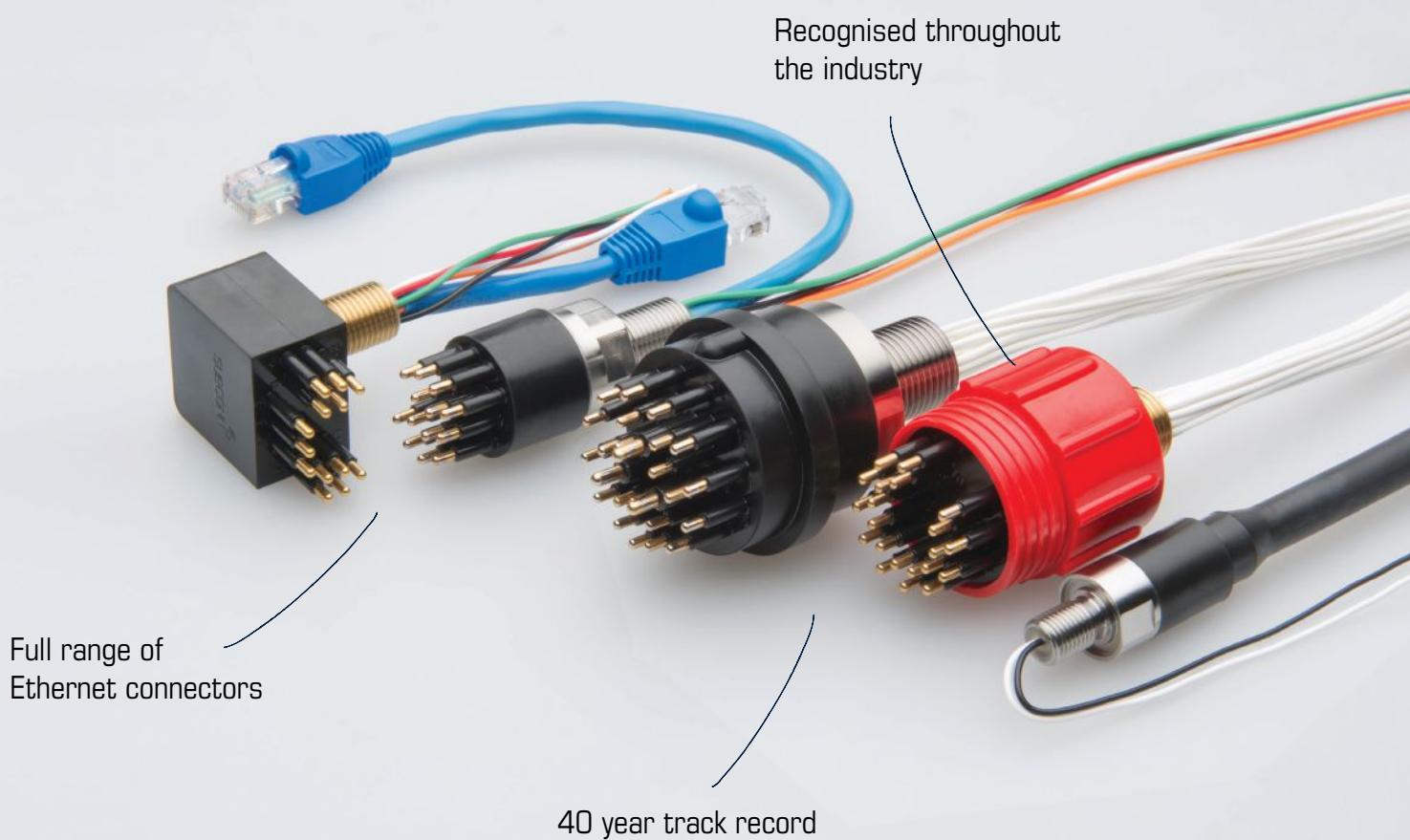
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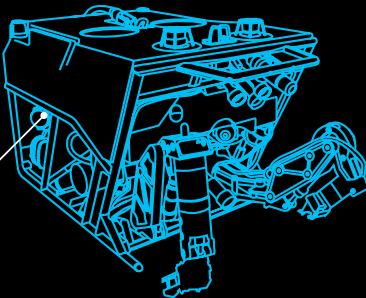


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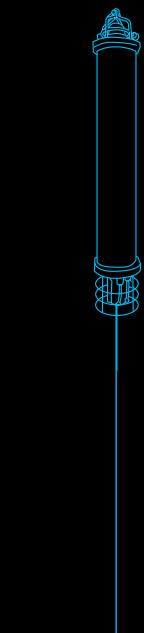
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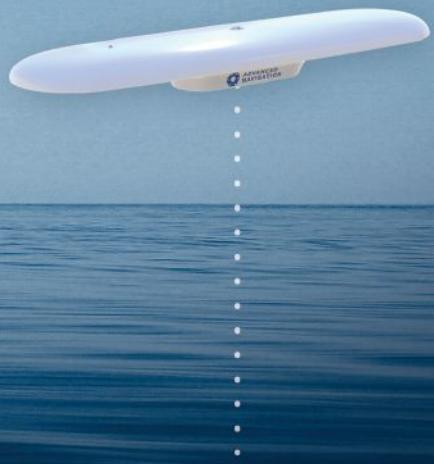
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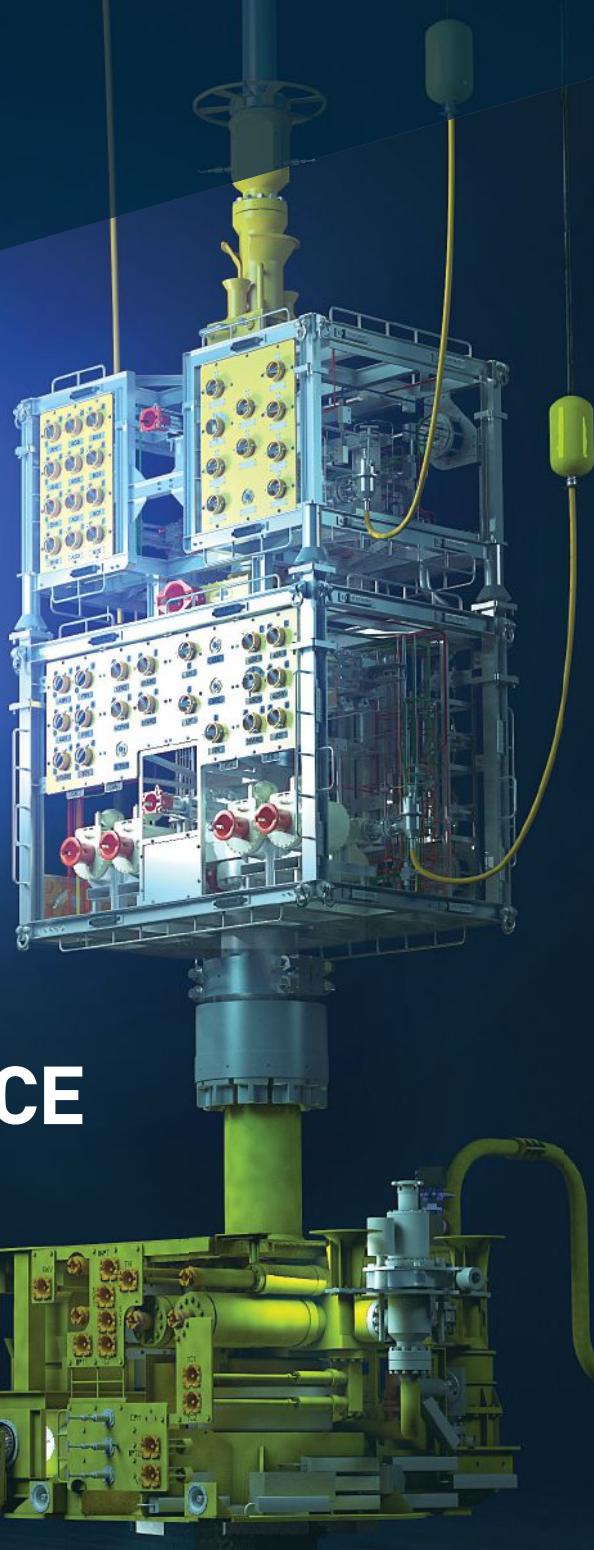


ON THE COVER:

Over 95% of communications data is transmitted through subsea fiber optic cable systems installed by vessels like SubCom's Reliance Class. Photo courtesy of SubCom.

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EDITORIAL

The Symbiosis of Offshore Wind and Oil & Gas

BY TIM BÖRNER,
*Ampelmann's Business Development Manager,
 Offshore Wind Germany*


The offshore renewables industry often appears to be the opposite of the non-regenerative offshore Oil & Gas (O&G) exploration business. It all comes down to the credo that we are looking at competing and contradicting industries. However, there is at least one industry segment where these two are benefitting from each other, and that is the utilization of Walk-to-Work (W2W) vessels for safely transferring people and cargo in harsh sea conditions. The way these industries are taking advantage from the strengths and experiences of each other is coming close to something we could call symbiosis.

The mutual benefits of two 'competing' industries

This symbiosis was initially driven by the commercial pressure of dropping oil prices in 2014 on many construction vessel owners, who were seeking to utilize their highly-specialized vessels in the offshore wind sector. And the wind sector welcomed them with open arms as, for the first time, highly capable assets that were affordable for the transfer and accommodation of personnel.

Testing this transfer method on a wider scale, which at the time was still relatively new, showed that W2W is a highly cost-efficient and safe alternative to conventional offshore accommodation and transfer methods. This is especially true for tasks such as turbine commissioning, inter-array cable installations and, in general, all personnel and cargo transfers in higher sea states.

After gaining this insight and following the demand of big industry players like Siemens, Ørsted or Vestas for safe and reliable year-round maintenance, a whole new vessel type was introduced to the market – the Service Operation Vessel (SOV).

Several shipowners, traditionally only active in the O&G sector, took the chance and offered newly-built, tailor-made vessels or conversions to fulfill this demand against long-term charter contracts. This example shows how the two in-

dustries are exchanging long-term maritime experience against predictable turnovers and utilization for several years.

Catering to the increased safety of offshore workers

Yet, it is not just the shipowners that can benefit from the exchange of knowledge and experience. The safety of the offshore workers – essentially the most important assets – is improving significantly, too.

While crew transfer operations in the North Sea's O&G sector have been mainly conducted by helicopters, which are statistically a very safe method of transferring personnel, in many other regions of the world, swing roping, bump-and-jump, or baskets are still common methods of having workers reach their workplace.

After the extensive W2W experience gained in the renewables sector over the last years, Ampelmann – as the leading provider for motion compensated transfer systems, has noticed an increasing demand from the O&G sector in 2018.

Following this trend, it is expected that the big years for W2W in O&G are still to come, while in offshore wind this is already a fully integrated transfer solution in almost all logistical concepts. To cater to the increasing demand in O&G, Ampelmann enhanced their L-type gangway system, made for safe, efficient and reliable transfer while having an extremely low power consumption.

Learn more about Ampelmann at

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HOW GOOGLE AND OTHER OTTS

ARE REDEFINING THE SUBSEA CABLE MARKET

By Jose Troncoso, Project Manager / Ocean Specialists Inc.

The submarine fiber optic cable industry is in the midst of an unprecedented growth period. New capacity is being added across the world's oceans at a pace that was unimaginable only a few years ago. The frantic pace of growth has many drivers, but perhaps the most significant is the impact of the Over-The-Top (OTT) Internet content providers – specifically Google, Facebook, Microsoft, and Amazon -- on the overall market. So exactly what impact are the OTTs having on the submarine cable market right now and how will that develop in the future?

Ocean Specialists Inc. (OSI) is a leading submarine cable system development and advisory firm for telecommunications network solutions. OSI is committed to helping its clients ensure subsea cable networks are designed in the most technically sound and cost-efficient manner possible. We have been involved in the development of submarine cable systems for more than 18 years, delivering over 200 subsea cable projects to our global client base. During this time, OSI has worked alongside OTTs in a number of projects, both regional and trans-oceanic. We have

seen the market change dramatically a number of times and have been watching as the impact of OTTs grows.

The participation of OTTs in the submarine cable market is not new. They have been buying capacity on cable systems for more than a decade. But in 2008, a major change occurred when Google became the first OTT to be a founding member of a consortium to build a submarine cable system -- the transpacific Unity cable. Prior to that moment, the consortia that built international submarine fiber optic cables were the domain of international telecom carriers. These carriers, each often holding a large percentage of the telecom market in their home countries, would join together to build cable systems that would land in their respective countries. Each carrier would receive a share of the cable's capacity based on the amount of their financial contribution to the project. Google's participation did not alter the consortium model as such, but it did herald a change that has resulted in the tremendous market power that the OTTs have now.

But that change was gradual. After Unity entered service in 2010, it was three more years before a second cable entered service with OTT presence as one of its consortium members.

The real impact of the OTTs began more recently. From 2010 through 2017, three submarine cable systems entered service that included at least one OTT in the ownership consortium. These three systems had a combined design capacity of 88 Terabits per second (Tbps). From 2018 through 2020, 16 new systems that include at least one OTT in their ownership consortia are scheduled to enter service. These have a combined design capacity of 1,278 Tbps.

So, let's take a closer look at the numbers that demonstrate the growth of the OTTs in the submarine cable industry. The following table lists the cable systems, planned and in place, that have at least one OTT as an owner.

Submarine Cable Systems with OTT Ownership						
Name	Landings	Region	Design Capacity (Tbps)	Route Length	RFS	OTT Involved
BtoBE	Hong Kong, Singapore, US West Coast	Transpacific	108	16,000	2020	Amazon, Facebook
Dunant	US East Coast, France	Transatlantic	80	6,600	2020	Google
Hong Kong America (HKA)	Hong Kong, US West Coast	Transpacific	80	13,000	2020	Facebook
Jupiter	Japan, Philippines, US West Coast	Transpacific	60	14,000	2020	Amazon, Facebook
SJC-2	Singapore, Thailand, Cambodia, Vietnam, Hong Kong, Taiwan, Mainland China, Korea and Japan	Regional Pacific	144	10,500	2020	Facebook
HAVFRUE	US East Coast, Denmark, Ireland, with future extension to Norway	Transatlantic	108	7,400	2019	Google, Facebook
Curie	US West Coast, Chile, with future extension to Panama	Americas	80	10,000	2019	Google
Hong Kong-Guam Cable System (HK-G)	Hong Kong, Guam	Regional Pacific	20	3,900	2019	Google
INDIGO	Singapore, Indonesia, Australia	Regional Pacific	18	9,000	2019	Google
JGA Cable System South	Australia, Guam	Regional Pacific	36	6,500	2019	Google
Pacific Light Cable Network (PLCN)	Hong Kong, US West Coast	Transpacific	120	12,800	2019	Google, Microsoft, Facebook
Junior	Rio de Janeiro to São Paulo, Brazil	Americas	60	400	2018	Google
New Cross Pacific (NCP)	Korea, China, Japan, US West Coast	Transpacific	80	14,000	2018	Microsoft
Tannat	Uruguay, Brazil	Americas	60	2,000	2018	Google
MAREA	US East Coast, Spain	Transatlantic	160	6,600	2018	Microsoft, Facebook
Monet	US East Coast, Brazil	Americas	64	10,500	2018	Google
FASTER	Japan, Taiwan, US West Coast	Transpacific	60	11,500	2016	Google
SJC	China, Hong Kong, Japan, Philippines, Brunei, Thailand, Singapore	Regional Pacific	23	9,700	2013	Google
Unity	Japan, US West Coast	Transpacific	5	10,000	2010	Google
TOTALS			1,366	174,400		

The table shows the vast amount of capacity that the OTT-backed cables are bringing to the market – 1,366 Terabits per second (Tbps), but it also shows how technology has advanced to deliver more capacity to the latest generation of cables. In 2010, the 5-Tbps Unity cable had a capacity that was considered enormous for its time, while the 23-Tbps SJC cable a few years later was touted as the fastest in the world. Now it is common for cable systems to exceed 100 Tbps.



» Repeater being loaded on board a cable ship at NEC Corporation's submarine cable factory in Kitakyushu, Japan.

Meanwhile, the nearly 175,000 kilometers of new cable represented by these systems is enough cable to ring the earth four times.

Geographically, of the 19 cable systems with OTT ownership, 12 of them are in the Pacific – either transpacific or regional systems. This is in line with internet bandwidth demand projections that identify Asia as having the highest increase in demand in the near future. But the transatlantic and Americas regions also are well represented. Beyond 2020, it is likely that the OTT will expand their building of new cables into other geographic regions.

Google is going one step further in its drive to build new cable systems and adding extraordinary amounts of new internet bandwidth around the world. The content giant in 2018 became the first OTT to announce that it would build international submarine cable systems entirely on its own with the announcements of the 10,000-kilometer Curie cable (connecting the United States and Chile) and the 6,600-kilometer Dunant cable (from the U.S. to France). Google is willing to take on the risk of funding and building submarine cables of this scale on its own; something very few companies have been willing to even consider before.

So, what do the OTTs have to offer to the submarine cable market? They have tremendous demand for internet bandwidth. This is true today and

their demand for bandwidth will only become greater. They also have strong financial resources. They have the financial strength to invest heavily in new submarine cable projects and know that the capacity they gain from these projects will be consumed. They are driving the market to new heights.

OTTs also are reinventing long-standing industry practices in an effort to lower the prices of new cable systems. OTTs are not the types of companies that will do things a certain way only because that is the way they were always done in the past. Perhaps a result of their history as innovative start-ups, OTTs are not hesitant to question why things are done that way and ask if there is a better and cheaper way to do it. They are not afraid to push concepts such as using different construction materials or exploring new and often radical concepts that change the way the industry thinks of everything from the Network Operations Center to the life expectancy of new cables. Thanks to their tremendous buying power, the OTTs are on the driver's seat and can make suppliers adapt to their demands.

It may seem strange to hear about OTTs trying to find ways to reduce the costs of new submarine cable systems considering their vast financial resources, but OTTs are in this for the long term; they will be building on a global scale in the next decade. As we noted earlier, they will be bringing online 16 new cable systems between 2018 and 2020 alone. A modest reduction of cost in each system can result in tremendous savings over the long term.

OTTs also are picking out new routes that, in some cases, are very different than the traditional routes for new cables. Whereas traditional submarine cable routes connected major population and business centers, OTTs primarily want to link data centers. That is why they are involved in cable systems going to Ireland, already a major data center location, Denmark, a country with growing data center aspirations, and Chile, where a cooler climate and abundant clean energy sources is luring new data centers.



» Orange Marine cable ship Rene Descartes preparing to load a repeater for the SACS project linking Angola and Brazil.





» Submarine cable repeaters stacked aboard a TE SubCom cable ship for deployment on the Monet cable system.

Given the market power of the OTTs, where do system developers and advisors fit in? Building a submarine fiber optic cable is a complicated and expensive undertaking. The table below is an excerpt of the myriad of steps associated with each of the four main phases: Planning, Project Development, Constructing and Owning & Operating.

