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OFFSHORE ENERGY CONNECTS

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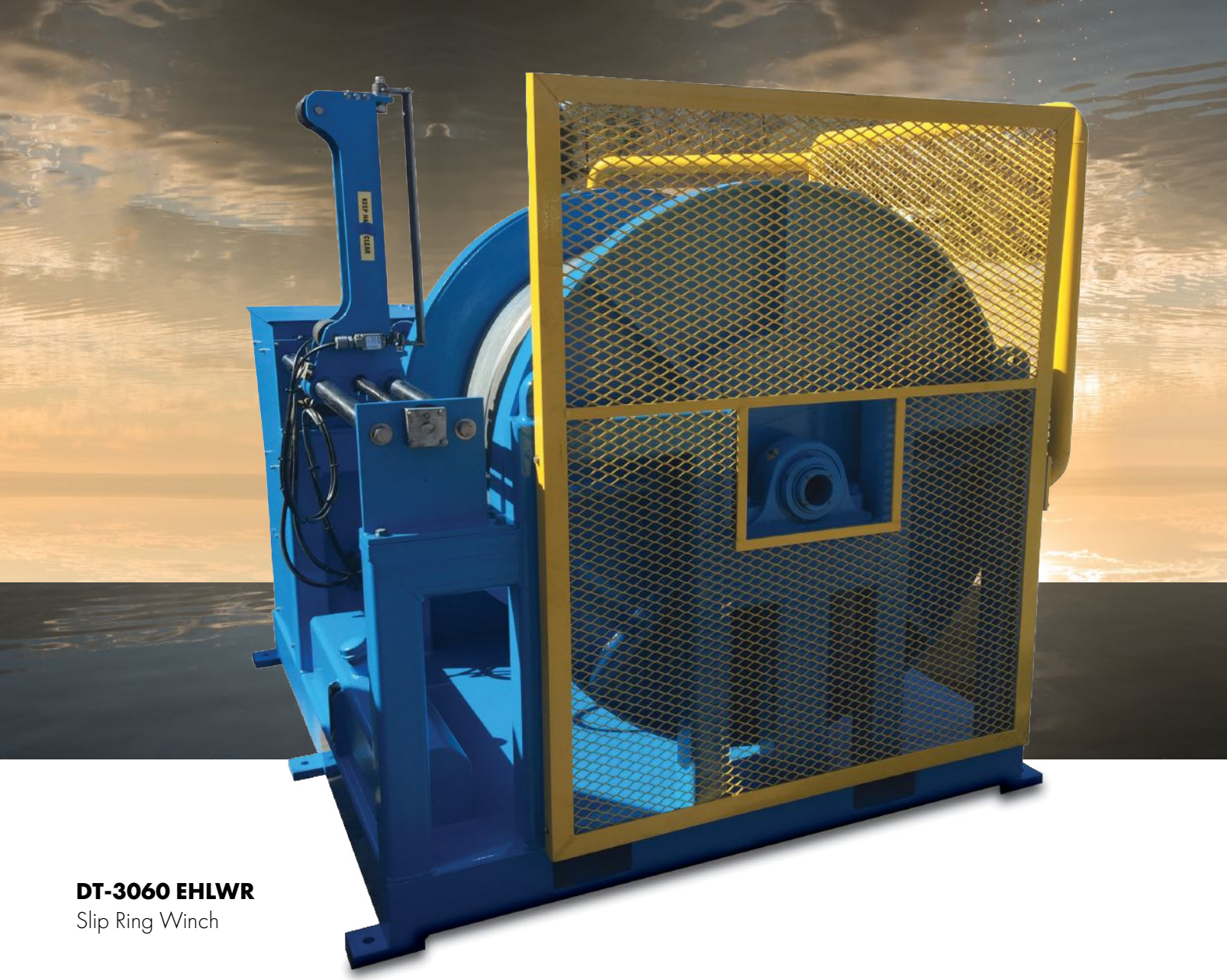

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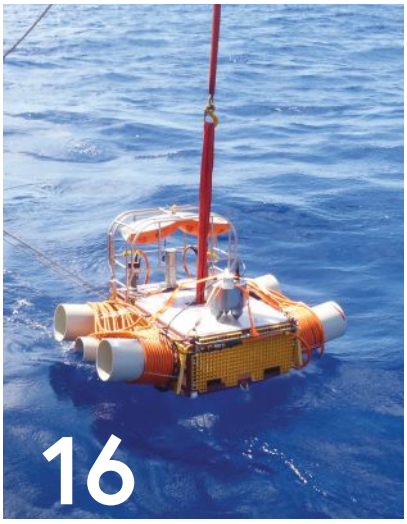

FEATURES

DEPARTMENTS

IN EVERY ISSUE

ON THE COVER:
An unmanned aerial vehicle (UAV) inspects a wind turbine. The UAV uses software from BladeEdge Analytics, which helps make the most of each flight. Image courtesy of BladeEdge Analytics.

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8502 SW KANSAS AVE. STUART, FL USA / +1 (772) 219-3000 / INFO@CSAOCEAN.COM / WWW.CSAOCEAN.COM

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Editor in Chief
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UK Editor
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Newsletter Editor
INGER PETERSON

Conference Coordinator
WHITNEY SCHWERIN

Circulation
JESSICA LEWIS
Jlewis@tscpublishing.com

Advisory Board
DR. PHIL HART
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TOBY STAPLETON
Fall River, Massachusetts

Published by
Technology Systems Corporation
PATRICK C. LAGRANGE, CEO

ADVERTISING SALES
LISA CHILIK
Tel: 574-261-4215
Lchilik@tscpublishing.com

MIMI KING
Tel: +44 (0) 777 6017 564
mking@tscpublishing.com

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Will Offshore Energy Companies Embrace Blockchain?

BY GREG LEATHERMAN,
Editor in Chief, ON&T

Offshore energy companies have often been among the first to adopt new technologies. From unmanned submersibles to dynamic positioning, the promise of reduced risk and greater profits has driven the industry to invest in a proactive manner. However, during a downturn, companies may be reactive, or reluctant to invest at all.

When it comes to blockchain technology, the difference between being reactive and proactive could be decided this year. Already, investment is flowing, and yet, the average offshore industry employee doesn't quite understand how blockchain might benefit them. Let's look at some companies investing in blockchain and see what we can learn.

In June 2018, Diamond Offshore announced what it calls "the first application of blockchain technology in the offshore drilling industry."

Diamond Offshore made this announcement during a run of declining revenue. In fact, Barron's reports that a Barclays investment analyst has described offshore drillers overall as the "most overvalued group in our coverage universe."

However, Diamond Offshore also recently secured long-term contracts for several new drill ships, which may explain the timing of their announcement. In a June 30, 2018 conference call (transcribed by The Motley Fool), the company's CEO, Marc Edwards, said,

"Blockchain technology shines when there are multiple parties to a single longitudinal transaction, which in offshore drilling is the manufacture of a well. The technology will provide an immutable platform for the optimization of well construction activities including drilling-related services, material and the supply chain, both offshore and shore-based.

"Current tracking systems rely on a unidirectional flow of data from outside sources onto a central database. Instead, the Blockchain Drilling Service enables a bi-directional flow of data between all nodes in a system, which is then confirmed using consensus algorithms.

"By enabling automated actions and removing the lag associated with updating currently available databases, Blockchain has the ability to make the exchange of goods and services associated with the manufacture of a well quicker, more efficient, more reliable and more automated."

Clearly, Diamond Offshore is being proactive. And if you look closer, there are announcements every quarter about one or more energy companies investing in blockchain. For example, BP, Equinor, Statoil, and Shell have joined a consortium effort to develop a blockchain-based platform for energy trading. In fact, the Interim CEO of the company building the consortium's platform is John Jimenez—a top executive from BP. Other members include trading houses Gunvor, Koch Supply & Trading, and Mercuria, and banks ABN Amro, ING and Societe General.

As you can see, when it comes to blockchain, the time for deciding between proactive or reactive investment has arrived. Early adoption could save time and money but investing wisely requires some education. One option geared towards educating industry stakeholders is The Blockchain in Oil and Gas 2018 Conference (September 20-21 in Houston, TX). This event presents expert keynotes, interactive panel discussions, and case studies that could empower you to make your own decision about whether to invest in blockchain.

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THE FUTURE IS ELECTRIC

THE CHALLENGES of Moving Offshore Wind

FROM THE OUTER CONTINENTAL SHELF TO THE GRID

By: Jonathan K. Waldron, Partner, Blank Rome LLP

and Joan M. Bondareff, of Counsel, Blank Rome LLP

INTRODUCTION

The Department of the Interior's Bureau of Ocean Energy Management (BOEM), operating under 2005 amendments to the Outer Continental Shelf Lands Act (OCSLA), which authorized BOEM to issue leases for energy projects other than oil or gas, has awarded 13 leases for offshore wind (OSW) farms on the Outer Continental Shelf (OCS) adjacent to the Atlantic Coast. Many of these lease holders are experienced European offshore wind developers that have opened offices in the United States. Lessees are preparing to submit Construction and Operation Plans (COPs) to BOEM; BOEM is simultaneously working on streamlining the federal review process and proposing new wind energy areas.