1. PLANNING

- » System design and cost analysis
- » Compare and decide configurations
- » Landing Party and Partner MOU

2. PROJECT DEVELOPMENT

- » Develop technical and commercial requirements
- » Issue RFP to vendors
- » BAFO, vendor selection, and contract negotiation

3. CONSTRUCTING

- » Desktop Study and Permitting
- » Route survey
- » Plant manufacture
- » Installation
- » Commissioning and Acceptance

4. OWNING & OPERATING

- » OA&M contracts, maintenance plan
- » Establish network operations center(s)
- » Network readiness test
- » Upgrades

Subsea network development has not been part of an OTT's list of core competencies. While some OTTs have created and continue to grow internal teams to address their subsea infrastructure development, others don't have those type of resources in house and rely on their consortium members or even the supplier to make technical decisions. Developers and advisors partner with OTTs at all levels of the development process to protect their



» The ATISA submarine cable coming ashore at a beach on the island of Rota in the Northern Mariana Islands.

client's interests. Offloading scope and responsibility to suppliers leads to a shift in priorities, an increase in price, and a loss of negotiating power and, at the end of the day, network uptime risk remains even if liability is shifted to the supplier.

In addition, system developers, as subject matter experts, can provide an independent outlook to help manage the risks associated with the fundamental industry changes that OTTs are exploring and introducing. Subsea cable failures are expensive to repair and can lead to several weeks of network downtime; the costs associated with cable failures will be greater than those associated with proper planning, installation, and commissioning.

The future is always difficult to predict, but for the submarine fiber optic cable industry, some things are clear: Google and the other OTTs will continue to play a major role in new cable building in both the short and long term. They will lead the market as they push to change the traditional ways in which these cables are funded and built.

For more information, visit
WWW.OCEANSPECIALISTS.COM

Hugin AUV Maps Previously Unknown Deep Sea Mineral Deposits

In September 2018, the Norwegian Petroleum Directorate (NPD) concluded a three-week data acquisition expedition on the Mohn's ridge in the western part of the Norwegian Sea. The mapping was carried out using the Kongsberg Hugin autonomous underwater vehicle (AUV) operated by Ocean Floor Geophysics.

"It is very satisfying for everybody involved in this project to have been part of a new seafloor massive sulfide (SMS) discovery. I'm glad that we could contribute to NPD's discovery with our AUV, proprietary sensors and SMS exploration expertise," said

Mathew Kowalczyk, CEO of Ocean Floor Geophysics.

The Mohn's ridge is a seafloor spreading ridge, separating two oceanic plates, and the objective of the expedition was to investigate the possible existence of mineral resource deposits in this area. The NPD has identified a large area of sulfide minerals, that was previously unknown. The deposits could include important industrial metals such as copper, zinc, cobalt, nickel, vanadium, wolfram and silver.

The NPD has been assigned the task of proving and mapping deep sea minerals after the Ministry of Petroleum and Energy was given administrative responsibility for mineral deposits on the Norwegian continental shelf.

During this year's expedition, the NPD surveyed an area of 90 km x 35 km centrally located over the spreading ridge, where water depths vary between 1,200 and 3,500 meters. The expedition was conducted with the *Seabed Worker* vessel, which is owned by Swire Seabed AS.

NPD geologist Jan Stenløkk participated in the voyage. He says that the Hugin AUV mapped the seabed in long corridors, totaling 750 kilometers. The AUV was equipped with several sensors, including seabed penetrating echo sounders. Other types of data collected include multibeam bathymetry, synthetic aperture sonar data, magnetometry and spontaneous potential field data.

"Areas where these data indicated possible mineral deposits were examined using a remote operated vehicle, also known as an ROV, and large volumes of photo and video material were acquired. A number of mineral samples were also collected," says Stenløkk.

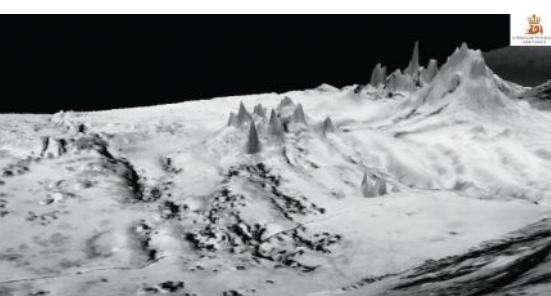
The seawater penetrates deep into the seabed, is heated to more than 400 degrees by underlying magma chambers, and dissolves many minerals. The warm seawater is flushed back



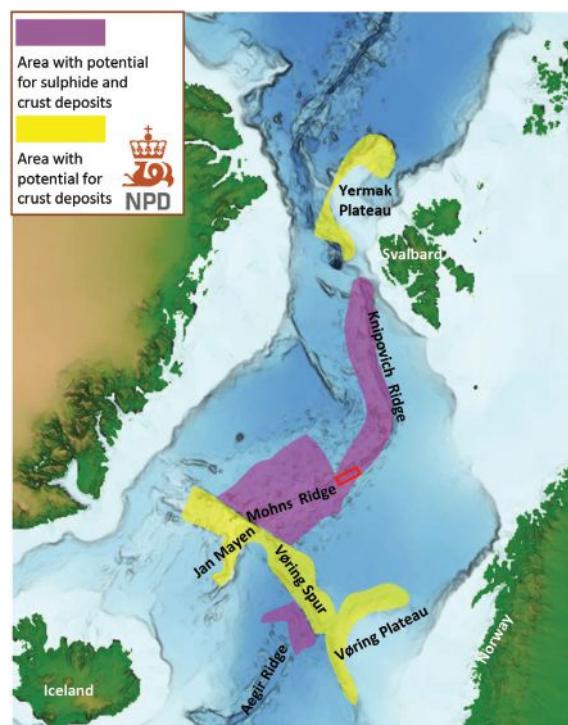
Collapsed non-active smokers. Image courtesy of the NPD.



Sulfide minerals as large fragments and gravel piles. Image courtesy of the NPD.



Synthetic aperture sonar data over areas with active and inactive smokers. Image courtesy of the NPD.



Mapping area (red square) in the central part of the Mohn ridge in the Norwegian Sea. The map also shows potential areas for seabed minerals such as sulfides and crusts. Image courtesy of the NPD.

out to the seabed through so-called "black smokers" where the minerals are precipitated in contact with the cold seawater. When the magma chambers shift due to the spreading between the plates, the flushing of the warm water stops, and the black smokers collapse and end up as piles of gravel on the seabed.

The new area of sulfide minerals that was discovered contains many such piles of gravel and collapsed black smokers, including a 26-meter high, non-active tower, in addition to some active systems. The mineral samples taken from these piles of gravel will now undergo several analyses. All mapping data from the AUV sensors will also be processed and interpreted.

Exploration director Torgeir Stordal of NPD said, "We have also tested a number of measurement and mapping techniques that will be useful in future data acquisition expeditions."

R2Sonic MultiBeam EchoSounder for First-of-Its-Kind Scientific Project

Large quantities of methane, a potent greenhouse gas, are trapped within the seafloor in the form of gas hydrates, solid ice-like deposits, which are only stable at particular conditions of high pressure and low temperature. As a result, only a small volume of methane bubbles up into the ocean. However, there is a concern that with the temperature increase of oceans, the seafloor methane hydrate deposits will dissociate, which would result in a greater volume of methane released in the ocean, and potentially reaching the atmosphere.

Scholars at the MARUM Center for Marine Environmental Sciences, University of Bremen, and the University of Washington, are working on a project called M3 to monitor the natural release of methane at the Southern Hydrate Ridge (SHR) off the coast of Oregon State.

Real-time monitoring is performed by a MultiBeam EchoSounder (MBES). Until recently it was unconceivable to envision a long-term monitoring due to the high-power consumption of the MBES. The objective is to conduct this project over two or more years in order to gather as much data as possible to help scientists determine if there is a relationship with ocean warming and volume of methane release in the ocean. Once more, R2Sonic is breaking barriers: the MBES Sonic 2022 offers high performances while ensuring low power consumption, making the M3 project possible.

The Sonic 2022 is mounted on a tripod that lays on the seafloor and is connected to the Regional Cabled Array of the Ocean Observatory Initiative (OOI), an underwater cabled observatory, which provides power supply and two-way communication to the instrument. The Sonic 2022 rotates 360° to survey the ocean for methane emissions in all directions. For more information, visit: <https://www.marum.de/Page5784.html> and www.r2sonic.com.



China's 'Sea Dragon' ROV Reaches 5,630-Meter Depth

China's Ministry of Natural Resources has announced that its newest remotely operated vehicle (ROV) reached a depth of 5,630 meters in its latest test dive – going deeper below the ocean surface than any Chinese vehicle of its type has gone before.

About the size of a car, the Hailong 11000, or Sea Dragon, was put to the test near undersea mountains in the northwest Pacific Ocean, the Ministry of Natural Resources said on September 10, 2018. This surpassed the previous record set by the Haixing ROV, which made it to 5,611 meters last year.

According to an article in the *South China Morning Post*, the test dive lasted for about 13 hours and involved tasks such as high-definition photography and observation. It was carried out as part of a broader scientific expedition in the area that began last month and runs until November.

The Hailong 11000 is the first ultra-deep sea ROV to be designed and manufactured in China, according to Ge Tong, a naval engineering professor at Shanghai Jiao Tong University.

Ge's team led the engineering work on the underwater robot, which he said was designed to reach a maximum depth of 11,000 meters – approximately that of the deepest part of the ocean at Mariana Trench.

During the test dive, the Hailong 11000 was connected by cables to research ship the *Dayang Yihao*, or *Ocean No 1*. Like other ROVs, it can be remotely controlled by crew members on a ship or from land, while its relatively small size and the fact it is unmanned means it does not use much power and can spend long hours deep below the ocean surface. They can include equipment such as video cameras, lights, sonar systems and articulating arms to carry out tasks such as picking up objects.

Only a few ROVs have been developed worldwide to dive to a depth of 6,000 meters or more, including the Deep Discoverer, or D2, which was launched by NOAA in 2013.

The *Dayang Yihao*'s 100-day expedition in the northwest Pacific involves 87 scientists and technicians from Chinese universities and research institutes and 30 crew members. The research vessel will return to its home port of Qingdao in November.

"The area is full of mineral resources, such as cobalt-rich crusts," said Li Bo, an official with the natural resources ministry. "It's a hotspot for international seabed expeditions."

Source: <https://www.scmp.com/news/china/science/article/2163777/chinas-sea-dragon-underwater-robot-reaches-record-depth-test-dive>

OCEAN EXCHANGE FINALISTS FOR \$100,000 WWL ORCELLE AWARD NAMED

The eighth annual Ocean Exchange, to be held in Savannah, Georgia from October 7 to 9, has selected the finalists for the WWL Orcelle® Award 2018. The award will be given to the solution that can make Wallenius Wilhelmsen Logistics (WWL) operations more sustainable. This year's finalists are:

- ➲ **Ashored Innovations (Nova Scotia, Canada)** – MOBI (Modular Ocean Based Instrument) system is a bottom-bound ropeless fishing system that prevents whale entanglements and trap loss, where damaged traps become ocean waste.
- ➲ **Blue Nalu (CA, USA)** – A pioneer in cellular aquaculture, in which living cells are isolated from fish tissue, placed into culture media for proliferation, and then assembled into fresh and frozen seafood products.
- ➲ **Coral Vita (Freeport, Bahamas)** – Land-based farms integrate new methods to accelerate coral growth, while enhancing resiliency to changing environmental conditions.
- ➲ **Graphite Innovations and Technology (Nova Scotia, Canada)** – Developed marine coating materials which utilize graphene to create a formula that protects ship hulls from corrosion and biofouling.
- ➲ **Hoopers Island Oyster Co (MD, USA)** – Developed a vertically integrated oyster aquaculture system that provides new and established growers with seed, grow-out equipment, and processing equipment to support oysterpreneurs.
- ➲ **Jolt Energy Storage Technologies (MI, USA)** – Developed a new and highly scalable battery technology where no expensive catalysts or selective membranes are required.
- ➲ **MicroSynbiotix (Cork, Ireland)** – Helps solve the fish vaccine challenge by engineering microalgae to lock the vaccine in the biomass which is a natural part of the fish diet

and an essential dietary element in the early development of shrimp and fin-fish.

- ➲ **OceanComm (IL, USA)** – Developed a wireless underwater modem that offers communication similar to Wi-Fi, negating the need for tethered communication links.
- ➲ **Osmo Systems (CA, USA)** – The Osmobot integrates a series of well-proven photochemical sensors into a single, low-cost robust probe, improving aquaculture management and monitoring.
- ➲ **Pajarito Powder (NM, USA)** – Developed catalyst and engineered catalyst supports for improved Proton Exchange Membranes in fuel cells and electrolyzers, facilitating energy-dense onboard energy storage of electricity.
- ➲ **Sailing for Sustainability S4S (Suva, Fiji)** – Drawing on designs of one of the greatest innovations of the Pacific Islanders, the proa boat, and using modern materials, S4S created a low-cost cargo and passenger sailing proa for last mile connection to scattered island communities around the world, helping solve logistics issues and saving the culture of island life.
- ➲ **ThisFish Inc. (British Columbia, Canada)** – Built for the seafood processing sector, Tally is simple, user-friendly software that enables companies to digitize all their production, traceability and quality control data, using visual data dashboards and data analytics.

This is the first of two \$100,000 awards to be given at the Ocean Exchange. The second is the Neptune Award 2018, which will be given to the solution that advances our understanding of the ocean and that helps minimize our impact on these resources, even while using them for human benefit, resulting in more resilient bodies of water, including healthy marine life and coastlines.

The Blue Innovation Symposium Scheduled for Late November

The Blue Innovation Symposium is the premier event in New England for connecting the marine technology industry for education, networking and facilitating partnering opportunities.

The theme for this year's conference is "The Ocean, Data and You," with a focus on data analytics and cyber security. This year's conference, which is being organized by Salve Regina University and sponsored by the Consulate General of Canada in Boston, will be held November

26-27 in Newport, Rhode Island.

The symposium will bring together leading-edge marine technology companies for programming aimed at providing an overview of current trends in the industry, and a showcase of start-up companies to discuss their new technologies. This year, we expect more than 200 attendees and more than 30 corporate sponsors.

The Blue Innovation Symposium is being

organized by Salve Regina's Office of Graduate Studies and Continuing Education and is part of our effort to connect the University with industry, organizations, state and federal agencies, and other key stakeholders in order to grow the region's economy. *Ocean News & Technology* is an official media partner of the event and will be in attendance.

To register, visit <https://salve.edu/blue-innovation-symposium>.



Okeanus Delivers Magnetometer Winch Systems to the Colombian Navy

Okeanus Science & Technology (Okeanus), an established marine equipment and engineering services provider, has announced delivery of two Okeanus Model DT3030EHLWR winch systems to the Colombian Navy for magnetometer deployments.

"This is our second winch set delivery to the Colombian Navy and illustrates once again that our systems have exceeded their expectations," said Darrell Troville, Production Director at Okeanus. "We are pleased to have been selected to provide such highly transportable, durable, user-friendly systems, giving the Colombian Navy years of reliable service."

The Model DT3030EHLWR winch is a general purpose, highly transportable winch designed for a wide variety of oceanographic applications such as sub-bottom profiling, side scan sonar, CTD or other similar operations. Each of the two fully integrated systems features a gearbox-hydraulic motor drive, primary automatic failsafe brake, secondary manual band brake, automatic bi-directional level wind, and local/remote control stations providing infinitely variable speed control. Both winches are equipped with lifting eyes for four-point lifting; sea fastening plates to allow rapid installation and removal aboard vessels of opportunity.

Each winch assembly provides a bare drum safe working load of 16,013 N (1,633 kg, 3,600 lbs) at a bare drum line speed of 1.00 m/s (60 ppm, 200 fpm). The winch drum is capable of holding 5,000 meters (16,405 feet) of 11.43 mm (0.45 in) outside diameter cable. Overall dimensions are 1,473 mm (58 in) depth, 1,930 mm (76 in) width across the drum face and 1,473 mm (58 in) height. Each winch is equipped with a 22 kW (30 HP) electro-hydraulic power unit integrated into the winch base frame.



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QUT Professor Matthew Dunbabin with RangerBot. Photo credit: QUT.



RangerBot being deployed. Photo credit: QUT.

Meet RangerBot, Robot Reef Protector

An underwater drone that can keep watch on reef health and accurately identify and inject the devastating crown-of-thorns starfish is ready to be put to the test on the Great Barrier Reef, as a result of a collaboration between QUT, Google and the Great Barrier Reef Foundation.

Equipped with a high-tech vision system which allows it to 'see' underwater, and operated using a smart tablet, RangerBot is the low-cost, autonomous robot concept that won the 2016 Google Impact Challenge People's Choice prize, enabling QUT roboticists to develop innovative robotics technology into a real-life reef protector.



RangerBot.
Photo credit: QUT

Launching RangerBot at Townsville's Reef HQ Aquarium, QUT Professor Matthew Dunbabin said after almost two years of research, development and testing, RangerBot's industry-leading technology is now ready to be put through its paces by those working to monitor and protect the Reef.

"RangerBot is the world's first underwater robotic system designed specifically for coral reef environments, using only robot-vision for real-time navigation, obstacle avoidance and complex science missions," Professor Dunbabin said.

"This multifunction ocean drone can monitor a wide range of issues facing coral reefs including coral bleaching, water quality, pest species, pollution and siltation. It can help to map expansive underwater areas at scales not previously possible, making it a valuable tool for reef research and management. RangerBot can stay under water almost three times longer than

a human diver, gather more data, and operate in all conditions and at all times of the day or night, including where it may not be safe for a human diver. The robot is fitted with computer vision to 'see' where it's going and avoid obstacles as well as multiple thrusters so it can move in every direction.

"We've 'trained' RangerBot to detect crown-of-thorns starfish – and only these coral-destroying starfish – in much the same way as people learn to differentiate between various forms of sea life. Using real-time computer vision processed on board the robot, RangerBot can identify these deadly starfish with 99.4 percent accuracy. Once the identification is confirmed, RangerBot can instigate an injection which is fatal for the crown-of-thorns starfish, but doesn't affect anything else on the reef," he said.

Professor Dunbabin said unlike single-purpose marine robots – which are more manual and based on expensive acoustic technologies – RangerBot uses innovative vision-based technologies.

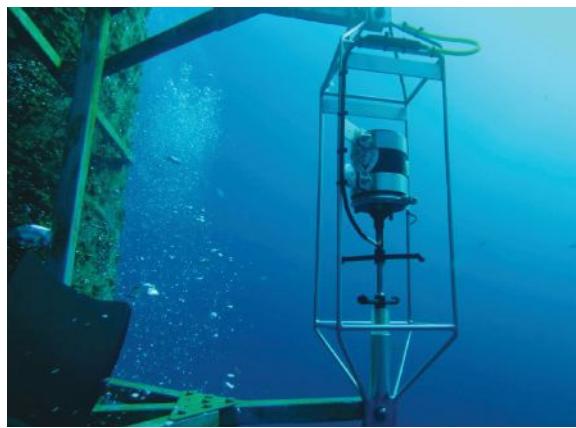
"RangerBot is also deliberately low cost, to allow production to be scaled up once the next level of operational testing is completed and all the necessary approvals are in place. Weighing just 15 kilograms and measuring 75 centimeters, it takes just 15 minutes to learn how to operate RangerBot using a smart tablet. Our vision is to make RangerBots readily available and accessible to be deployed on the Reef where they're most needed and to put them in the hands of reef managers, researchers and communities worldwide," he said.