The first offshore wind farm in the United States, the 30 megawatt, five turbine Block Island Wind Farm, began commercial operations in December 2016 providing clean and sustainable energy to the residents of Block Island, Rhode Island. While Block Island Wind Farm is currently the only operational commercial offshore wind farm on the east coast of the United States, there are many emerging projects up and down the coastline.

In this regard, the governors and state legislatures in the Northeast have established new ambitious goals and incentives for renewable energy including offshore wind. Between the goals set by New York Governor Andrew Cuomo, New Jersey Governor Phil Murphy, and Massachusetts Governor Charlie Barker, a total of 8,000 MW of offshore wind energy is planned for by 2030. Rhode Island Governor Gina Raimondo has also established a goal of 1,000 MW of clean energy projects by 2020. These goals now have to be implemented by state regulatory bodies in rate approvals and contracts with utilities and other offtakers for OSW.

The Trump Administration, participating in several recent OSW conferences, including Houston in July 2018, has articulated its support for offshore wind—as part of its "all-of-the-above energy" strategy towards energy independence. BOEM is moving forward with new lease sales off Massachusetts and Long Island and is asking the public for comments on additional wind energy areas to develop.

These developments mean that the public will soon share in the clean energy benefits of offshore wind—as they are presently doing for onshore wind—but questions remain: when and at what price?

This article describes some of the incentives the federal government and states are using to attract offshore wind developers and the related supply chain, and to bring down costs of offshore wind. The article also identifies and briefly discusses some of the important technical, legal, and policy challenges that remain to establish a robust offshore wind industry that benefits the consumer as well as the developer.

FEDERAL, STATE, AND PUBLIC INCENTIVES

The Department of Energy (DOE) is funding demonstration projects as well as research into various aspects of offshore wind. For example, DOE has funded two OSW demonstration projects at a cost of $10.7 million each, including the Lake Erie Energy Development Corporation's Icebreaker Project (LEEDCo) and the University of Maine's New England Aqua Ventus I project.

On July 18, 2018, DOE announced six million dollars in funding for research on three topics, including two million dollars to develop offshore wind instruments for environmental monitoring and mitigation. Concept papers were due on August 15, 2018. Prior to this announcement, DOE selected the New York State Energy Research and Development Authority (NYSERDA) to administer an offshore wind research and development consortium seeded with $18.5 million. According to DOE, further research is needed on offshore conditions in deep water for floating foundations, and the impact of hurricanes on the East Coast, among other technical challenges.

An additional two million dollars will be allocated to DOE's national laboratories to continue its research on offshore wind, especially floating wind turbines.

States along the East Coast have stepped up to the plate with grants and other financial incentives, including Ocean Renewable Energy Credits (ORECs). The OREC is in effect a subsidy to offset the price of OSW. In Maryland, the OREC was set last year at a leveled price of $131.93 per MWh and ORECs were awarded by the Maryland Public Service Commission to two projects, U.S. Wind and Skipjack (an Ørsted project). In exchange, the companies must invest in Baltimore port facilities and a steel fabrication plant.

Maryland and Massachusetts have appropriated funds for grants to promote workplace development and supply chains. Maryland just announced its grants for FY2019. Virginia just commissioned a study of its supply chain for OSW and created a new website for public input before its first OSW project goes before the State Corporation Commission in early October 2018.

New Jersey also has legislation to create ORECs to support the price of offshore wind. With the support of New Jersey Governor Phil Murphy, the Board of Public Utilities ("BPU") just issued a proposed rule to establish an offshore wind energy certificate funding mechanism or OREC to support NJ's immediate goal of 1,100 MW of OSW capacity.

Major technology companies such as Google and Apple are powered by wind, solar, or other renewable energy instead of fossil fuels. According to Forbes, Apple and Google are now both 100 percent powered by renewable energy. In addition, Google is developing a wind energy kite system (called "Makani") to harness energy from wind efficiently and its low mass technology opens up new possibilities for wind power in deepwater offshore sites.

Finally, on the incentive side, the American Council on Renewable Energy (ACORE) has launched a campaign to attract one trillion dollars in private investment by 2030 to be split between renewable energy and technologies that modernize the grid. ACORE hopes to achieve this goal by working with banking institutions and the private sector.

Makani energy kites produce electricity by harnessing energy efficiently from the wind. Photo credit: Makani.

Parts of a Haliade rotor heading out to sea in Europe. Photo credit: GE Renewable Energy.

ONGOING CHALLENGES TO BRINGING MORE OFFSHORE WIND TO SHORE AND TO THE CONSUMER

Some of the critical technical issues for which DOE is funding research, include connecting the wind farms to the shore and the grid, identifying areas where floating platforms will work best, and determining whether offshore wind farms in the Atlantic Ocean can withstand ever-increasing and more dangerous hurricanes.

The National Renewable Energy Laboratory (NREL) is doing extensive research on floating wind farms. At a recent conference in Houston on floating technology, NREL's Walt Musial addressed potential advances in floating technology and urged the oil and gas industry to apply their knowledge to this work.

Another critical technical issue will be how to store the wind energy during times when the wind may not be blowing and when to distribute it to the grid. In this regard we note that Deepwater Wind has established a partnership with Tesla's Elon Musk to develop the technology to store offshore wind energy.

Two European companies—Equinor (formerly Statoil) and Masdar—have just installed a new battery system at the Hywind Scotland floating wind farm that will allow electricity produced at the farm to be transported by cable to an onshore substation where 1 MW batteries are placed that will know when to hold back the power and when to send it to the grid. This can be a model for battery storage in the United States.

General Electric (GE) has introduced a new 12 MW offshore wind turbine, the Haliade-X, which GE calls the most powerful and most efficient wind turbine in the world. Larger turbines such as the Haliade-X should serve to bring down the cost of offshore wind and perhaps reduce the number of turbines. These new generation turbines promise to significantly bring the cost of wind energy down to compete with other energy sources and provide more incentives to invest in wind energy.

Installing giant turbines on top of fixed and floating platforms remains a challenge as does getting work crews to the wind farms and back safely. U.S. Jones Act companies can bring equipment to the platforms and do work on the offshore wind farms and some companies are already providing these services, e.g., Blount Boats to Block Island Wind. U.S. yards have not yet built the larger cable-laying and heavy-lift vessels that can perform the more complicated tasks of installing the wind turbines. They may do so in the future but the cost of building these vessels in U.S. yards and competing world-wide for projects may continue to be an impediment to development in this area.

Conflicts with other users of the ocean must continue to be addressed early on in the planning stages. Military users, the shipping community, and the commercial fishing industry need to ensure that their uses of the OCS are protected. The Navy has initially placed large areas off the coast of California off limits to future offshore wind farms at the same time the state has been moving forward with plans for OSW. It remains to be seen how these use conflicts will be resolved in new Wind Energy Areas.

Policy challenges include how ratepayers will react to the higher costs of energy from these early projects. Ratemaking bodies in several states including New Jersey and Virginia are dealing with these challenges now. This will remain a challenge as the Production Tax Credit

("PTC") will end after 2019. At the same time, the price of offshore wind is coming down dramatically especially in Europe and will likely do the same in the United States with developing technology and expertise. A Forbes article reported data from a Lawrence Berkeley National Laboratory study indicating that the market value of electricity generated by offshore wind will soon exceed its cost in New York and New England—if you take into account jobs created.

Private companies with goals to be more sustainable may step up to the plate and take the power from the offshore wind farms. This is the basis for the ACORE $1 trillion challenge to private investors. Private offtakers can purchase the wind to run their plants either through direct Power Purchase Agreements (PPAs) or Virtual PPAs to offset usage of fossil fuels from new wind farms not adjacent to their plants.

CONCLUSIONS

The technical, policy, and legal challenges described above offer opportunities for scientists, engineers, lawyers, and policymakers, including Congress, to offer solutions and assistance to further help create this new U.S. energy industry. May the offshore winds continue to blow strong and steady and consumers soon reap the benefits of clean energy.

Jonathan K. Waldron is a partner in Blank Rome's Washington, D.C., office. He is the former chair of the firm's Maritime & International Trade Practice group and concentrates his practice on maritime, international, and environmental law, including maritime security. He can be reached at waldron@blankrome.com.

Joan M. Bondareff is of counsel in Blank Rome's Washington D.C., office. She focuses her practice on marine transportation, environmental, regulatory, renewable energy, and legislative issues. She can be reached at bondareff@blankrome.com.

Floating platforms are well-suited for wind farms off the Pacific Coast.

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The team recovering the ROV Lu'ukai on the deck of the R/V Kilo Moana after a successful dive. Image courtesy of the DeepCCZ expedition.