RangerBot's capabilities have been extensively tested in the lab and on the Reef. The next steps will involve further collaboration with the Great Barrier Reef Marine Park Authority, Australian Institute of Marine Science (AIMS), and others on the specific testing, review and approvals necessary to ensure RangerBot is set to take on Reef duty.

For more information, visit
WWW.QUT.EDU.AU/

FSI Expands the ACM-PLUS Family of Current, Wave, and Tide Meters

In the past, Falmouth Scientific, Inc. (FSI) offered two standard housings for its ACM-PLUS family of products – a 200-m version for shallow water applications, and a titanium 7,000-m version for deep moorings and other full ocean depth deployments. FSI has updated and requalified the shallow version to be rated to depths of 300-m and added an anodized aluminum 3,000-m version. For more information, visit www.oceannews.com/news/science-technology/fsi-expands-the-acm-plus-family-of-current-wave-and-tide-meters



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BP Deploys Analytics Solution on Gulf Platforms

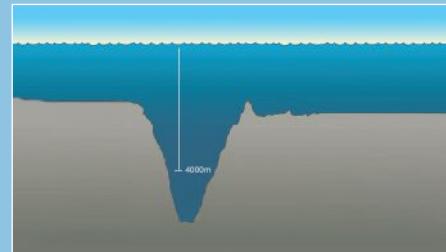
BP has successfully deployed Plant Operations Advisor (POA), a cloud-based advanced analytics solution developed with Baker Hughes, a GE company, across all four of its operated production platforms in the deepwater Gulf of Mexico.

www.oceannews.com/news/science-technology/bp-deploys-plant-operations-advisor-on-gulf-of-mexico-platforms



Rutter Provides Integrated Solution to RRS Sir David Attenborough

Rutter's high definition radar data processing software is being added to the British Antarctic Survey's new state-of-the-art Polar Research Vessel, the RRS Sir David Attenborough. The ship, owned by the Natural Environment Research Council (NERC) is currently under construction at the Cammell Laird Birkenhead shipyard in Liverpool, U.K. [https://www.oceannews.com/news/science-technology/rutter-provides-integrated-solution-to-rrs-sir-david-attenborough](http://www.oceannews.com/news/science-technology/rutter-provides-integrated-solution-to-rrs-sir-david-attenborough)



Novacavi's Cable Solutions Chosen for Deep Blue Probe

Novacavi's custom cable solutions have been chosen for the new Idronaut VIP Deep Blue probe for the monitoring of trace metals in the aquatic ecosystems down to 4,000 meter depth.

[https://www.oceannews.com/news/science-technology/novacavi-s-cable-solutions-chosen-for-new-idronaut-vip-deep-blue-probe](http://www.oceannews.com/news/science-technology/novacavi-s-cable-solutions-chosen-for-new-idronaut-vip-deep-blue-probe)



Marlink Launches Unique Real-Time Cyber Threat Detection Solution

Marlink unveiled Cyber Detection, a unique and intelligent threat detection solution for the maritime industry at SMM 2018, as part of its fully integrated ship and shore-based Cyber Guard portfolio. Cyber Guard enables Marlink customers to protect, detect and resolve any cyber-threat through a holistic combination of network resilience and redundancy, dedicated maritime cyber-security technology and maritime Security Operation Center (SOC) experts.

Cyber Detection, the latest addition to the Cyber Guard portfolio, monitors all outbound and inbound network traffic around the clock and enables customers to view threats affecting their vessels through an intuitive, web-based dashboard. In addition, customers may also set-up notifications on critical threats to be received by email and/or SMS. Compromised assets may be remedied using Cyber Guard solutions, with additional, optional assistance from a specialized team at Marlink's Security Operations Centre (SOC).

Requiring no additional installation of equipment onboard vessels, nor upfront investment (CAPEX) for the client, the Cyber Detection service identifies more than 50 different threat categories (including malicious applications, intrusion attempts, confirmed intrusions, abusive usage and social engineering), whatever type of satcom technology used to connect the ship, VSAT or MSS. As part of the Cyber Detection solution, Marlink has established a new SOC and introduced a dynamic and intuitive Cyber Dashboard, which provides customers with real-time actionable alerts and counter-measures while delivering easy to digest insight on the cyber risk level throughout their fleet.

The combination of machine and human intelligence is integral to Marlink's Cyber Detection service and offers a significant improvement over existing maritime cyber-security systems. While using proven rule-based algorithms to detect malware or unauthorized activity on a network, Marlink's SOC experts investigate in parallel any anomalies and proactively hunt for Advanced Persistent Threats (APT) designed to stay 'under the radar.'

Cyber Detection is ideal for vessels equipped with Sealink VSAT connectivity. In addition, the service is fully compatible with Marlink's delivery of Fleet Xpress as well as Inmarsat FleetBroadband and Iridium Certus. For more information, visit www.marlink.com.

Moog Focal Releases New Subsea Qualified 922-DSLH Modem

Moog Focal announces the latest addition to its Model 922 family of robust optical and copper communications products for subsea oilfields. The Model 922-DSLH is a combined DSL and optical fiber modem with integrated managed Ethernet switch and serial gateway. Qualified to API 17F and ISO 13628-6 standards with a design life in excess of 20 years, the Model 922-DSLH has been successfully fielded in a number of BOP and subsea production control systems, and proposed for emerging IWOCS and ROV solutions.

The Model 922-DSLH is a multi-functional card providing reliable and redundant long distance communication capability to support subsea umbilical applications,

including twisted pair, AC or DC power lines and up to 200 kilometers of optical fiber. This highly flexible communication technology easily integrates into new or existing Subsea Electronic Modules (SEM) design infrastructure. The advanced and compact design supports the replacement of legacy systems in the field that are reaching the

end of their operational design life, thereby helping to reduce costs. Custom designs are available to support the upgrade of subsea communication systems that require a smaller design footprint or are no longer supported by the original electronics manufacturer. The Model 922-DSLH is the latest addition to the Moog Focal family of SOC products joining the 922-QSS Quad Serial Server, 922-MES Managed Ethernet Switch, and 922-FOM Fiber Optic Modem.



KONGSBERG Unveils New Leading-Edge Mapping Cloud Data Handling Solution

KONGSBERG has unveiled its new, leading-edge Mapping Cloud data handling solution which provides storage of different types of data within the Cloud. For more information, visit www.oceannews.com/news/science-technology/kongsberg-unveil-new-leading-edge-mapping-cloud-data-handling-solution

Marlink Hardware Delivers Real-time Info for Fleet Xpress Users

Marlink has launched XChange FX, an advanced new hardware solution designed to maximize value for customers using Inmarsat Fleet Xpress voice and data services. XChange FX provides previously unavailable network and service information in real-time, enabling users on board to manage usage according to status and ensuring Marlink's global support network can react quickly and effectively to any issues, based on the availability of precise, real-time network data. The system also future-proofs Fleet Xpress, by enabling over-the-air firmware and software updates.

Developed by Marlink and Inmarsat's expert engineers and powered by Soft NSD (Network Switching Device) V1.5, XChange FX enhances the standard solution by introducing several key features, including real-time on-board connectivity monitoring, enabling traffic prioritization to ensure critical applications are always globally available. While Marlink Fleet Xpress users already enjoy exclusive access to the most extensive portfolio of business critical solutions, XChange FX adds an extra layer of management functionality which empowers end-users to make the most effective use of Fleet Xpress.

XChange FX provides unique visibility into on board network performance and statistics, ensuring users will always know if they are using Ka-band or L-band via a number of methods including a built in LCD screen, enabling usage patterns to be adjusted. More in-depth data will be available in a customer dashboard providing easy to understand bandwidth performance and traffic statistics, available on board and for Marlink support experts to



streamline remote troubleshooting. XChange FX is not subject to an Export Control License, so can be delivered globally without customs and border delays. The system is simple to install, and once on board, delivers the most advanced functionality available for Fleet Xpress network management available today.

Fleet Xpress is augmented by an extensive layer of value-added services from Marlink, including the already available Portal360 online management system and the SkyFile email and anti-virus suite. Marlink customers choosing Fleet Xpress can also enjoy low-cost voice calling, as well as remote network access and advanced crew communication solutions, including specific prepaid or postpaid account and crew connectivity via laptops, tablets and smartphone.

For more information, visit
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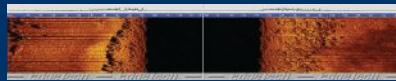
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Many refineries in India were designed specifically for Iranian crudes.

With Iran Sanctions Coming, Who Will Supply India with Much Needed Oil and Gas?

The following is a summary of a more in-depth analysis by Noumaan Anwer of the Observer Research Foundation, which can be read in full at www.orfonline.org.

The restoration of U.S. sanctions on Iran doesn't stop at that nation's borders. The U.S. is set to impose sanctions on banks enabling the import of Iranian oil by third countries. Among the nations that will be majorly affected by these steps, is India.

About 80 percent of India's oil is shipped in from foreign countries and Iran is India's third biggest oil supplier, behind Saudi Arabia and Iraq. With the U.S. pushing India to nullify its trade with Iran, by November, 5 – the day the sanctions come into effect – the search for alternative sources of oil is on.

There are three possible approaches to ensure oil inflows from abroad are not seriously affected by the sanctions.

The first approach is to attempt to secure a waiver allowing India to continue its trade with Iran from the U.S. Achieving this will involve leveraging the fact that India has noticeably reduced Iranian oil imports over the past two years. However, the likelihood of a waiver is fairly low, given that it would require a mandate from the U.S. Congress.

The second approach involves ramping up imports from nations that already supply India. Examples would be Iraq, the United Arab Emirates (UAE), and

Kuwait. These nations have proven to be reliable trading partners, and India has witnessed significant growth in their oil exports in the recent past.

The third possible approach could be to scour for new willing partners, such as Oman, and the U.S. With regards to Oman, India witnessed an exponential rise in oil imports in the last year – with growth pegged at 1,071 percent increase in actual quantity. And American oil companies are already turning towards India in the face of a hike in Chinese tariffs on U.S. oil imports. Refiners have been testing American crudes since last year, and Indian companies are confident about an approach where they balance American shale with crudes from other nations. In fact, the U.S. exported a record 228,000 barrels per day to India in June 2018.

Given that American shale is much lighter than the crudes India imported from Iran, India will have to consider shipping in larger quantities. But distributing purchases between American shale and heavier crudes from elsewhere involves further complications in the form of negotiation of deals with multiple parties. Failure to secure transportation concessions and extended credit periods – both guarantees that Iran gave India

– with new partners, could lead to a relative rise in energy costs.

Another significant challenge is the technological restrictions of public oil refineries in India. While the Nelson Complexity Index rates refineries such as Reliance Industries Limited (RIL) extremely highly, public refineries often have far lesser adaptability. Their capability to refine different kind of crudes is limited by the fact that they still use outdated technology. In fact, certain refineries are based specifically upon Iranian crudes, and therefore, nullifying imports from the Islamic Republic will involve significant investment to upgrade these refineries, not to mention the possibility of permanent closure for some.

There also remains the question of how India will balance negotiations while dealing with volatility in global oil prices. Rising oil prices could clamp down on growth and lead to rise in current account deficit. Combined with a weak rupee, this is likely to fuel inflation.

The mood in the Indian oil industry has remained optimistic. But how effectively India negotiates these murky waters come November 5th, remains to be seen.

California Governor Signs Bills to Block Offshore Oil Drilling Expansion

On September 8, 2018, California Governor Jerry Brown signed legislation to block new federal offshore oil drilling along California's coast, and announced the state's opposition to the federal government's plan to expand oil drilling on public lands in California.

SB 834 and AB 1775 block the Trump administration's plan to expand offshore oil drilling by prohibiting new leases for new construction of oil and gas-related infrastructure, such as pipelines, within state waters if the federal government authorizes any new offshore oil leases.

The bills also require new public notices and processes for lease renewals, extension amendments or modifications to authorize new construction of oil and gas-related infrastructure associated with new federal leases. There has been no federal expansion of oil and gas drilling along California's coastline for more than 30 years.

One day earlier, the Governor submitted the state's formal opposition to the Bureau of Land Management's proposal to



open new public land and mineral estates for oil and gas lease sales, citing concerns over "the threats of climate change" in a letter to the U.S. Secretary of the Interior.

In addition to the Governor's letter, the state also included comments on the proposal from the California Department of Conservation, the California Department of Fish and Wildlife, the California Department of Water Resources, the California Department of Parks and Recreation, the California Air Resources Board and the State Water Resources Control Board.

For full text of the bills, visit <http://leginfo.legislature.ca.gov>. The full text of the Governor's letter, with the state's comments on the proposal, can be found at <https://www.gov.ca.gov/wp-content/uploads/2018/09/9.7.18-BLM-Letter.pdf>.



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iXblue Tech Results in Record Fast Rig Move in the North Sea

In May 2018, the North Sea was the theater for a new kind of rig move operation. Transferred to a location within meters of a live production manifold, iXblue's navigation and positioning technology was chosen for this delicate rig relocation.

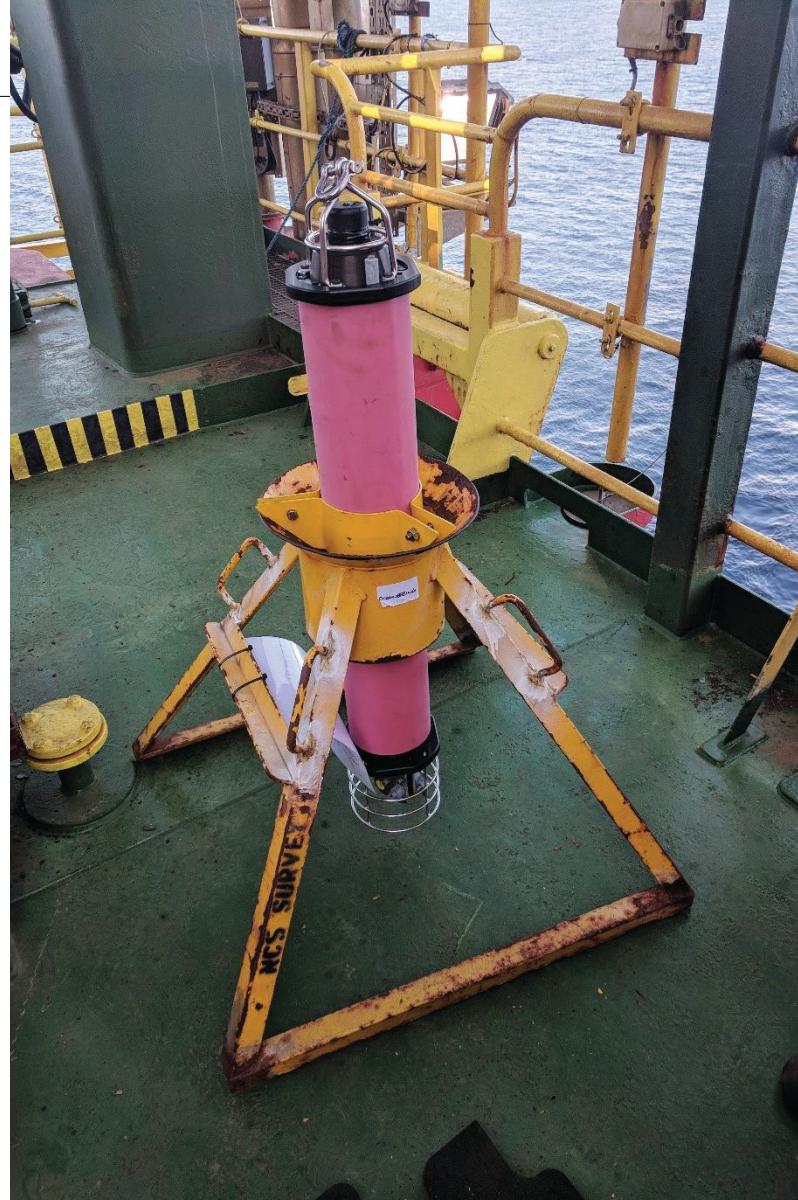
iXblue tech provided a smarter and more flexible way to achieve the required positioning accuracy without having to pre-install an LBL (Long Baseline) array of beacons on the seabed (a costly and lengthy operation that would have involved the mobilization of a separate ROV support vessel). But the solution offered by iXblue only required the installation of three transponders on the seabed during the operation and proved successful. The operation was conducted in a record time of six hours, including deploying the ROV to the seabed, placing and calibrating the Canopus transponders, and placing the marker buoys (with a position accuracy estimated by the INS of better than 30 centimeters and a relative precision better than 5 centimeters).

For this operation, the existing structure on the seabed (included two manifold-mounted transponder buckets which positions were known) was used for the quick deployment of a sparse array of Canopus beacons (iXblue's latest acoustic transponder). An ROV was thus able to navigate with the utmost accuracy and position the Canopus transponders in each available buckets thanks to the use of iXblue's Phins INS (Inertial Navigation System) and Ramses LBL and sparse LBL transceiver, both fitted onto the ROV.

Because the precise location of the two transponders were already known, there was no need to calibrate them from the surface, saving precious operational time, and the ROV was able to ensure that the required gap between the new drilling template and the live infrastructure was maintained. It was however soon evident that the acoustic visibility of the manifold-mounted transponders was limited and a third un-calibrated Canopus beacon was deployed in a tripod on the seabed. Quick calibration of this additional transponder was however conducted thanks to the tight integration of the Ramses transceiver to the Phins INS.

The process of calibrating a beacon relative to existing known locations is known as SLAM(ing) (Simultaneous Localization And Mapping). The ranges to the two known beacon locations were passed to the Phins INS as an aiding input, along with velocity information provided thanks to intelligent DVL coupling, depth data provided by the pressure sensor, and sound velocity data from the SV sensor.

A quick circular trajectory was taken by the ROV around the Canopus transponder requiring calibration. During the maneuvers, a Ramses transceiver fitted on the ROV kept



correlating the change in range measurements to the beacon under calibration, integrating the trajectory from the INS. Continuously adjusting the estimated position of the beacon being calibrated to fit the change in range, the correct location of the Canopus transponder was then known. The whole process of "SLAMing" a beacon on the seabed using the ROV is a fast operation, completed in a matter of minutes. During this operation, the Canopus transponder was positioned relative to the live manifold with a latitude standard deviation of 3.7 centimeters and a longitude standard deviation of 4.8 centimeters after two clockwise and two counter clockwise circuits over the beacon.

With the three calibrated Canopus transponders now deployed, and their exact location known, the ROV was precisely positioned within the area of the new drill location, ensuring reliable navigation. The ROV was thus able to move to the primary drill location to deploy a marker buoy on location and four buoys at the extents of the template to facilitate the future deployment.

For more information, visit
WWW.IXBLUE.COM/PRODUCTS/CANOPUS

Trump Signs Energy and Water Development Funding Package



President Trump has approved a spending bill that includes \$44.6 billion for Federal energy and water programs.

On September 21, President Donald Trump signed into law a package of three spending bills for 2019. The \$147 billion "minibus" package will fund certain legislative branch and military appropriations, including Energy and Water appropriations.

The minibus includes \$44.6 billion for Federal energy and water programs. This amounts to \$1.4 billion above what was approved for 2018, and \$8.1 billion above the President's budget request. Funded projects included research into renewable energy and fossil fuels. The package also funds flood-control projects, waterway restoration, and regional ports and waterways. Agencies receiving funding under the Energy and Water portion of the appropriations include the U.S. Department of Energy, the Army Corps of Engineers, and the Department of the Interior.

The minibus had wide bi-partisan support. The Senate approved the measure 92-5. The House passed it 377-20. Some of that popularity may be due to the fact that the

bill directly names and funds water projects in every state.

The text of the bill is available at <https://docs.house.gov/billsthisweek/20180910/CRPT-115hrpt929.pdf> with more specifics at <https://docs.house.gov/billsthisweek/20180910/Joint%20Statement.pdf>.

The U.S. Army Corps of Engineers receives \$7 billion under this plan – up \$172 million from 2018 – with much of that tagged for the building and maintenance of American water resources infrastructure.

As this issue of ON&T went to press, lawmakers were also expected to pass packages funding additional federal aid for victims of Hurricane Florence, which has ravaged North and South Carolina in September.

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BOEM to Offer 78 Million Acres for a Region-Wide Lease Sale in Gulf of Mexico

Deputy Secretary of the Interior David Bernhardt and Bureau of Ocean Energy Management (BOEM) Acting Director Walter Cruickshank have announced that BOEM proposes to offer 78 million acres for a region-wide lease sale scheduled for March 2019. The sale would include all available unleased areas in federal waters of the Gulf of Mexico.

Lease Sale 252, scheduled to be livestreamed from New Orleans, will be the fourth offshore sale under the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program (2017-2022 OCS Program). Under this program, ten region-wide lease sales are scheduled for the Gulf, where resource potential and industry interest are high, and oil and gas infrastructure is well established. Two Gulf lease sales will be held each year and include all available blocks in the combined Western, Central, and Eastern Gulf of Mexico Planning Areas.

In January, Secretary of the Interior Ryan Zinke announced a draft proposed program for a new National OCS Program for years 2019-2024. The 60-day public comment period for the draft ended on March 9. After considering all public comments received in response, BOEM will develop and publish a proposed program for public comment later this year, followed by the proposed final program expected in 2019. BOEM will continue to implement the 2017-2022 OCS Program until the new National OCS Program is approved.

Lease Sale 252 will include approximately 14,696 unleased blocks, located from three to 231 miles offshore, in the Gulf's Western, Central and Eastern planning areas in water depths ranging from nine to more than 11,115 feet (three to 3,400 meters). Excluded from the lease sale are: blocks subject to the congressional moratorium established by the Gulf of Mexico Energy Security Act of 2006; blocks adjacent to or beyond the U.S. Exclusive Economic Zone in the area known as the northern portion of the Eastern Gap; and whole blocks and partial blocks within the current boundaries of the Flower Garden Banks National Marine Sanctuary.

The Gulf of Mexico OCS, covering about 160 million acres, is estimated to contain about 48 billion barrels of undiscovered technically recoverable oil and 141 trillion cubic feet of undiscovered technically recoverable gas.

Revenues received from OCS leases (including high bids, rental payments and royalty payments) are directed to the U.S. Treasury, certain Gulf Coast states (Texas, Louisiana, Mississippi, Alabama), the Land and Water Conservation Fund, and Historic Preservation Fund.

Leases resulting from this proposed sale would include stipulations to protect biologically sensitive resources, mitigate potential adverse effects on protected species, and avoid potential conflicts associated with oil and gas development in the region.

Additionally, BOEM has included appropriate fiscal terms that take into account market conditions and ensure taxpayers receive a fair return for use of the OCS. These terms include a 12.5 percent royalty rate for leases in less than 200 meters of water depth, and a royalty rate of 18.75 percent for all other leases issued pursuant to the sale, in recognition of current hydrocarbon price conditions and the marginal nature of remaining Gulf of Mexico shallow water resources.

All terms and conditions for Gulf of Mexico Region-wide Sale 252 are detailed in the Proposed Notice of Sale (PNOS) information package at: www.boem.gov/Sale-252/. Copies of the PNOS maps can be requested from the Gulf of Mexico Region's Public Information Unit at 1201 Elmwood Park Boulevard, New Orleans, LA 70123, or at 800-200-GULF (4853).

The Notice of Availability of the PNOS is available for inspection in the Federal Register at: www.archives.gov/federal-register/public-inspection/index.html.

Grant Triggers Tidal Energy Investment in the Bay of Fundy

A grant of CA\$29,750,000 under the Emerging Renewable Power Program (ERPP) from Natural Resources Canada is set to trigger the next wave of tidal energy development at the FORCE facility in the Bay of Fundy Nova Scotia. DP Energy's Canadian registered company, Halagonia Tidal Energy Limited intends to develop a project incorporating five Andritz Hydro Mk1 1.5MW sea-bed mounted tidal turbines and a single SR2-2000 floating turbine by Scotrenewables Tidal Power Limited. At 9MW this will make it the largest tidal stream array to be deployed anywhere in the world. <https://www.oceannews.com/news/energy/nrcan-grant-triggers-major-investment-in-the-bay-of-fundy>



Photo credit: DP Energy



Photo credit: Equinor

First Electricity from Arkona Offshore Windfarm

The Arkona offshore wind farm in the German part of the Baltic Sea has supplied the first electricity into the German electricity grid. The 385 MW project, operated by E.ON in partnership with Equinor, can when completed, deliver power to approximately 400,000 German households.

<https://www.oceannews.com/news/energy/first-electricity-from-arkona-offshore-windfarm>



Fugro Awarded E & P Support Contracts in Trinidad & GoM

Fugro has won three contracts with BHP Petroleum (Deepwater) Inc., which see the company delivering a range of specialist services to support exploration and production operations in Trinidad and Tobago and the Gulf of Mexico.

<https://www.oceannews.com/news/subsea-intervention-survey/fugro-awarded-e-p-support-contracts-in-trinidad-gom>

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DNV GL Forecasts Gas Capital Expenditure Boost

Natural gas will overtake oil as the world's primary energy source in 2026, and account for a quarter of the world's energy by mid-century. This according to DNV GL's 2018 Energy Transition Outlook, which predicts global upstream gas capital expenditure to grow from \$960 billion in 2015, to a peak of \$1.13 trillion in 2025.

<https://www.oceannews.com/news/energy/dnv-gl-forecasts-gas-capital-expenditure-boost>

AUVS PROVIDE LARGEST-KNOWN 3D COLOR RECONSTRUCTION OF THE SEAFLOOR

A recent expedition led by Dr. Blair Thornton, Associate Professor at the University of Southampton, demonstrated how the use of autonomous robotics and artificial intelligence (AI) at sea can dramatically accelerate the exploration and study of hard to reach deep sea ecosystems, like intermittently active methane seeps.

Thanks to rapid high throughput data analysis at sea, a multinational team aboard the Schmidt Ocean Institute's research vessel *Falkor* created a photogrammetric map of one of the best studied gas hydrate deposits - the Hydrate Ridge Region off the coast of Oregon. The resulting 3D color reconstruction of the seafloor is believed to be the largest by area, in the world, measuring more than 118,000 square meters or 11.8 hectares, and covering a region of approximately 500 x 350 meters.

This project demonstrated how modern data science can greatly increase the efficiency of conventional research at sea, and improve the productivity of interactive seafloor exploration with the all too familiar "stumbling in the dark" mode.

"Developing totally new operational workflows is risky, however, it is very relevant for applications such as seafloor monitoring, ecosystem survey, and planning the installation and decommissioning of seafloor infrastructure," said Dr. Thornton, who is also Associate Professor at the Institute of Industrial Science, the University of Tokyo.

The idea behind this Adaptive Robotics mission was not to upturn the structure of how things are done at sea, but simply to remove bottlenecks in the flow of information and data-processing using computational methods and artificial intelligence. The algorithms used are able to rapidly produce simple summaries of observations, and form subsequent deployment plans. This way, scientists can respond to dynamic changes in the environment and target areas that will lead to the biggest operational, scientific, or environmental management gains.

More than 1.3 million seafloor images were collected and algorithmically analyzed to find biological hotspots and precisely target them for interactive sampling and observations. The initial wide-area seafloor imagery was acquired with an underwater vehicle "AE2000f" using high-altitude 3D visual





AUV AE2000f is the expedition's scout – it swims at about 20km/h and collects preliminary images of the seafloor in order to determine where the other robots should focus for future dives.

1. One of the Tuna Sand ROVs being recovered.
2. Engineer Adrian Bodenmann works on the camera-sets that are part of the payload of the underwater robots. Photo courtesy of Monika Naranjo Gonzalez, Schmidt Ocean Institute.
3. AUV AE2000f being recovered.
4. Underwater technology on Falkor's aft deck. The robots work in coordination, to acquire high resolution imagery of the seafloor. L to R: Tuna Sand 1, Tuna Sand 2, SubBastian, and AE2000f. Photo courtesy of Schmidt Ocean Institute.

[1]



[3]

mapping cameras at underwater sites between 680- and 780-meters depth.

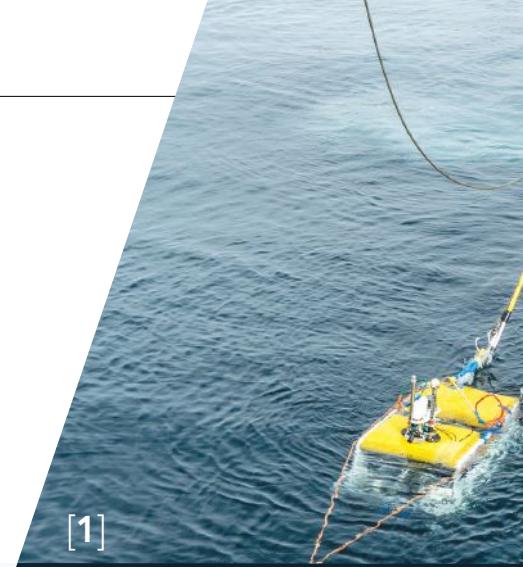
The international team deployed multiple autonomous underwater vehicles (AUVs), developed by the University of Tokyo, which were equipped with 3D visual mapping

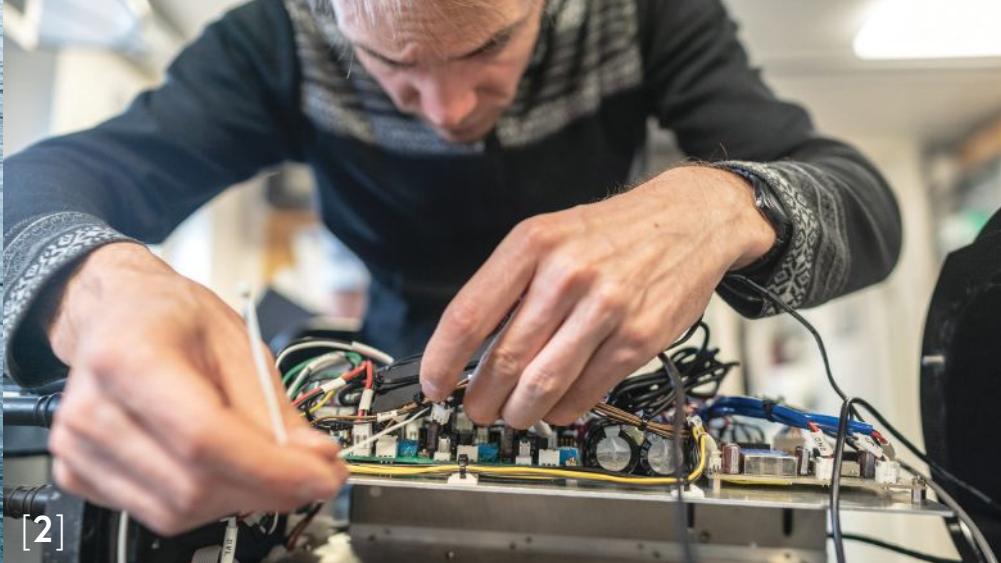
technology developed jointly by the University of Sydney, University of Southampton, and the University of Tokyo and the Kyushu Institute of Technology as part of an international collaboration. The conversion of the initial wide-area survey imagery into three-dimensional seafloor maps

and habitat type summaries onboard *Falkor*, allowed the researchers to plan the subsequent robotic deployments to perform higher resolution visual imaging, environmental and chemical surveying, and physical sampling in areas of greatest interest. Nineteen AUV deployments

and fifteen ROV dives were completed in total during the expedition, including several multi-vehicle operations.

Normally, maps like this would take several months to process and only after the completion of an expedition, at which point





[4]

the science team is no longer at the site, and the habitats may have already evolved or expired. Instead, the research team was able to compose the 3D maps on board of *Falkor* within days of the images being acquired. The composite map was used

during the expedition to plan operations, including the recovery of seafloor instruments and was invaluable for revisiting specific sites, such as active bubble plumes, making the entire operation more efficient.

"It is quite amazing to see such large areas of the seafloor mapped visually, especially only days after the raw data was collected," said Dr. Thornton. "It is not just the size of the map, but also the way we were able to use it to inform our decisions while still on site.

This makes a real difference as the technology makes it possible to visualize wide areas at very high resolution, and also easily identify and target areas where we should collect data. This has not previously been possible."

Enhanced Air Freight Capability for Capping Stacks

Oil Spill Response Limited (OSRL) has reached another important milestone in the development of its subsea capping and containment response capabilities – successfully completing an air transport test flight of a fully assembled subsea capping stack for the first time.

The newly demonstrated expertise has the potential to significantly reduce capping stack mobilization times, and represents the realization of a key objective for OSRL and all those involved in its Subsea Well Intervention Services (SWIS).

Matt Clements, OSRL's director of SWIS, commented: "At OSRL, part of our mission is to constantly identify new ways to better support our members and adapt to their changing requirements through new technology, equipment and processes. From our leading role working with the Subsea Well Response Project (SWRP), to the recent development of our Offset Installation System for subsea wells, to today and the realization of another major achievement, we are continuing to lead and demonstrate the value we provide to our members and the wider industry."

OSRL worked with Subscribers Technical Advisory Forum (STAF) to understand members' requirements, looking at various options to reduce capping stack mobilization response times, including an assessment of existing alternative air freight capping stacks and new-build proposals. A STAF working group, led by BP, was established to investigate and develop the best technical solution for the AFCS project with OSRL. The recommendation from the STAF's investigation conveyed that expediting mobilization of the existing best-in-class OSRL Capping stacks (developed under the industry SWRP) would be the preferred solution. Key for the members was the compatibility of the OSRL capping stacks with the extensive suite of tooling, including the Containment Solution and Offset Installation System, also offered through OSRL.

After an extensive logistics study by Chapman Freeborn, looking at the members' areas of operations, the AN-124 was chosen as the most suitable airframe



due to its payload capacity (ability to travel up to 5,000 kilometers with a 120-tonne payload), self-loading / off-loading capabilities (alleviating airport deck loader capacity concerns) and availability on the European spot market.

To facilitate the movement of the capping stack in a single operation, OSRL worked with L+M to design and fabricate a bespoke frame, with support from Trendsetter as the original equipment manufacturer (OEM) for the capping stacks. Both Antonov Airlines and Volga Dnepr reviewed and approved the combined skid / capping stack design and physical load for flight.

Prior to the successful mobilization exercise and test flight, which took place at Sola Airport, Stavanger, Norway (10 kilometers from OSRL's base in Tananger), transporting the equipment by air would have required the 85-tonne capping stack to be broken down into multiple payloads, and delivered on several Boeing 747 (or equivalent) transport planes, before being reassembled at the destination location and moved to the incident site.

Chris Lund, Technical Manager for OSRL's SWIS team added: "When every minute counts, the number one priority is stopping the flow of hydrocarbons as quickly as possible. The ability to transport a fully assembled capping stack by air is a critical development for the industry. Sea transport remains the most likely mobilization option for the majority of well sites, which is why we have four capping stacks strategically located in key upstream regions – fully assembled at storage bases with direct quayside access. But for wells in more remote areas, and for members looking to secure drilling licenses in new or remote exploration locations, this is a vital addition to our subsea capping and containment offering."

For more information, visit
WWW.OILSPILLRESPONSE.COM

CGG Conducts Innovative Rich-Azimuth Multi-Client Survey

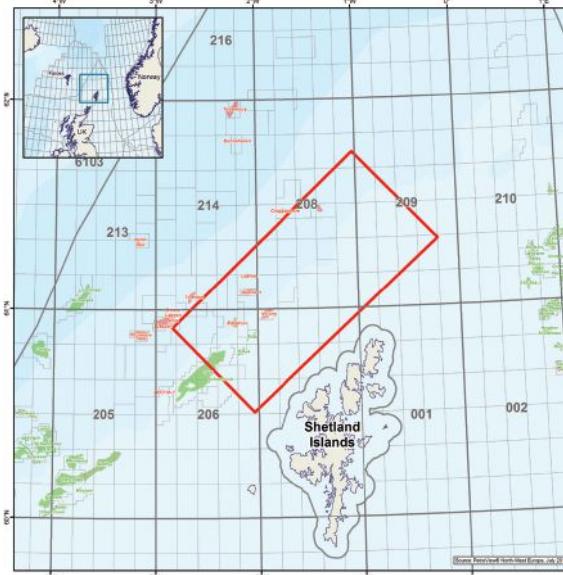
CGG has commenced acquisition of a high-density, rich-azimuth, towed-streamer multi-client survey in the U.K. West Shetland Basin. The 3,600 square kilometer survey has received strong industry support and been designed in collaboration with major international oil companies. It focuses on delivering high-resolution seismic data in a prospective but underexplored area north-west of the Shetland Isles over the northern part of the Rona Ridge. A fast-track PreSDM data set will be available in Q1 2019.

The innovative acquisition geometry is designed to image multiple targets from shallow Tertiary and Cretaceous plays to complex fractured Devonian-Carboniferous reservoirs by undershooting the volcanic intrusions and shallow unconformities present

in the area. Two vessels, the Oceanic Vega and the Geo Caribbean, are being deployed. Each vessel operates triple sources using simultaneous source technology.

Sophie Zurquiyah, CEO, CGG said: "This survey is another example of CGG working closely with clients to deliver the best possible subsurface images in a cost-effective and timely manner. Until now, oil and gas companies interested in the exploration potential of this part of the West Shetland Basin have lacked high-quality seismic data. We expect our new rich-azimuth images to reveal an unprecedented level of detail in this exciting frontier area."

The data will be processed in depth using CGG's state-of-the-art broadband imaging technology, including advanced de-blending and Full-Waveform Inversion velocity modeling. The final data will be available in mid-2019.



Location map for CGG's rich-azimuth survey north-west of the Shetland Isles.

For more information, visit
WWW.CGG.COM



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Subcon's Integrated Artificial Reef (IAR) Concept Becomes a Reality

Launched by the Hon. David Kelly MLA, Minister for Fisheries, Subcon's Integrated Artificial Reef (IAR) concept has become a reality! After many years working on bringing this vision to life, Subcon, Recfishwest, BHP, NERA, Curtin and the local community are thrilled to see new accessible and safe fishing opportunities for locals and tourists in the Exmouth area. The reef integrates offshore structures into a purpose-built reef through re-engineering and augmentation with specially designed concrete substrates and is a world first solution to habitat restoration.