Scientists Explore Areas Targeted for Seafloor Mining

An international team led by scientists from the University of Hawai'i at Mānoa (UH Manoa) recently returned from a 34-day expedition to study deep-sea biodiversity and ecological processes in the western Clarion-Clipperton Zone (CCZ). The expedition, aboard the UH-operated research vessel *Kilo Moana*, studied an area in the Pacific Ocean where numerous manganese nodule mining exploration claims are located.

Chief scientist Craig Smith, professor of oceanography at UH Mānoa School of Ocean and Earth Science and Technology (SOEST), said, "The diversity of life in these seafloor areas is really amazing. We found at least ten species of giant sea cucumbers, a huge squid worm never seen before in the Pacific Ocean, and all kinds of sponges and other animals with really neat adaptations, such as sea cucumbers with long tails that allow them to sail along the seafloor!"

More than one million square kilometers of the abyssal Pacific seafloor have been identified for possible seafloor nodule mining. Manganese nodules are a potential source of copper, nickel, cobalt, iron, manganese and rare earth elements—metals used in electrical systems and for electronics like rechargeable batteries and touch screens.

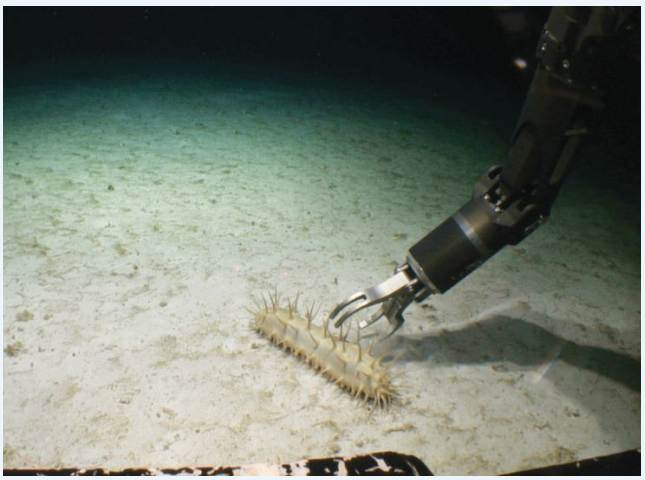
Deep-sea nodule mining is expected to result in the destruction of marine life and seabed habitats over large areas; this destruction has the potential to occur within sites directly mined as well as in adjoining areas impacted by sediment plumes created by mining activities.

The abyssal plains cover roughly 70 percent of the global seabed and are the biggest habitat on Earth's surface. These seafloor habitats remain among the most poorly studied on the planet because they are remote and require specialized equipment to study. Yet they may harbor an extraordinary diversity of organisms ranging from giant sea cucumbers to novel bacteria.

The research cruise, dubbed the DeepCCZ Expedition, was the first to study the wealth of organisms on seafloor plains and seamounts in areas currently designated as "no-mining areas" in the western CCZ. A major goal is to determine whether these protected areas are adequate to conserve the biodiversity in the region from the destructive activities of seafloor mining.

The expedition made 12 successful dives with UH's new remotely operated vehicle (ROV) *Lu'ukai*, which used robotic arms and deep-sea cameras to photograph and collect animals, manganese nodules, and sediments from greater than three miles deep. More than 100 species of large animals were collected or videotaped at the seafloor, many of which appear to be newly discovered species.

In addition to the ROV, the expedition used a broad suite of new deep-sea technologies to study the biodiversity and ecology of abyssal organisms ranging from bacteria to meter-long fish. State-of-the-art equipment designed to function at the enormous pressures of the abyssal ocean (more than 7000 lb per square inch) included an autonomous respirometer that descended to the seafloor to measure biological activity and food-web structure of deep-sea sediment communities, and baited stereo cameras that attracted and measured the mobile predators at the top of the deep-sea food chain. DNA samples were also collected from the environment, and from individual animals, to test



A 40-centimeter long elasipod sea cucumber about to be collected by the ROV Lu'ukai's manipulator. This sea cucumber, with 92 feet, seven lips, and numerous spikey processes, and was found at 3,500 meters depth atop a seamount. It walks along the seafloor using its 92 podia or feet. Image courtesy of the DeepCCZ expedition.

A manganese nodule gathered during the expedition. At the size of large potatoes, these nodules are tens of millions of years old. Image courtesy of the DeepCCZ expedition.