King Reef is located 3.5nM north of the township of Exmouth in Western Australia. The reef lies in close proximity to multiple boat ramps located in Exmouth Gulf on the sheltered side of the North West Cape which will create new and safe fishing opportunities for families with small boats. King reef occupies two acres on the ocean floor, in 18 meter water depth and resides only 10 minutes from local boat ramps.

The project is a collaboration between Recfishwest, BHP, National Energy Resources Australia (NERA), Subcon International and Curtin University. Through Recfishwest the project also has support and funding from the Western Australian State Government. This partnership between industry and community has allowed for the creation of WA's largest artificial reef thanks to six large repurposed steel reef units kindly donated by BHP. These structures have been modified with additional features creating the unique, environmentally safe habitat for fish.

Positioned on a previously sandy barren seafloor, the six giant steel structures are integrated with concrete modules (49) to form the reef's 55 module arrangement. With over

27,000m³ of new habitat being introduced, the reef will quickly become home to a range of different fish species as well as food sources and a colonizing organisms such algae, coral, and sponges enhancing ocean biodiversity and fishing experiences for generations to come.

The 'King' name has strong links to the Exmouth Gulf and fishing in Exmouth in general, with marine surveyor Lieutenant Phillip Parker King naming Exmouth Gulf in 1818, and the late George King a popular pioneer of charter fishing in Exmouth and Coral Bay in the 1960s and 70s. Fittingly the newest edition to the fishing landscape in Exmouth is named 'King Reef.'

The reef will be monitored by Curtin University and Recfishwest under their reef vision program for the next 30 years.

Subcon CEO Matthew Allen said: "Subcon and the consortium partners have set a new benchmark for habitat restoration in the region. The re-engineering of retired marine structures into purpose-built substrates will provide important habitat for centuries and creates a truly excellent outcome for the Exmouth community, Australian tax payers and the environment. I'd like to recognize our talented team at Subcon, who have blazed a trail by blending science and offshore engineering to deliver a very special project for the Exmouth community and the thousands of tourists that visit from Perth and around the world each year."



Concrete modules being deployed. Photo credit: Subcon

OSIL Enhances ROV Tools for Deep Sea Mining Monitoring



Global environmental monitoring and sediment sampling experts Ocean Scientific International Ltd (OSIL) have augmented their offering of deep sea ROV sampling equipment with a multiple water sample collection system with inbuilt water quality monitoring. OSIL's range of ROV tools now not only includes the instrumented water sample collection system, but also an undisturbed sediment sampling system, an instrumented pressure activated camera system, and a deep-sea solenoid actuator, which

can be adapted to suit application requirements.

The ROV tools are designed for ease of mounting and systems can be daisy-chained together to create a sampling network that is ideal for rapid assessment work. All OSIL ROV tools are rated to 6000 meters and have a wide range of potential applications including monitoring deep sea mineral retrieval and oil & gas operations, scientific exploration and environmental impact assessments.

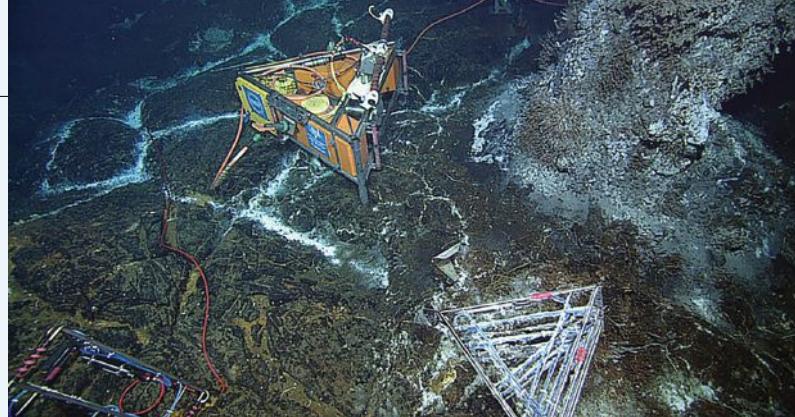
For more information, visit WWW.OSIL.COM

SubC Contracted for Ocean Observatories Initiative (OOI) Cabled Array

SubC has been awarded a contract by the University of Washington to provide underwater Ethernet digital cameras, lighting and related services to support the objectives of the National Science Foundations' Ocean Observatories Initiative (OOI) Cabled Array. The OOI Cabled Array is a networked infrastructure of sensor systems to measure physical, chemical, geological, and biological variables in the ocean and beneath/at the seafloor.

SubC's Rayfin cameras, featuring parallel dot scaling lasers and paired with Aquorea LEDs, will be deployed on mooring platforms at a water depth of 200 meters in some of the most biologically productive waters for real-time observations of the biota.

In addition to this recent contract, SubC was previously involved with supplying cameras and lights for the OOI Cabled Array and Ocean Network Canada's Neptune ocean



University of Washington, NSF-OOI, CSSF.

observatories. This involvement has helped SubC develop the expertise to create extremely reliable underwater systems for long-term deployments. Each part of the system is multi-purpose, thereby reducing the complexity of the overall system. By automating as much as possible workflow is improved.

The Cabled Array is part of the NSF-funded OOI located off the Oregon coast. Data from over 140 instruments are streamed live to shore and used to progress research areas from plate-scale geodynamics to underwater volcanoes, ocean circulation, climate change and coastal ecosystems.

For more information, visit WWW.SUBCIMAGING.COM

Equinor to Collaborate with Aker Solutions and TechnipFMC

Equinor is signing collaboration agreements with Aker Solutions and TechnipFMC for subsea equipment and services on the Norwegian continental shelf (NCS) and internationally. The work will focus on improvements in safety, quality, cost and technology from concept through project execution and subsea operations services.

In 2017, Equinor and its partners sanctioned projects for more than NOK 90 billion on the NCS. Subsea procurements for the Johan Castberg, Snorre Expansion, Askeladd and Troll phase 3 projects accounted for a third of the global market last year.

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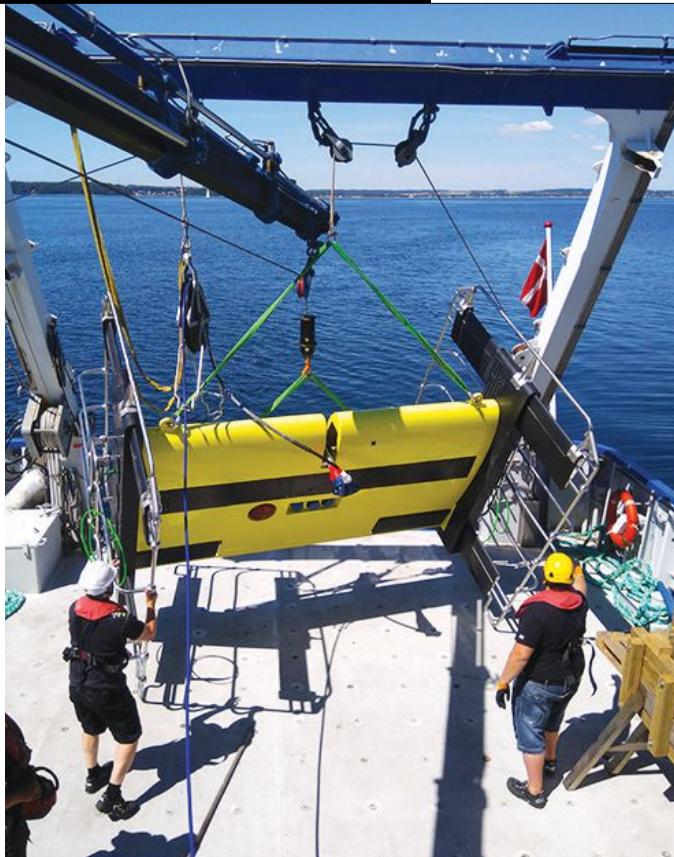
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A close-up photograph of a black, cylindrical pan and tilt unit. It has a circular lens on one side and a mounting base on the other. A bright red laser beam is visible, originating from the unit and pointing towards the bottom right corner of the frame.



EIVA ScanFish XL is lifted off of the deck of research vessel AURORA, and deployed with well-rehearsed precision.

EIVA's Mammoth ScanFish XL Excels During Latest Sea Trials

Returning to sea with hardware refinements, the largest and newest addition to EIVA's family of ScanFish remotely operated towed vehicles (ROTVs), ScanFish XL's latest sea trials took place in late June in the summery waters of Aarhus Bay. ScanFish XL's performance indicates that the subsea survey platform will not only enable reduced vessel time and lower survey costs, but also conditions supporting enhanced data collection.

Operating at survey speeds of 3-4 knots, ScanFish XL is at least three to four times faster than a work class ROV. Nevertheless, despite its ability to work at speed, with very low roll and pitch, the inherent high stability of ScanFish XL makes it an ideal platform for sensors and instruments sensitive to unwanted movements, such as synthetic aperture sonar. These characteristics mean that ScanFish XL can secure swift, high quality data collection without compromise.

"The idea with the tests was to press the system to the limit. It is designed for an operational speed of 6 knots, but in our tests we were running at 9 knots for a period

with good results, a stable system and good responses," reported Martin Kristensen, EIVA Hardware Development Manager, who was on-board the research vessel AURORA to supervise the trials.

The high payload capacity at low system cost of ScanFish XL is another compelling benefit of the system. The ScanFish XL unit under evaluation has been outfitted to host a 350 kilogram 3D SAS Sub Bottom Imager (SBI) from marine geophysical-geotechnical service delivery specialist PanGeo Subsea.

Compared to a work class ROV, which would be the alternative platform for carrying the weighty PanGeo SBI, ScanFish XL is about a tenth the cost.

"The XL is able to carry up to 500 kilograms of hardware, that's an increase of 900 percent compared to the 50 kilogram payload of the original EIVA ScanFish models. Payload capacity at that scale really opens up opportunities for surveyors," said Kristensen.

Of interest to EIVA technicians during the trials was ScanFish XL's performance whilst executing movements across three dimensions — maneuvers enabled via manipulation of the vehicle's vertical and horizontal flaps. With this feature, customers will not only be able to control the vertical position of their sensors in the water column, but also benefit significantly from the capability of controlling the sideways movements of the ROTV.

Performance of new motors fitted to the ScanFish XL since its last sea excursion was therefore under close observation as operators sought to test the design standards of ScanFish XL whilst operating with high speed runlines.

Collaboration with PanGeo Subsea

The sea trials were arranged in collaboration PanGeo Subsea, which is taking delivery of the first ScanFish XL unit. Outfitted with its 3D SAS SBI, PanGeo Subsea will market the ScanFish XL as the SBI SeaKite — a platform designed to deliver a more cost effective multi-sensor towed solution for pre-route and UXO surveys.

Seeking to evaluate performance of their SBI, PanGeo personnel travelled to Denmark from as far as Canada and Scotland for the trials. The ScanFish XL system performed excellently, and line steering with 3D autopilot — configured to follow the seabed and remain on runline — proved successful.

Various system calibrations were completed on day one. On the second and third days of the sea trials operators of ScanFish XL sought out unexploded ordnance known to reside at the bottom of Aarhus Bay, as well as demonstrated the system's ability to find and follow cables.

The trials were conducted from Aarhus University's research vessel, AURORA, with which EIVA partners.

Osbit Delivers Upgraded AMP1500 Pipeline Plough on Schedule

Osbit Ltd has completed a major upgrade to DeepOcean's subsea pipeline plough, to provide the AMP1500 with class-leading capabilities. The extensive modifications included state of the art new pipe shares and upgraded pipe handling equipment, all operated by Osbit's in-house modular control system. To meet the client's requirements, these modifications were carried out within a 30-week lead time.

To meet this challenging project deadline, Osbit applied its innovative processes and engineering expertise to design the equipment, which it then managed through its trusted supply chain, before final assembly and testing at the Port of Blyth. The detailed modifications not only allow the asset to bury the planned pipeline, but also ensure enhanced operational capability for the plough's full range of usage, as well as dramatically improving the asset's reliability and ease of maintenance.

The new shares feature improved structural design and enhanced wear resistance, as well as incorporating a new fore cutter, for reduced tow forces. The new Osbit control system provides a best-in-class operating environment. Its extensive in-built diagnostics are packaged in a scalable suite of modular elements which can be easily reconfigured to suit other DeepOcean subsea assets, for increased operational flexibility.



The 30th China Ocean Surveying and Mapping Academic Seminar

On August 29, 2018, the 30th Ocean Surveying and Mapping Academic Seminar was held in Zhuhai, China. The event attracted nearly 200 representatives from the government and surveying and industry.

www.oceannews.com/news/subsea-intervention-survey/the-30th-china-ocean-surveying-and-mapping-academic-seminar



Subsea 7 Awards Oceaneering Umbilical Contract

Oceaneering International, Inc. has entered into a contract with Subsea 7 to supply an umbilical and flying leads for Shell's deepwater Vito development in the Mississippi Canyon area of the U.S. Gulf of Mexico.

www.oceannews.com/news/subsea-intervention-survey/subsea-7-awards-oceaneering-umbilical-contract



Swire Seabed to Provide Marine Subsea Services for Wintershall

Swire Seabed has secured a Framework Agreement with Wintershall Norge AS for the provision of marine subsea services in the North Sea, including the supply of vessel and services which encompasses survey, IMR and light construction.

www.oceannews.com/news/subsea-intervention-survey/swire-seabed-to-provide-marine-subsea-services-for-wintershall

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HIGH-THROUGHPUT SATELLITE TECHNOLOGY OPTIMIZES OPERATIONAL EFFICIENCY AND ENABLES MISSION-CRITICAL COMMUNICATIONS

BY SANJAY SINGAM, VICE PRESIDENT, GLOBAL ENGINEERING, ITC GLOBAL

As the offshore oil and gas industry continues its upturn, big data and satellite connectivity are going to be key topics of discussion for offshore business when it comes to optimizing operations.

In the remote and harsh environment rigs and offshore vessels are exposed to on a daily basis, having an always-on, highly reliable satellite communications service is non-negotiable. From emergency communications to the ability to transfer mission-critical data, consistent and reliable connectivity can mean the success or failure of an operation. It can also make the difference in life or death situations.

With high-throughput satellite (HTS) technology, operators can rest assured that their vessels, rigs and crew are running at maximum efficiency and safety. HTS technologies leverage spot beams and reuse frequency across these beams to increase throughput across a finite radio frequency (RF) spectrum. With the rapid growth in customer demand for broadband connectivity in any location, HTS technology enables service providers to meet those demands while often reducing the cost per bit delivered in the long run.

HTS Technologies And Benefits

HTS solutions include both Ka-band and Ku-band options. While this enables companies to use HTS technology to best fit their needs, each band has its own strengths and weaknesses. In order to choose the solution that works best with the intended application, a company should have an understanding of how HTS solutions are designed.

Spot Beam Technology

An HTS system uses a large number of small spot beams to provide stronger connectivity over a particular area, unlike a conventional satellite, which provides coverage through one large beam. Spot beams enable large-scale frequency reuse because they are concentrated in smaller areas, making each spot beam stronger than a conventional wide beam. Smaller spot beams mean better link performance but less coverage and require more overlapping beams for global coverage. On the other hand, larger spot beams can have weaker link performance, getting less reliable connectivity the closer a vessel moves to the edge of the beam.

The three most relevant classifications of HTS spot beam systems include Ka-band small spot beam systems, Ka-band large spot beam systems

and Ku-band spot beam systems. While Ka-band large spot beams and Ku-band spot beams are around the same size, Ka-band small spot beams only cover roughly 15 percent of the traditional spot beam footprint. Similar to most modern satellite solutions, HTS systems are designed to be multi-purpose. In addition to spot beams, HTS antennas may also provide large regional and hemispherical beams, and their payloads may include transponders for several different satellite bands.

Global connectivity service providers with comprehensive network portfolios can take these systems a step further to extract maximum value by deploying a combination of these technologies for customers. For instance, network systems can be designed to leverage Ka-band from the teleport to the satellite, and Ku-band from the satellite to the remote site location, further optimizing the network to its fullest potential. This is being actively done across the Middle East and parts of APAC today, and the industry will likely see more of this as technologies progress and networks mature.

Alternate Technologies (MEO/LEO)

In addition to geostationary (GEO) satellites that leverage spot beam technology, recently launched

alternate technologies, including middle-earth orbit (MEO) and low-earth orbit (LEO) satellites, can be considered depending on region and operational requirements. These constellations have lower latency than GEO-based solutions which can enable improved real-time information sharing with corporate offices and headquarters locations, ostensibly leading to better decision making. These solutions often require complex tracking and added remote site equipment (including additional VSAT systems), and many don't provide true global coverage and service.

Rain Fade And Mitigation Technologies

One of the most important environmental considerations for offshore customers when it comes to satellite connectivity is weather. When high frequencies are transmitted and received in a heavy rain fall area, signal degradation occurs proportionate to the amount of rain fall (known as rain fade). Since a Ka-band runs at more than twice the frequency of Ku-band, it can be more susceptible to interference from rain. At lower frequencies, such as those found in Ku-band solutions, the link requires smaller margins to overcome propagation impairments.

Customers should consider the amount of rain fall that occurs over a specific period of time in the regions in which they operate. For instance, land-based regions in North America and across Europe and Russia, and offshore regions near the United Kingdom where rain fall is minimal, may benefit more from HTS Ka-band solutions. Conversely, heavy rain zone areas in Central and South America, and parts of the African continent, as well as the southern Asia regions, would be better suited for HTS Ku-band solutions.

Adaptive power control and adaptive coding and modulation are two mitigation techniques that can help compensate for rain fade when it occurs. Adaptive power control enables remote sites to automatically increase their power during a rain event in order to maintain performance

and availability based on their requirements. However, increased power can lead to increased costs. Additionally, the dynamic power fluctuation may affect the life and reliability of a satellite and could increase interference with other users in the same frequency.

Adaptive coding and modulation enables remote sites to adjust modulation schemes automatically for different environmental conditions. In poor weather, allowing a remote to stay in the network while at a lower modulation provides an added mitigation to signal degradation. This technique can be used with both Ku- and Ka-band systems. While both of these techniques can help provide some compensation to signal degradation, each is only a partial solution to the overall issue.

Finding The Right Technology & Provider

Whether a company is drilling off the coast of Asia, or a vessel is transporting goods across the North Sea, one thing remains consistent, the need for a highly reliable, always-on communications solution. Partnering with a global service provider who understands the requirements for connectivity in different regions can help customers find the HTS solution that best fits their needs.