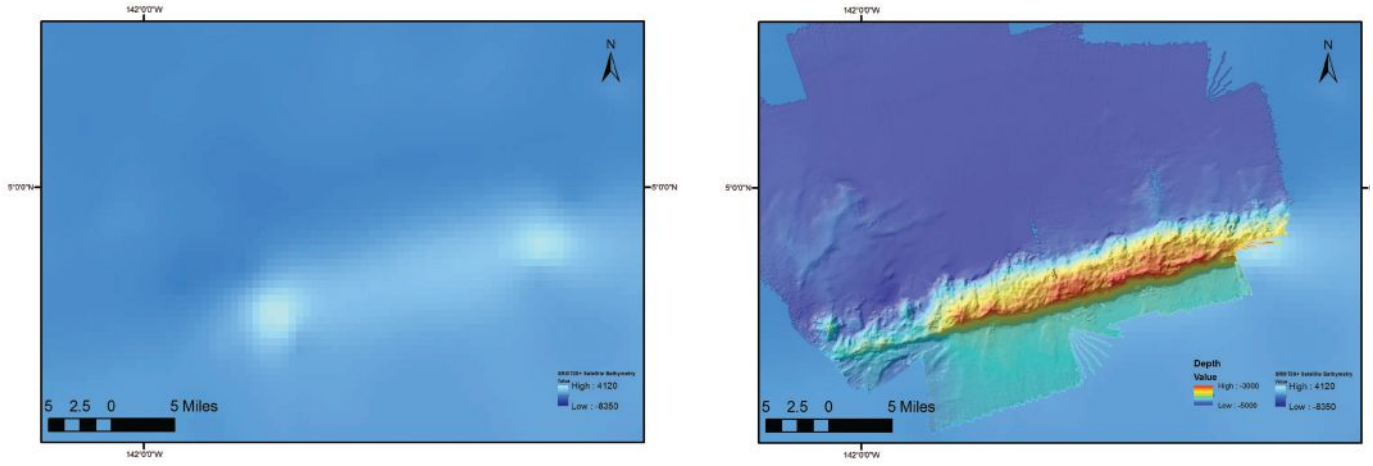
A sediment core, collected from the seafloor using the ROV. With such slow rates of sedimentation on the abyssal plains of the CCZ, this core could represent thousands and thousands of years of deposition. Image courtesy of the DeepCCZ expedition.

new approaches to assess biodiversity and ecological functions of microbes and animals living in sediments, on manganese nodules, and in the waters above. DNA samples from the animals collected will also aid in the identification and description of the many new species, and to assess their occurrence across the abyssal Pacific Ocean.

"Another unexpected find," said Smith, "was a dramatic difference in the abundance of manganese nodules and animals living on them, over surprisingly short distances of a few hundred miles across the abyssal plain."

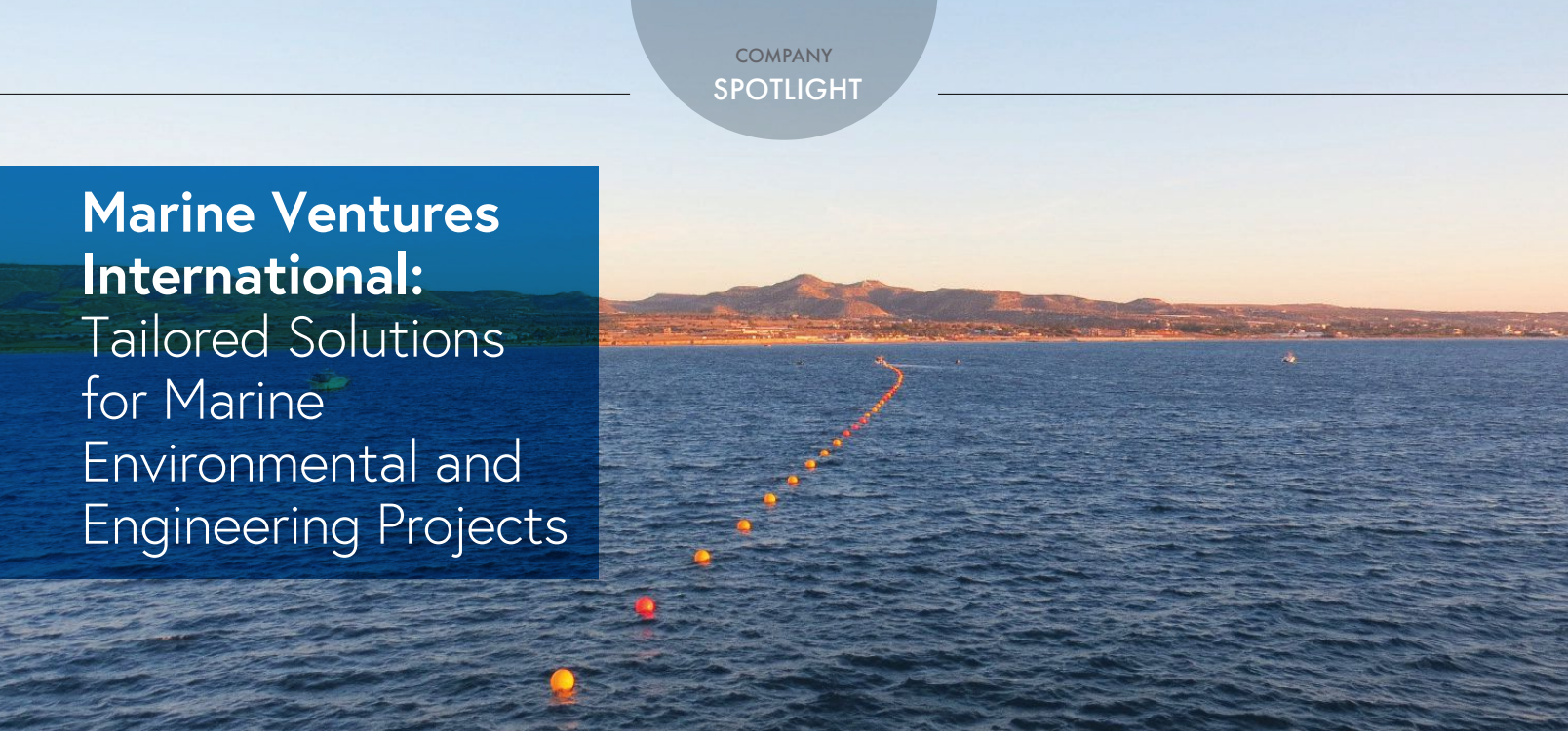
The data collected on this cruise will take many months to fully analyze, and is expected to substantially improve understanding of the biodiversity and ecology of the vast and poorly studied CCZ. The scientists will use these data to help assess the adequacy of conservation measures presently in place to protect deep-sea biodiversity in the face of seafloor mining. These data will also be incorporated into a regional synthesis of the CCZ, to be used to make science-based recommendations to the International Seabed Authority and other stakeholders concerning environmental protection and management for deep-sea mining in the CCZ.

Project co-leader and UH oceanography professor Jeff Drazen said, "This cruise was a wonderful opportunity to evaluate if three no-mining zones will be adequate protection for abyssal communities in the region, before seafloor mining begins."



Before (left) and after (right) shots of the seamount of interest. The left map shows estimated bathymetry from satellite. The right area shows the multibeam data we have just finished gathering and processing over the same region. Image courtesy of the DeepCCZ expedition.

Marine Ventures International: Tailored Solutions for Marine Environmental and Engineering Projects



Marine Ventures International (MVI) provides high quality marine environmental and technical experts to conduct marine projects worldwide. As a small business with big business experience, MVI excels at providing integrated engineering and environmental management services to commercial and governmental projects. Strategic partnerships allow MVI to call on the experience of highly-specialized small businesses as needed, reducing cost while also adding value to both long and short-term projects.

SMES FOR EVERY PROJECT

Marine Ventures' core Subject Matter Expert (SME) Team is the driving force behind their success. MVI SMEs have both the extensive field experience and the managerial insight to guide the right selection of personnel for field operations and desktop studies. The MVI SME Team has the regulatory, HSSE, and environmental impact assessment experience to staff projects with best of breed personnel. They also carry all required marine insurance to protect their customers.

FROM SUBSEA CABLES TO OFFSHORE INFRASTRUCTURE

An array of successful projects demonstrates MVI's extensive experience. One core service for the company is submarine cable projects. MVI personnel has been providing route design, cable, factory acceptance testing (FAT), landing, and testing services since inception and have been involved in a number of landmark projects.

"One current project we are very excited about is the $245 million Multiple Award Contract from Naval Facilities, Port Hueneme, CA. This contract melds perfectly with the team MVI has established and ranges from submarine fiber optic cables to ocean moorings," said Kevin Comer, MVI President.

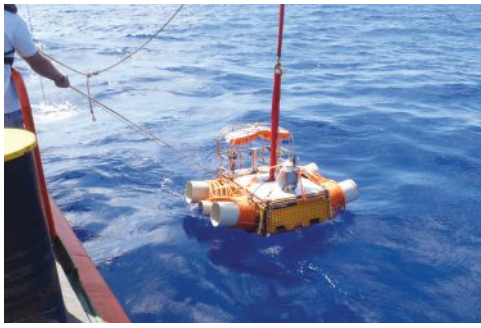
Another crucial project is MVI's ongoing support in Israel for infrastructure development and Oil & Gas development projects. Specifically the company is supporting Noble's Leviathan project, as well as Israeli Government port projects, both in scientific assessment and field surveys and data collection. This support includes deepwater ROV sampling operations as well as inshore dive surveys.