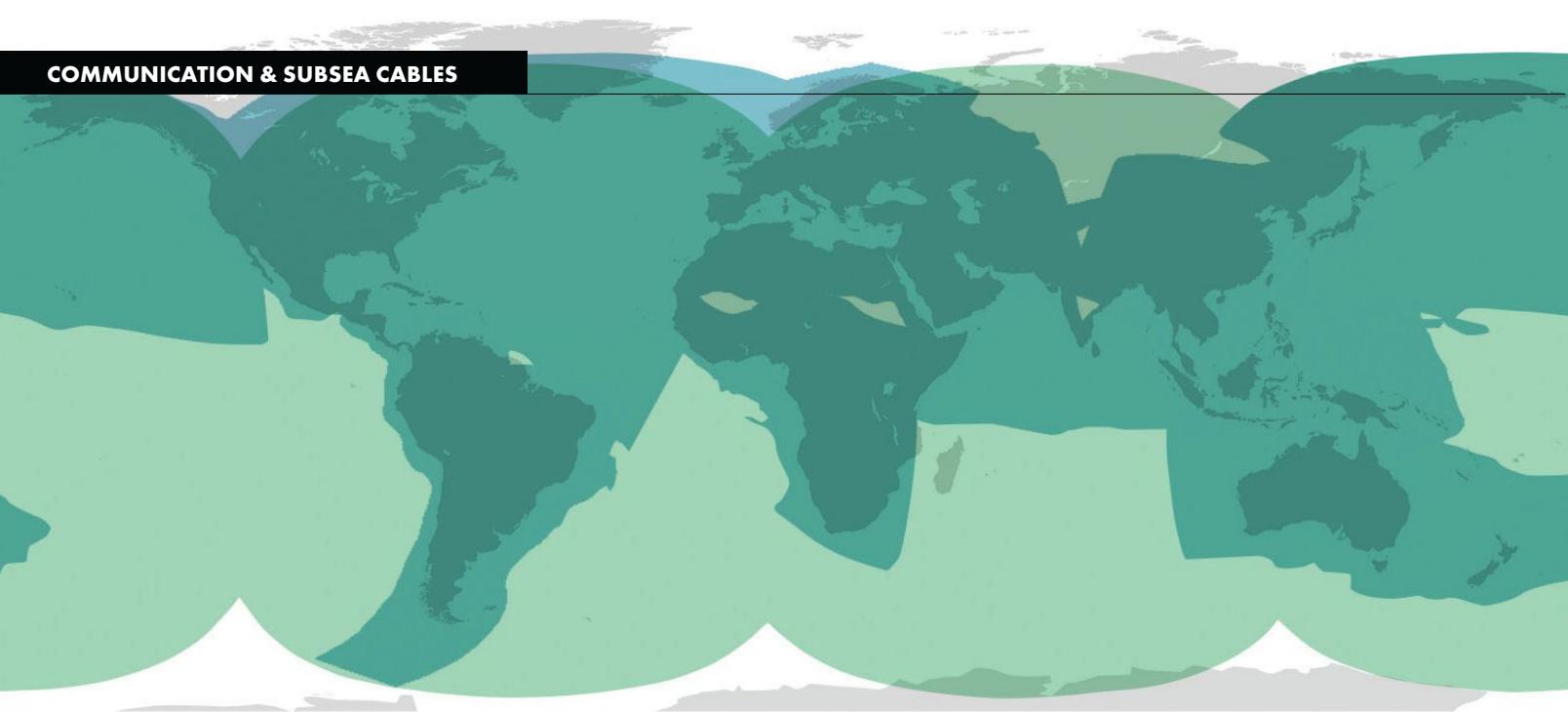
The right HTS system can go a long way in boosting efficiency and optimization, while enabling the transfer of critical data and emergency communications a company needs to operate without stress, regardless of location.



About the Author: As vice president of global engineering, Sanjay Singam leads global engineering efforts focused on customer projects and support, as well as solutions strategy and development. Sanjay holds more than 10 years of industry experience in cost-effective engineering and operations management. Most recently, Sanjay served as part of the executive team leading operations and engineering at ipDataTel, LLC, a leading innovator in the home security IoT space, leveraging cellular technology. Prior to that, he held various engineering and operational leadership roles at Harris CapRock Communications, including director of global solutions and operations engineering, senior manager – RF and systems engineering and manager – product engineering. Singam launched his career at Invocon Inc., where he completed engineering projects for NASA and the International Space Station, as well as for the U.S. Navy.

He received a Master of Science degree in software design and analysis and a Bachelor of Science degree in hardware design from Syracuse University.





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■ C-band Coverage

KVH ACCELERATES MARITIME DIGITALIZATION

Increased demand for the AgilePlans(TM) subscription-based Connectivity as a Service (CaaS) program from KVH Industries, Inc. has been the driving force behind the company's unprecedented growth in VSAT unit deployments during the first six months of 2018, a timeframe when the maritime industry has been increasing its drive toward digitalization.

KVH recently reported that it shipped almost as many VSAT systems in the first six months of 2018 as it shipped in all of 2017. Further, KVH VSAT unit shipments from April to June were up 100 percent compared to the same timeframe last year and shipments are at an all-time record by far compared to any quarter in KVH's 10-year history in the maritime VSAT business.

Throughout the maritime industry, commercial fleets are transitioning to digitalization to increase operational efficiency and allow for integrated IoT solutions. Vessel operators can leverage faster connectivity to take advantage of real-time data transfers to improve decision making for fuel optimization, route planning, and safety. Providing Internet access to seafarers for crew welfare and onboard training is also important in attracting and retaining today's more digitally sophisticated crew.

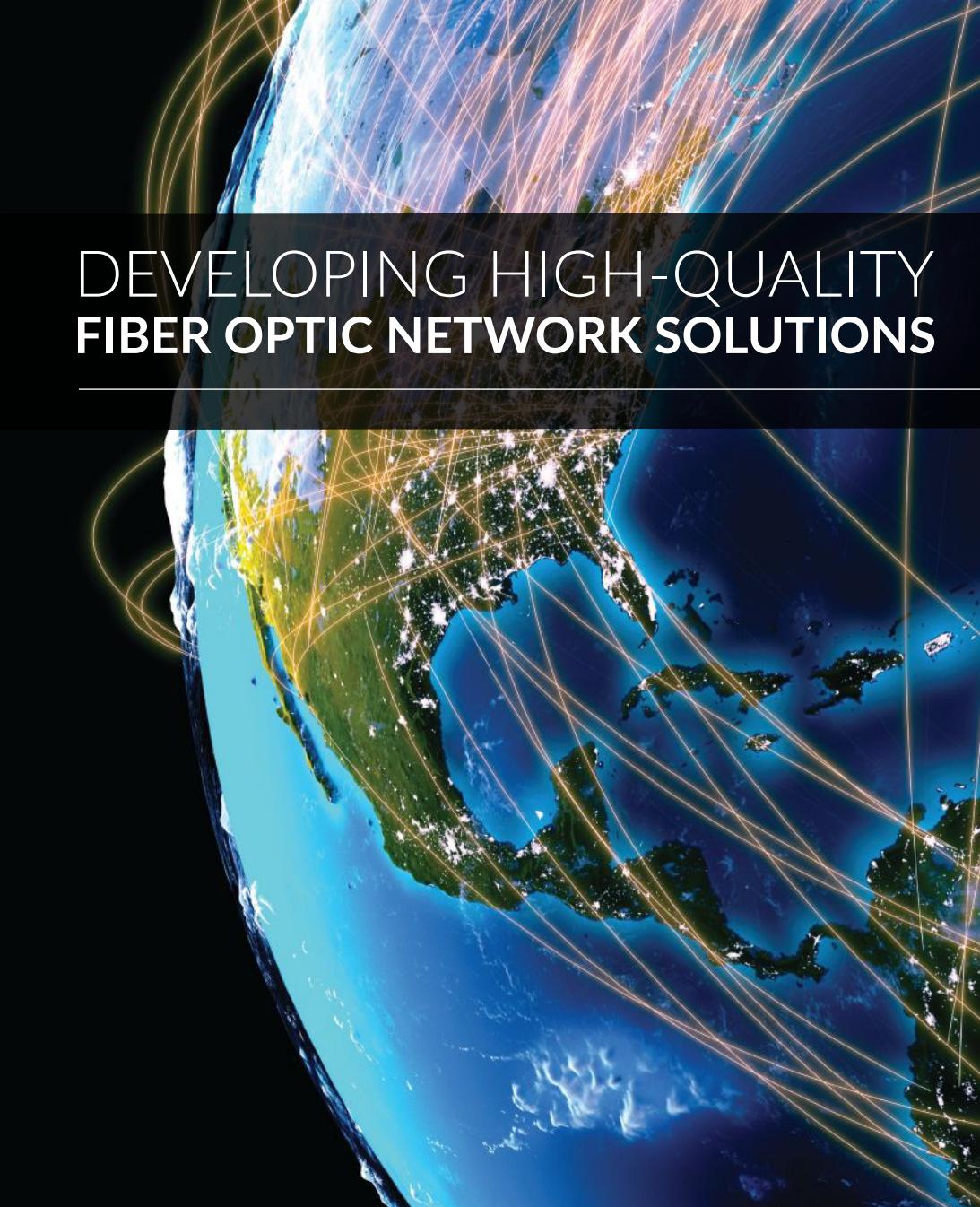
The AgilePlans program--a CaaS subscription-based model offering KVH's global connectivity, VSAT hardware, news, entertainment, and training content, free installation in select ports, and zero maintenance--is proving extremely attractive to global fleets. KVH's recent AgilePlans customers include fleets with hundreds of vessels transiting the world's oceans, from Supramax bulk carriers and dry-bulk carriers to chemical tankers and containerships.

The CaaS solution is popular when paired with KVH's newest antenna system, the TracPhone V7-HTS, introduced in late 2017; nearly 80 percent of recent AgilePlans vessels selected the TracPhone V7-HTS.

This 60 centimeter, Ku-band antenna system is designed to consistently deliver global data download speeds of up to 10 Mbps, and upload speeds of up to 3 Mbps. The TracPhone V7-HTS was designed for KVH's mini-VSAT Broadband [SM] network, which late last year began utilizing the award-winning IntelsatOne Flex platform, a global managed service designed to optimize bandwidth allocations and provide flexible coverage where it is needed. With the TracPhone V7-HTS, vessels can take advantage of cloud-based software programs, remote system monitoring, and data analytics in the pursuit of digitalization.

KVH is a mobile tech innovator that provides connectivity solutions for commercial maritime, leisure marine, and land mobile applications on vessels and vehicles, including the award-winning TracPhone and TracVision product lines, the global mini-VSAT Broadband network, and AgilePlans Connectivity as a Service (CaaS). The company's Videotel business is a market-leading provider of training films, computer-based training, and eLearning for the maritime industry, and its KVH Media Group provides news, sports, and entertainment content with such brands as NEWSlink and SPORTSlink.

For more information, visit
WWW.KVH.COM/AGILEPLANS



DEVELOPING HIGH-QUALITY FIBER OPTIC NETWORK SOLUTIONS

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TELECOM



Developing fiber optic networks.

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SubCableWorld and The Radar Screen Report

You've seen the headlines.

In 2017, Microsoft and Facebook announced completion of their transatlantic internet cable. Earlier this year, Google announced investments in connections from Virginia to France, Chile to California, and Japan to Australia. Then, in late September, Angola Cable's South Atlantic Cable System (SACS) opened for commercial traffic.

But headlines are just part of the story. What is driving these investments? How long will the boom continue? And where do new opportunities exist?

Well, first, you need some context.

SubCableWorld (SCW) has been keeping decision makers in the submarine cable industry informed on the latest developments in the market since 1998. We tracked the industry through the boom years at the end of the 20th century, the collapse of the market in the early 21st century, the slow recovery, and the current resurgence.

Factors such as the availability of financing and the question of overbuilding versus redundancy interact to either drive or constrain the demand for new cables. Our format is designed to monitor such conditions; looking for signs of change—either for better or worse—and reporting on conditions in a clear and objective way.

SCW tracks how these forces interact and what affect they have on the submarine cable market on a daily basis; delivering that data to subscribers to SCW in real-time.

Our editor, John Manock, has been covering and analyzing the submarine cable market for 30 years. In fact, he built the first commercially available database on submarine cables. He also has also worked on numerous feasibility studies for submarine cable systems, beginning with the FLAG project in the early 1990s. Through his expertise, SCW not only

provides the context to understand the latest submarine cable developments, it sets the standard for covering the industry.

SCW feeds breaking news to readers as well as notices of the latest updates to our forecasts. A daily newsletter delivers content to subscribers' desktops. The newsletter clearly and concisely updates subscribers on the key news in the submarine cable and related industries.

Beyond the latest industry news, SCW presents in-depth analysis of the submarine cable market. Whether it's a merger, changing regulations, or a new technology, SCW experts cover it first. And we don't stop there. From data centers and content development to streaming video and broadband technologies, if it impacts the submarine cable market, SCW puts you in the know. The result is a thorough, comprehensive service that tracks the drivers and constrainters of what can be a volatile industry.

A lot of this coverage is free on our website, but for subscribers, we go beyond our newsletter format to provide in-depth analysis and forecasting via The Radar Screen Report.

THE RADAR SCREEN REPORT

The Radar Screen Report is SCW's analysis and forecasting service. Updated in real-time online, with monthly reports and a year-in-review summary delivered electronically to subscribers, the Radar Screen Report studies the interplay between the driving and constraining forces in the market and watches for developments that could result in a dramatic shift in market conditions.

In addition, SCW monitors market conditions such as the financial results of public companies that are major players in the industry, the climate for investment in the industry, the actions of government around the world that could stimulate or slow the growth of the global submarine cable market—all of this with the goal of presenting the most complete picture of the submarine cable market available in one place.

If you work in an industry that contributes to or relies upon submarine cables, you owe it to your bottom line to subscribe. For more information, visit subcableworld.com.



Intellian's v85NX Antenna Debuts

Intellian has launched its new 85 cm Ku to Ka band convertible maritime VSAT antenna, the Intellian v85NX, the first to be developed based on the high-performance more reliable NX platform.

The v85NX supports GEO constellations as well as ensuring compatibility with future networks, such as LEO and MEO. It is convertible from Ku to Ka band by changing the RF Assembly and Feed while still using the dual-band optimized reflector and radome, and is capable of supporting full 2.5GHz Wide Ka-band networks, the first antenna to be so. Hence, users can avoid having to buy a new system to use new services in the future.

The v85NX's features make it easy to install, operate and maintain. The new 85 cm antenna uses an efficient RF design that increases gain compared to existing 80 cm class systems operating on Ku band. This increase in gain enables the antenna to operate on 1 meter networks despite its small size, giving smaller vessels access to those networks. It also has several BUC power options, up to 25W, that give it a wider operational range than other sub-1m-class antennas.

With the modular component design, the number of spare parts is reduced by more than 30 percent. It now only needs 13 common spare parts to fix most potential problems. Thus, reliability is improved, maintenance is simpler, and the total cost of ownership is lowered.

The v85NX combines Tx, Rx and DC power into one coaxial cable for simplified installation. The new radome design has a single external cable connection, combined with dynamic motor braking, so the radome no longer has to be removed during installation.

Intellian also provides an upgraded antenna management and control platform, AptusNX, which has been configured to be more intuitive. For more information, visit www.intelliantech.com.

MONTH IN REVIEW



Furuno and Radio Holland Extend Distributorship Agreements

The senior management of both companies signed the agreements during the SMM maritime trade fair in Hamburg. The companies have been working together in the global maritime market for more than 55 years and have partnered to equip many newbuild and retrofit vessels with Furuno equipment. <https://www.oceannews.com/news/communication/furuno-and-radio-holland-prolong-distributorship-agreements>



Inmarsat Unveils IoT Service for the Shipping Industry

Inmarsat has unveiled Fleet Data, a new Internet of Things (IoT) service, which will enable ship owners and managers to access and analyze real-time onboard data more efficiently, and as a result will help accelerate the adoption of IoT across the maritime industry. <https://www.oceannews.com/news/communication/inmarsat-unveils-major-new-iot-service-for-the-shipping-industry>



GlobeNet and Facebook Begin Construction of Malbec Cable System

The new 2,500 km submarine cable will link Rio de Janeiro and Sao Paulo to Buenos Aires, and will have a branching unit to reach Porto Alegre, Brazil. The new infrastructure will connect the Southern Cone of South America and the United States. GlobeNet and Facebook will co-own the system and it will be operated by GlobeNet. When completed, it will be the first new submarine cable route to reach the Argentinian coast since 2001 and will feature six fiber pairs, delivering double the current international capacity to Argentina. Both companies have informed that the contract with the supplier has come into force and confirmed the ready-for-service date for the first half of 2020. <https://www.oceannews.com/news/communication/globenet-and-facebook-begin-construction-of-malbec-cable-system>

Does Sea Control Mean Mastering the Electromagnetic Spectrum First?

In September 2018 the Center for International Maritime Security presented a series of articles by international experts on the topic of Bringing Back Sea Control. One of the articles was entitled, *For Sea Control, First Control the Electromagnetic Spectrum*, by LCDR Damien Dodge, United States Navy.

Dodge writes that, "current maritime Information Warfare (IW) capabilities, such as those contributing to Signals Intelligent (SIGINT), Electromagnetic Maneuver Warfare (EMW), Electronic Warfare (EW), and communications, do not afford sufficient operational agility or adaptability to gain advantage over or exploit the weaknesses of adversaries."

However, he adds that the "advent of new designs for antennas and Radio Frequency (RF) components, the evolution of Software Defined Radios (SDR), and more practical instantiations of Artificial Intelligence (AI)," means that "these technologies can now be innovatively combined to operationalize envisioned, but not yet fully realized, IW and EMW warfighting capabilities."

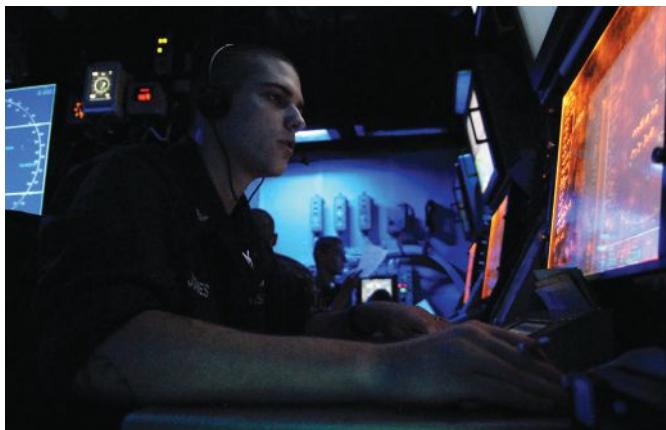
Dodge notes that, currently, warships are "bristling with single-purpose antennas awash in scarcely manageable electromagnetic interference (EMI) and subject to individualized, byzantine maintenance and logistic support tails."

Besides contributing to the complexity of Navy architecture, "when new capabilities are fielded, such as the F-35, existing systems are often not sufficiently adaptable to absorb their advanced capabilities."

"Additionally," Dodge writes, "shipboard antenna thickets create a significantly larger radar cross section (RCS), thus illuminating these ships to adversary active sensors. Finally, this collection of standalone systems complicates the ship's ability to manage its electromagnetic emissions in order to hide from passive threat sensors and often the only option may be a tactically dissatisfying binary approach: gain battlespace awareness and communicate, or hide from the adversary."

However, Dodge writes, "more open architecture (OA) and dynamic phased array antennas combined with advanced element-level RF components are improving beamforming parameters."

Ultimately, technologies like Georgia Tech Research Institute's agile aperture antenna technology "could enable various, low-RCS antenna arrays to perform and synchronize a multitude of electromagnetic functions – evidenced by the Zumwalt class destroyer's smooth exterior. Separate antenna array elements



Operations Specialist 2nd Class Matthew Jones, from Victorville, Calif., stands watch in Combat Direction Center aboard the forward-deployed aircraft carrier USS George Washington (CVN 73). U.S. Navy photo by Chief Mass Communication Specialist Jennifer A. Villalovos.

could form directional, purposeful transmitting or receiving beams pointing to traditional satellites, CubeSats, Aquila-like aircraft, UAVs, or other warships while other array elements establish links or sense the environment."

Dodge also writes that, "Evolving SDR performance is establishing the foundation for advanced capabilities . . . to sense the electromagnetic environment and determine times and frequencies that are being underused, offering an opportunity for use by the system."

"Additionally," Dodge says, "within the bounding parameters of the antenna arrays and RF hardware components, new waveform generation only requires a software update enabling an SDR to facilitate communications with new capabilities such as the F-35, a newly launched CubeSat, a friendly unmanned system, a newly arrived coalition partner, or a recently invented low probability of detection waveform designed to defeat the adversary's latest sensing algorithm."

"While SDRs are powerful tools, they could be improved by orders of magnitude through use of AI algorithms . . . AI could perform higher-level operations such as altering the application of DSP procedures and determining when and how best to sense and exploit underused, or purposefully below the noise floor, portions of the spectrum. AI could also link the myriad permutations of waveform possibilities to operational objectives . . ."

"Together," Dodge writes, "these capabilities crowned with practical AI implementations could contribute toward easing many tedious, human-speed and error-prone activities used to achieve IW and EMW capabilities. . . Empowered with AI-enabled automation and decision aids, a more integrated and homogenous approach using advanced antenna arrays and SDRs to access and sense the spectrum would vastly improve electromagnetic freedom of action and decision superiority. Thus, if the Navy desires to seize sea control when and where she chooses, first establishing electromagnetic spectrum control is a warfighting prerequisite."

To read the full article, visit <http://cimsec.org/for-sea-control-first-control-the-electromagnetic-spectrum/37651>.

Freeze Fighter: Warmer Wetsuit Will Increase Navy Dive Time

By Warren Duffie Jr.

Office of Naval Research Public Affairs

Diving in icy water is extremely dangerous to humans. Within seconds, arteries tighten, blood pressure and heart rate race, and lungs gasp for air. After only minutes, hyperventilation strikes and arms and legs go numb—signaling the onset of hypothermia.

To protect U.S. Navy divers operating in freezing conditions, the Office of Naval Research (ONR) is sponsoring work to design a wetsuit mirroring the insulating properties of animal blubber—allowing divers to swim in frozen waters for longer periods of time.

The work is being conducted by researchers at the Massachusetts Institute of Technology (MIT) and George Mason University. They've developed a wetsuit infused with an artificial blubber layer that can triple the endurance time of divers in frozen lakes, rivers or oceans.

"This kind of research is especially important as more Arctic sea lanes open up and the Navy increases its readiness to operate in that part of the world," said Maria Medeiros, a program officer in ONR's Sea Warfare and Weapons Department. "Whether it's special operations; search and rescue; or ship repair, maintenance and salvage, finding ways to increase divers' time and effectiveness in the ice is a priority."

The project is being led by two MIT professors—Dr. Michael Strano and Dr. Jacopo Buongiorno—and focuses on neoprene wetsuits. Neoprene is the most common material used to make wetsuits, and is a synthetic rubber resembling a thick foam with numerous air pockets.

These pockets slow the transfer of heat from the body into the surrounding cold water.

Strano and Buongiorno found that by substituting air with various heavy inert gasses—which are non-toxic, don't have negative chemical reactions, and don't burn or explode—they created a more efficient, artificial blubber layer within the wetsuit. This increased suit effectiveness in 10-degree-Celsius water from under an hour to multiple hours.

To do so, Strano and Buongiorno placed a neoprene wetsuit in a sealed, specially designed tank the size of a beer keg—and pumped the container with heavy inert gasses for several hours. Laboratory tests showed the newly pressurized wetsuit kept its insulating properties for over 20 hours after treatment, far longer than divers usually spend in frigid waters. The treatment also could be done in advance of a dive, with the wetsuit placed in a bag to be opened just before use. In such cases, the 20-hour countdown didn't start until the suit was removed from the bag.

"The great thing about this research is that you don't have to recreate neoprene from scratch," said Strano. "You can take a wetsuit from a closet, pump the gas into it and transform it into a super fabric."

Strano and Buongiorno examined diverse animal methods for enduring

cold water—air pockets in fur or feathers (otters and penguins), internally generated heat (mammals and fish) or a layer of insulating material slowing heat loss from the body (seal and whale blubber). Their wetsuit design reflects the latter two methods. The two hope to test the wetsuit further during in-water demonstrations involving Navy and civilian divers. The research falls under ONR's Naval Enterprise Partnership Teaming with Universities for National Excellence (NEPTUNE) program, which helps the Navy and Marine Corps discover ways to improve energy conservation, generate renewable energy and implement energy-efficient technologies—while giving active-duty military, military students and veterans the chance to immerse themselves in university-level research.

From left, graduate student Anton Cottrill, Dr. Buongiorno and Dr. Strano try out wetsuits at a pool at MIT's athletic center. Cottrill is holding the pressure tank used to treat the wetsuits with heavy inert gasses. Photo courtesy of Susan Young.



Underwater Communication Tested at ANTX 2018

A General Dynamics Mission Systems-led team demonstrated cross-domain, multi-level command, control and communication (C3) capabilities among unmanned underwater vehicles (UUV), submarines and land-based mission operations centers as part of the Advanced Naval Technology Exercise (ANTX) 2018 at the U.S. Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island.

The demonstration provided technology solutions to the challenges of communicating among multiple platforms in contested underwater environments, from high-level operation planning to tactical mission execution.

The General Dynamics team leveraged "big picture" theatre-level planning tools to enable cross-domain C3 of manned submarines and UUV systems. The demonstration employed real-time mission communications with a land-based, theatre-level planning command center and a submarine's tactical-level command center responsible for tasking the Bluefin™-21 and NUWC-owned UUV mission assets.

Collaborating with NUWC's Code 25 Team, General Dynamics demonstrated a hand-off from one AN/BYG-1 submarine combat

system operating at a NUWC lab, to another representation of an AN/BYG-1 system, operated pier-side by General Dynamics. Once control by the General Dynamics command center was established, the team re-tasked UUV assets by ending their existing mission and sending a new mission to the UUVs. The real-time, C3 followed a path using a simulated unmanned aerial vehicle, satellite and actual land-based and maritime communication nodes transmitting both radio frequency and acoustic communications.

For more information, visit
WWW.GDMISSIONSYSTEMS.COM



Bluefin-21 UUV in the launch bin during ANTX 2018. Photo courtesy of General Dynamics Mission Systems.

Ocean Infinity to Search for Argentine Navy Submarine

Ocean Infinity has been appointed by Argentinian authorities to carry out the search for ARA *San Juan*, the Argentine Navy submarine which was last heard from on November 15, 2017.

Operations have now commenced in the Atlantic Ocean approximately 300 nautical miles east of Comodoro Rivadavia.

Ocean Infinity is using five autonomous underwater vehicles (AUVs) to carry out the search, which will be conducted by a

team of approximately 60 crew members on board *Seabed Constructor*. In addition, three officers of the Argentine Navy and four family members of the crew of the ARA *San Juan* have joined *Seabed Constructor* to observe the search operation.

Ocean Infinity is grateful for the significant support it has received from many parties in determining the area to be searched, in particular the Argentine Navy and the United Kingdom's Royal Navy. Ocean Infinity, who has committed to conduct the search operation for up to sixty days, will take on the economic risk of the renewed search, only receiving payment if the submarine is found.

Ocean Infinity's AUVs are capable of operating in water depths from 5 meters to 6,000 meters. The AUVs are not tethered to the vessel during operations, allowing them to go deeper and collect

higher quality data for the search. They are equipped with a side scan sonar, a multi-beam echo-sounder, a sub-bottom profiler, an HD camera, a conductivity / temperature / depth sensor, a self-compensating magnetometer, a synthetic aperture sonar and a turbidity sensor.

Oliver Plunkett, Ocean Infinity's CEO, said, "For the sake of all involved in this tragedy, we hope that we can help locate the submarine. As ever, there can be no guarantee of success as the exact location is unknown, as are the circumstances around her loss."

For more information, visit
WWW.OCEANINFINITY.COM



Autonomous Vehicles Demonstration for Mine Detection at ANTX 2018

A global leader in the provision of autonomous and tethered surface and undersea vehicles, Teledyne Marine and their industry partners showcased an Autonomous, System of Systems approach to expeditionary Mine-Countermeasures (MCM) using multi domain unmanned assets. The demonstration took place at The Naval Undersea Warfare Center (NUWC) Division Newport during the 2018 Advanced Naval Technology Exercise (ANTX) August 29-31.

Demonstration Description

The multi-vehicle, multi-company demonstration begins with a Power Docks Blue Isles Autonomous Power Microgrid platform simulating providing power to all vehicles. A Teledyne Oceanscience Z-Boat 1800 RP Autonomous Surface Vessel, starts the exercise by performing a bathymetric and LiDAR survey of the basin. Next, a Planck Aerosystems Shearwater® Unmanned Aerial Vehicle conducts surface surveillance for both object avoidance and threat mitigation for the Z-Boat. A Teledyne Gavia Autonomous Underwater Vehicle then conducts a search-classify-map sidescan survey of the basin. Teledyne CARIS-Onboard, which is running on the Gavia AUV, performs mosaicing of the sidescan data in near real time while Charles River Analytics' ATR software, also running in near real time on the Gavia AUV, uses advanced image processing algorithms to analyze the CARIS mosaics and perform Automatic Target Recognition (ATR).



The coordinates of a mine-like object are passed to Marine Advanced Research's WAM-V Autonomous Surface Vessel. The WAM-V moves to the provided coordinates and deploys a Teledyne SeaBotix vLBV300 ROV equipped with a mock-up of a mine disposal system. Finally, Greensea Systems'

The maxon thruster.

- Max. depth limit of up to 6000 meters
- High energy efficient of minimum 80 percent
- Long service life of up to 1000 operation hours

More information about our maxon thruster can be found on our website:

aquaticsolutions.maxonmotor.com

maxon motor
driven by precision

inertial navigation and supervised autonomy, maneuvers the ROV to the waypoint with minimal operator assistance, visualizes the target, and simulates neutralization.

"Following the theme of 'Human Machine Interaction,' Teledyne and its partners demonstrated how today's Mine Countermeasures activities can safely be performed by multi-domain assets incorporating much needed autonomy. Nicknamed by NUWC Newport, 'The Battle of the Basin,' our exceptional team used a strength in numbers approach by combining our individual technologies, most of which were small businesses, to perform the job to be done. Autonomy was the focus, starting with mission planning, navigation, and station keeping. Then we mixed in real time data processing and target recognition on the vehicles themselves. Post mission analysis time was practically zero. The thirty-two minute exercise was an amazing display of using autonomous vehicles for mine detection and clearance in a small harbor while keeping the warfighter out of harm's way," explained Teledyne Marine System's VP of Engineering, Bob Melvin.

For more information, visit
WWW.TELEDYNEMARINE.COM



NSWC Carderock Division Selects Sonardyne Underwater Tracking

Underwater target tracking technology from Sonardyne Inc., has been chosen by the U.S. Naval Surface Warfare Center (NSWC), Carderock Division for use at its South Florida Ocean Measurement Facility (SFOMF).

Carderock Division is the U.S. Navy's research, engineering, modeling, and

test center for surface and undersea technologies. It is the largest, most comprehensive establishment of its kind in the world. Thanks to its proximity to the Gulf Stream, Carderock's SFOMF provides a demanding open ocean test environment for subsea systems and unmanned underwater vehicles (UUVs) in development for both the Navy and wider maritime industry.

To support this work, Carderock Division has ordered Sonardyne's high accuracy Ranger 2 Ultra Short Baseline (USBL) acoustic tracking system, complete with a GyroUSBL transceiver, Nano and Wideband Sub-Mini 6 Plus (WSM 6+) transponders.

Mobilized aboard vessels-of-opportunity, the Ranger 2 system will enable operators to track the precise underwater position of any subsea system or UUV that comes through the SFOMF for testing. The system offers the capability of tracking systems in both shallow and deep

water, near the surface and over very long ranges. By purchasing both Nano and WSM 6+ transponders, all sizes of vehicle can be accommodated, from man-portable models through to extra-large (XLUUV) designs.

The SFOMF has housed an active, continuously operating Navy range for more than 50 years. Its main mission is to perform electromagnetic signature tests of Navy assets, using multiple fixed, in-water electromagnetic and acoustic measurement sites. The facility also tests and evaluates mine detection, countermeasures and mine response; performs acoustic measurements; and acquires radar cross section and infrared signatures. For more information, visit www.sonardyne.com.

For more information, visit
WWW.SONARDYNE.COM

Looking deeper and seeing more.



Morgan & Eklund Inc.

Morgan & Eklund, Inc. specializes in collecting data in the coastal zone providing bathymetric surveying services for project monitoring, beach restoration, dredging and offshore borrow area investigations.

For more information, visit www.morganeklund.com or call (772) 388-5364.

Teledyne Gavia Introduces ASW Training Target Module

Teledyne Gavia announces the recent delivery to an undisclosed military customer of a Sonar Transponder Module (STM) for ASW training. The STM module made by Scanmatic AS of Norway and integrated into a Gavia payload module is capable of receiving and retransmitting sonar signals for training sonar operators. The STM consists of a flooded transducer compartment, an electronic compartment, and a hydrophone that is towed behind the Gavia AUV. The STM is programmable to emulate different types of realistic submarine target characteristics including sizes and speeds for cost effective and re-usable ASW training applications.

When a Gavia vehicle is not utilizing the STM module, it can be configured for a variety of other applications including MCM, SAR and REA operations. STM modules are suitable for use with all existing Gavia vehicles in the field.

The Gavia AUV is an autonomous sensor platform that is user configurable by the addition of one or more sensor, navigation or battery modules by means of a unique twist lock system. The Gavia AUV is a low logistics, fully modular system designed for operation from vessels of opportunity and has the greatest depth rating of any vehicle in its class. The modular design of the Gavia ensures maximum mission



Sonar Training Target Module for Gavia AUV

flexibility and system upgradability. Module options include acoustic payloads for ASW training, various side scan sonars, multibeam sonars, camera, and an array of environmental sensors.

For more information, visit
WWW.TELEDYNEMARINE.COM/GAVIA



Phoenix SRDRS Receives Operational Readiness Certification

The Phoenix Submarine Rescue Team deployed on board the M/V HOS DOMINATOR July 9-19 and completed eight days of submarine rescue operations off the coast of Catalina Island, which culminated in a satisfactory Operational Readiness Evaluation (ORE) by Undersea Rescue Command's (URC) parent command (Submarine Squadron ELEVEN). <https://www.oceannews.com/news/defense/phoenix-srdrs-receives-operational-readiness-certification>



RFA Mounts Bay. Photo credit: Royal Navy

UK and French Forces Train for Hurricane Relief in the Caribbean

Royal Naval auxiliary ship RFA Mounts Bay recently landed a team of U.K. military personnel ashore in Martinique to train in hurricane relief with their French counterparts. The Royal Fleet Auxiliary ship has been playing host to the Humanitarian Assistance and Disaster Relief (HADR) Troop sent to the region to cover the six months of core hurricane season. <https://www.oceannews.com/news/defense/uk-and-french-forces-train-for-hurricane-relief-in-the-caribbean>



NOSKE-KAESER Maritime Solutions Awarded Major New Order

The German Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support has commissioned the K130 consortium to build another five K130 Class Corvettes. NOSKE-KAESER Maritime Solutions will supply the consortium. <https://www.oceannews.com/news/defense/noske-kaeser-maritime-solutions-awarded-major-new>



VOLATILITY LURKS OVER OIL AND GAS PRICING

BY G. ALLEN BROOKS | Author, *Musings From the Oil Patch* | www.energymusings.com

CRUDE OIL

In recent weeks, crude oil prices have jumped around, mostly in response to extraneous market events such as hurricanes in the Atlantic Ocean and Middle East geopolitical tensions. Add in concern over the impact on global economies from the growing list of tariffs on goods imported and exported from China, and you have a nervous commodity market.

Waiting in the wings to drive oil prices higher is the upcoming re-imposition of trade sanctions against Iran that will force a substantial volume of its oil output off the market. Analysts are watching the country's oil output beginning to fall due to the impending sanctions with their accompanying restriction against other nations conducting business with Iran using U.S. dollars. Reports are that there are now three Iranian-owned tankers loaded with crude oil just sitting off the Kharg Island loading facility. There are also reports South Korea and Japan have stopped buying refined Iranian petroleum products, further pressuring the regime's oil output, economy, and possibly its political stability.

Estimates suggest the sanctions will remove 800,000 to 1 million barrels a day of Iranian supply from the market. So far, stepped up exports from other OPEC members have offset whatever Iranian oil loss has occurred to date. Will that continue given Venezuela's oil production also collapsing due to its economic/political implosion? The market also has to deal with

periodic Libyan and Nigerian oil supply shocks, which make oil forecasters nervous about the size of global spare production capacity. The rise and fall of that measure has historically moved global oil prices.

Looking at how the path of crude oil spot prices since the start of 2017, we see three distinct trends. During January to September 2017, crude oil traded in a channel of the mid-\$40s to the low-\$50s a barrel. Beginning in September 2017 and lasting until May 2018, oil prices climbed steadily higher, rising from the high-\$40s to over \$70 a barrel. There were periods of volatility during this climb, but nothing unusual given such an extended uptrend. We are now in another channel of mid-\$60s to over \$70 a barrel, with questions over whether the concerns outlined above will drive WTI prices to the upper-\$70s or even higher should there be a supply shortage in the coming months. Any resolution of these concerns, however, could send oil prices lower.

NATURAL GAS

The mystery about the natural gas market continues to revolve around why spot gas prices are not higher in light of the pedestrian pace in rebuilding storage ahead of the upcoming winter heating season. Currently, our model shows that unless weekly injection volumes match or exceed the highest per week injection rate of the past five years, storage will be 300-500 Bcf below the average starting volume for

2009-2017. If we only match the five-year average weekly injection rates, beginning winter storage volumes will only reach 3,100 Bcf, or about the average volume seen during 2006-2008.

With Hurricane Florence shutting several nuclear power plants in the Carolinas, natural gas-fired power plants are being called upon to generate more electricity. That means the natural gas burn rate is up, which will limit weekly injection volumes. That assures winter gas storage will start below recent levels. Traditionally, such an outlook would signal the market that gas prices must rise to attract more gas into storage. As our weekly gas storage and Henry Hub spot gas price chart shows, gas prices remain below \$3/Mcf, the point differentiating market concern from market comfort. With gas prices languishing and storage volumes creeping slowly higher, what message is the market sending?

We believe there are several possible messages being sent. First, the market is counting on gas production growth to continue. It has been growing at the fastest pace since the turn of the century, so people may just be extrapolating the trend. Secondly, the market may be saying that the natural gas pipeline system expansion is allowing new gas supplies to service markets previously unreachable. This provides added comfort to the market. As an adjunct to increased pipeline infrastructure, it is bringing the huge gas volumes of the Marcellus and Utica regions into the national market. This gas is cheaper for the Northeast

and Midwest markets than hauling gas from the Southeast, Southwest or Gulf Coast regions. In other words, cheaper gas alternatives are weighing down overall spot gas prices.

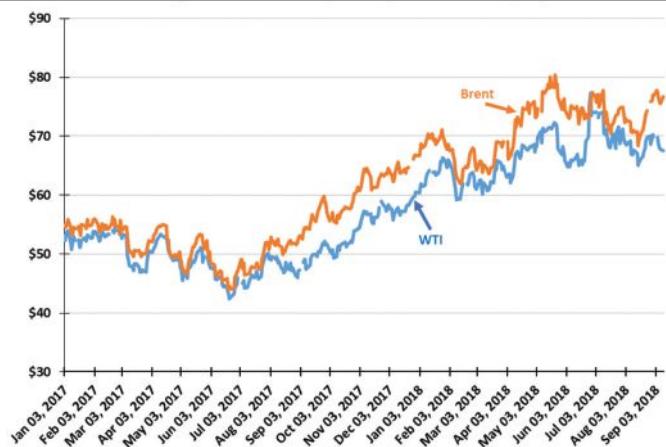
It is also possible that the users of natural gas are anticipating a warmer winter as suggested by NOAA and The Old Farmer's Almanac due to an anticipated El Niño weather event this winter. If this assumption proves wrong, we could see a spike

in natural gas prices when an extended Arctic cold front grips North America this winter.

The action in the gas market – storage injections and gas prices – may be telling us that we need to rethinking our view about how this market will function in the future, as it could be quite different than from the past.

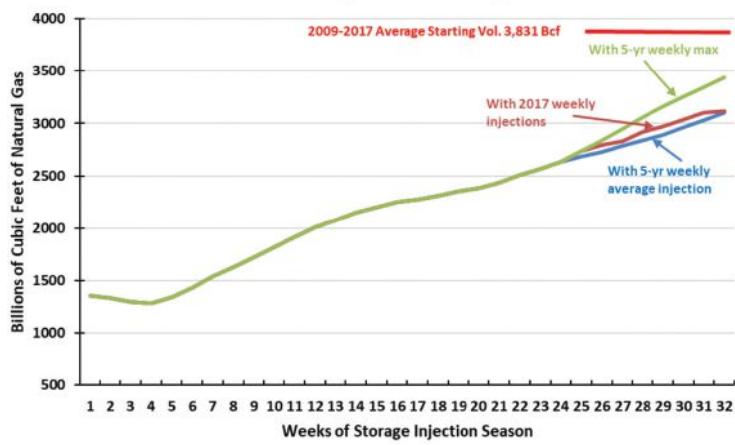
1.

ARE SPOT OIL PRICES SIGNALING ANOTHER LEG UP?



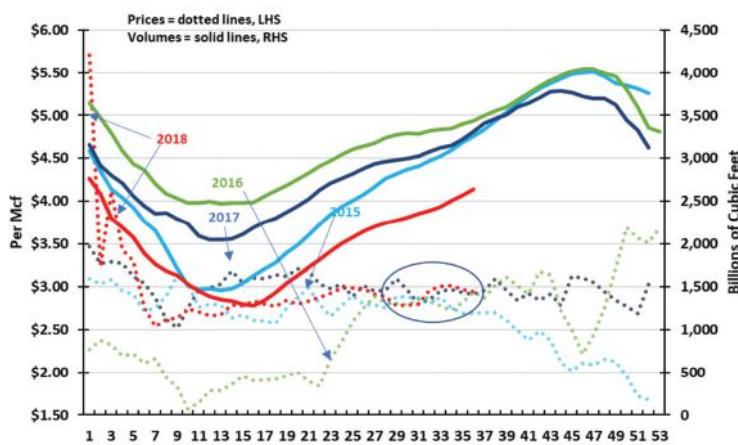
2.

FORECASTS FOR STARTING WINTER STORAGE VOLUMES



3.

NATURAL GAS HH SPOT PRICES vs STORAGE VOLUMES, WEEKLY



CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF SEPTEMBER 17, 2018

Oil and gas prices moved up modestly in the past month. WTI Spot Prices, which had surpassed the \$70/barrel mark several times over the summer, slide back to the mid-\$60s in August before gaining modestly to the upper-\$60s in early September. CNBC described the market as being "exposed to bullish and bearish sentiments." CNBC also noted that "Saudi Arabia, other members of OPEC and Russia were trying to prevent a spike in global oil prices."

Henry Hub Spot Prices saw a similar pattern. After spending most of the early summer flirting with the \$3.00/million BTU mark, prices dipped in July before rebounding strongly in August. Prices broke the \$3.00 mark briefly, before settling back into the \$2.90s. A U.S. Energy Information Administration (EIA) report that U.S. natural gas stockpiles increased by 69 billion cubic feet for the week ending August 31 may cause an increase in prices, at least in the short term.



KEY EQUITY Indexes

PRICES IN US DOLLARS AS OF SEPTEMBER 17, 2018

THE DOW JONES INDUSTRIAL AVERAGE AND S&P 500 have been relatively stable in the past month.

The Dow Jones Industrial Average continued its upward movement into record-breaking territory. The Dow passed the 26,000 point market for the first time ever; reaching 26,246.96 on September 17. The index rose steadily throughout the last month with only a slight setback caused by the financial crisis in Turkey. The Dow's rise is largely attributed to strong corporate profits.

The same pattern is true of the S&P 500. From the beginning of July through early August, the index was up significantly, but sank again by mid-month as the Turkish financial crisis worsened. The S&P rebounded in early September, again driven by strong financial results that drove the index into record territory, surpassing 2,900 points by mid-September.

The PHXL Oil Services Index (OSX) continues to struggle. After experiencing significant gains in May when oil prices spiked, it has trended steadily downward, closing at 141.17 on August 13. It had broken the 160-point mark in May.

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Metocean & Current Studies / Acoustic Monitoring & Modeling / Sound Mitigation (PSO, MMO, PAM)
Environmental Data Geospatial Services (EDGS) / Library & Document Services







CALENDAR

AUGUST

EDITORIAL: ROV and AUV Technology

FOCUS: Cameras, Batteries, Lights and Imaging Sonars;
Vehicle Sensor Suites

SEPTEMBER

EDITORIAL: Offshore Wind Installation and Maintenance;
Offshore Supply & Emergency Vehicles

FOCUS: Offshore Support; Turbines;
Offshore Wind Inspection Services

OCTOBER

EDITORIAL: Offshore Communications; Subsea Telecom;
Subsea Inspection, Monitoring, Repair & Maintenance

FOCUS: Marine Communications; Cable Installation Services

NOVEMBER/DECEMBER

EDITORIAL: Year in Review; Commercial Diving and Salvage;
Ocean Observing Systems; Ocean Science & Exploration

FOCUS: Acoustic Modems, Releases and Transponders;
Diving Equipment and Services; Salvage;
Buoyancy Materials

SHOW DISTRIBUTION

AUGUST

Submarine Networks World - September 24-26 *

MTS Dynamic Positioning - October 9-10

OCEANS '18 - October 22-25

SEPTEMBER

WindEnergy Hamburg - September 25-28

AWEA Offshore Wind - October 16-17

Teledyne Marine Tech Workshop - October 9-11 *

Offshore Energy - October 22-24

Ocean Energy Europe - October 30-31

Pacific Marine Expo - November 18-20 *

OCTOBER

Offshore Well Intervention - November 6-8

Clean Gulf - November 13-15

NOVEMBER/DECEMBER

TBD

* Digital Distribution

^ Pending



Bob Erickson

New Senior Scientist and NE Market Manager at CSA Ocean Sciences

CSA Ocean Sciences Inc., a marine environmental consulting firm that specializes in multidisciplinary projects concerning potential impacts of activities in coastal and marine ecosystems, recently announced that Bob Erickson has joined the team as a Senior Scientist and the Northeast Market Manager. In this capacity, Bob will help CSA expand its services and clients within the Government, Infrastructure, Ports, Harbors, Beaches, and Energy markets in the northeastern United States.

Mr. Erickson comes to CSA with over 30 years of consulting experience, where he conducted environmental assessments and permitting for a range of projects, including ecosystem restoration, waterfront infrastructure, environmental remediation, offshore energy facilities, natural gas pipelines, electric transmission lines, military operations, and water resource and transportation infrastructure. Mr. Erickson's consulting responsibilities have involved serving as a subject matter expert and Project Manager to direct business development efforts and expanding client relationships. For more information, visit www.csaocean.com.

IOSTIA Announces Healthcare Program

The International Ocean Science & Technology Industry Association (IOSTIA) has announced a new program for its U.S.-based members aimed at providing employer members, their employees, and self-employed industry professionals a viable, cost effective, and accessible healthcare program. For more information, visit www.IOSTIA.org/healthcare.html.

Center for Offshore Safety Selects Exxon Mobil and Baker Hughes for Safety Leadership Awards



The Center for Offshore Safety (COS) awarded its highest honor – 2018 Safety Leadership Awards – to Exxon Mobil Corporation and Baker Hughes, a GE Company, during the "Spotlight on Excellence" sessions at the 2018 COS Safety Forum, September 18, 2018.

The three finalists in the 2018 Operator category were BP Exploration & Production Inc., Exxon Mobil Corporation, and Shell Exploration & Production Company. The three finalists in the 2018 Contractor category were

American Bureau of Shipping (ABS), Baker Hughes, a GE Company, and Schlumberger. These represent the most outstanding contributions to improving offshore safety management.

This year's winner in the Operator category was Exxon Mobil Corporation who nominated their SSH&E Sharing & Learning App, designed for the use of ExxonMobil employees and contractors during execution of work on ExxonMobil's facilities and projects to prevent incidents through information sharing and learning.

Baker Hughes, a GE Company, is the contractor winner for their nominated Threat Response Drills program, which focuses on the prevention of process safety events by proactively identifying and responding to weak signals and potential threats to well control. For more information, visit www.centerforoffsafetys.org

Marine Ventures International Expands its Protected Species Program



Marine Ventures International, Inc. (MVI) announces and welcomes Ms. Brittney Bennett as the Protected Species Program Manager, effective September 3, 2018. This position was created in response to greater demand for protected species services for offshore geophysical and geotechnical surveys and coastal construction projects.

Ms. Bennett has extensive training and holds critical industry certifications; she has worked offshore for over 10

years as a protected species observer (PSO) performing visual, acoustic (PAM), and aerial surveys; and has an in-depth understanding of the various federal requirements for monitoring and mitigation during offshore surveys and operations.

Having served as Lead PSO on numerous projects, Ms. Bennett was responsible for giving pre-survey presentations on the permit and lease requirements; providing oversight, training, and guidance for other PSOs; and ensuring timely high-quality data submissions. She has conducted extensive data review and compilation and authored many technical and compliance reports for industry and government clients.

MVI is looking for additional, qualified PSOs/PAM Operators and Subject Matter Experts. To learn more visit www.marineventures.com.



BIRNS Welcomes Abel Nemeth as Manufacturing Engineer

BIRNS, Inc., an ISO 9001:2015 certified manufacturer of high-performance lighting and connector systems, announces the appointment of Abel Nemeth as Manufacturing Engineer at the company's headquarters. In his new role at BIRNS, Nemeth will be responsible for designing efficiency, cost-effectiveness, environmental and safety controls into each process, and will design, develop and evaluate integrated systems for managing industrial production procedures.

Nemeth brings more than 25 years of expertise to the position, having served previously in senior engineering roles for a range of companies and clients from SpaceX and Pentair Aquatic Systems to Genentech. He has extensive experience in lean and six sigma manufacturing, including the use of MSA/GR&R, SPC, DOE, and FMEA in a variety of quality environments such as TS-13485/21CFR820, TS-16949, AS9100, Global Food Safety, and ISO-9001. Nemeth holds a Bachelor of Science in chemical engineering from University of California, Berkeley, and a Master of Science in statistics from California State University, Hayward. For more information, visit www.birns.com.

Riptide Autonomous Solutions Launches Riptide Canada

Riptide Autonomous Solutions announces its first international expansion with the creation of Riptide Autonomous Solutions Canada. Headquartered in Halifax, Nova Scotia, Riptide Canada is being established to support the increasing demand in Canada and abroad for affordable, flexible AUV systems. Riptide Canada plans to establish development, production, and support capabilities in the Halifax area and add staff to meet their growing product demands over the next several years. For more information, visit www.riptideas.com.

Chet Morrison Contractors Wins National Excellence Safety Award

Chet Morrison Contractors (Morrison), a leading energy service company for the oil, gas and renewables industries, has been awarded a 2017 American Equity Underwriters, Inc. (AEU) Safety Award for the company's strong commitment to safety in the workplace. The AEU Safety Awards program recognizes the strongest safety programs in the maritime industry. Eligibility is based on the frequency and severity of workers' compensation accidents for the prior calendar year, as well as safety-related metrics determined by AEU's loss control team. For more information, visit www.chetmorrison.com.

Applied Acoustics Adding New Engineers to Its Team

Expansion plans have necessitated the employment of new technical staff at Applied Acoustic Engineering, based in Great Yarmouth, U.K. Recent BSc electronic engineering graduate Will Oakey has joined the production area; Will Shave, another BSc qualified engineer, is working on new developments in the company's seismic profiling systems and HND qualified Sean Evans is using his thirty years of technical expertise to improve the quality and build of the latest sparker systems.

Applied Acoustic Engineering is seeking to employ further engineers particularly with electronic design and software skills to work with them on some ambitious projects. For more information, visit www.appliedacoustics.com.



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Ocean Sonics designs and manufactures the iListen, a compact self-contained easy to deploy digital hydrophone. As the world leader in gathering ocean sound, Ocean Sonics combines very high signal performance with innovative ease of use, to give customers the best digital hydrophone technology available. It's a compact, all-in-one instrument capable of processing data while collecting in real-time.

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ADCP/DVL



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Nortek excels in the development and manufacture of acoustic Doppler instrumentation. Doppler Velocity Logs (DVLs) are used for subsea navigation. Acoustic Doppler Current Profilers (ADCPs) are used to understand physical processes in the ocean, rivers, lakes and laboratories. We pride ourselves on being innovative in product development and production processes. Nortek provides solutions to engineers and scientists by offering real-time data collection and support from our responsive technical team.

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Rowe Technologies designs and manufactures state-of-the-art Acoustic Doppler Current Profilers (ADCPs) and Doppler Velocity Logs (DVLs), applicable to an array of current measuring and navigational deployments for world-wide use, in oceans, lakes, and rivers. Rowe Technologies 7,100 ft² facility is headquartered in San Diego California and was founded in 2009 by Dan and Steve Rowe, the sons of Fran Rowe who is the originator of the Acoustic Doppler Current Profiler (ADCP) and co-founder of Teledyne RDI. Rowe Technologies highly experienced, innovative staff has over 250+ years of Doppler system development experience and is on the preponderance of ADCP patents.

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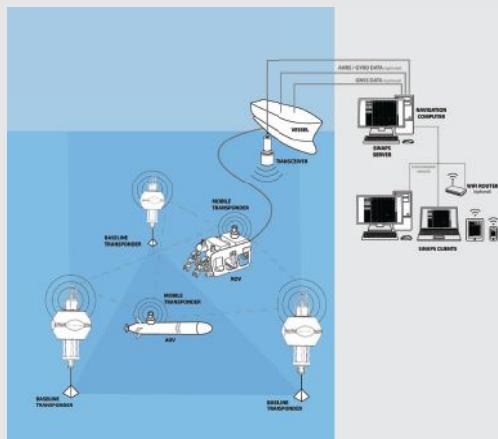
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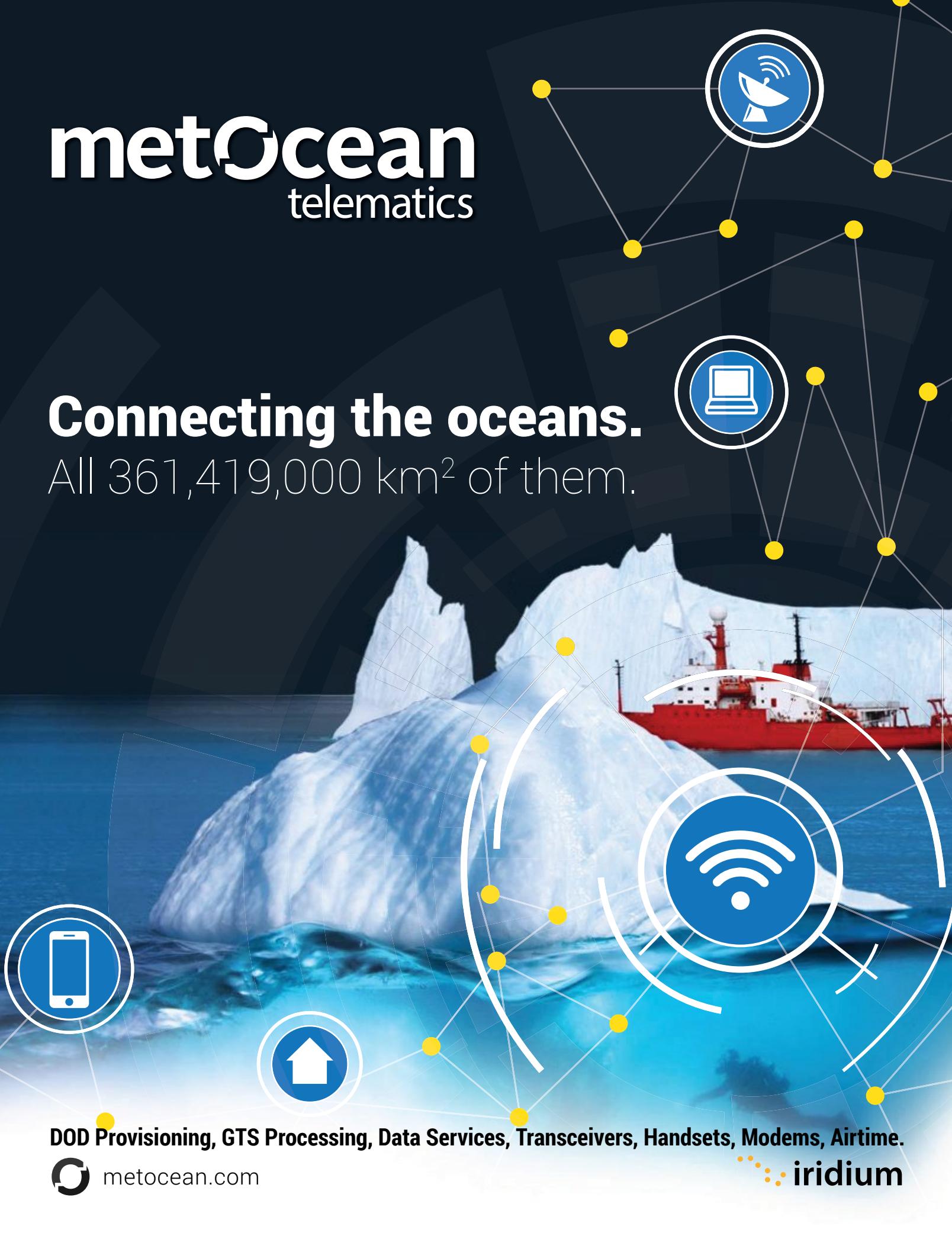


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