LOOKING TO THE FUTURE

Highly adaptable and agile, Marine Ventures is currently developing Protected Species Observation (PSO) services for the international markets and further developing their coral and seagrass impact assessment and mitigation services.

You could say the company builds on their success by keeping an eye on the future.

> ***"We are always watching industry trends**, predicting the kind of expertise the industry will need next," stated Comer.*



"For example, we have seen a big increase in seismic survey activity as early engineering requirements for the offshore wind market in the Northeast U.S. This has highlighted a need for more trained and experienced PSOs in the more complex seismic operations with the need to interpret and provide guidance on the appropriate responses and directions to vessel and survey crews during operations."

With an experience-based understanding of customers' project needs, MVI is the multifaceted solutions provider for your marine environmental or engineering project. Visit www.MarineVentures.com to view the most up to date capabilities including all MVI Subject Matter Experts.

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

NOC Scientist to Explore Changes in North Atlantic

TERIFIC (Targeted Experiment to Reconcile Increased Freshwater fluxes with Increased Convection) is an ambitious five-year project that will use marine robots to investigate how meltwater from Greenland and Arctic ice is changing 'deep water formation' in the North Atlantic.

This €2 million European Research Council (ERC) grant was awarded to Dr. Eleanor Frajka-Williams, a Principal Research Scientist at the NOC. She explained, "Deep water formation is a key part of the meridional overturning circulation and numerical models tell us that when you shut it down, the global ocean circulation responds by slowing. However, even though Greenland has been melting at accelerating rates, we have seen an increase in convection in the past couple of years. TERIFIC will zoom in to get a detailed look at the processes occurring during this spread of freshwater and deep water formation."

Developing a better understanding of how and on what timescales the ocean responds to freshwater inputs will improve our ability to make predictions about ocean circulation change in the coming decade, and the potential impacts on the climate of northwest Europe.

Dr. Frajka-Williams and her team at the NOC will use a combination of different marine robots including submarine gliders, an unmanned surface vehicle and mini surface drifters, to document the pathways that freshwater takes from Greenland ice melt to areas of deep water formation in the North Atlantic. Further details are available at http://noc.ac.uk/project/terific.

A schematic of the meridional overturning circulation where red lines show the northward flowing warm waters, and the blue lines, the deep water formed through open ocean convection.

Credit: NOC

Wave Gliders Monitor Seawater Near Hawaiian Lava Flow

By Kim Fulton-Bennett

In May 2018, Kilauea volcano on the Big Island of Hawai'i erupted, creating spectacular fire fountains and a massive river of lava, which has been flowing into the ocean near the eastern corner of the island. When this lava comes in contact with seawater, it explodes, sending fragments of volcanic rock and glass into the air and ocean. It also superheats and reacts chemically with seawater, releasing hydrochloric acid and other chemicals.

Using satellite images and aerial photos, scientists observed large plumes of discolored seawater streaming away from the area where lava is entering the ocean. But they couldn't tell if the discoloration is caused by sediment, chemicals, or perhaps algae growing in the water. Researchers saw a rare opportunity to learn how volcanic eruptions could affect the chemistry and biology of the ocean.

It can be dangerous for humans to do fieldwork near large, active lava flows. Fortunately, Hawai'i hosts a research facility run by Liquid Robotics (a subsidiary of Boeing), which develops autonomous ocean-surface vehicles called Wave Gliders. Resembling long, squared-off surfboards, Wave Gliders are propelled by the motion of ocean waves. They can stay at sea for months and travel across entire ocean basins without draining their batteries. Wave Gliders also carry solar panels that can power scientific instruments and transmitters that send data from these instruments back to shore via satellite.

In late June 2018, Liquid Robotics sent two Wave Gliders to monitor the ocean a few hundred meters offshore of the active lava flow on Hawai'i. Working with researchers at the University of Hawai'i at Hilo, the Massachusetts Institute of Technology, and the U.S. Geological Survey's Hawaiian Volcano Observatory, they outfitted these Wave Gliders with cameras and instruments to measure the temperature, conductivity, oxygen concentration, pH (acidity), salinity, and turbidity of the surrounding seawater.

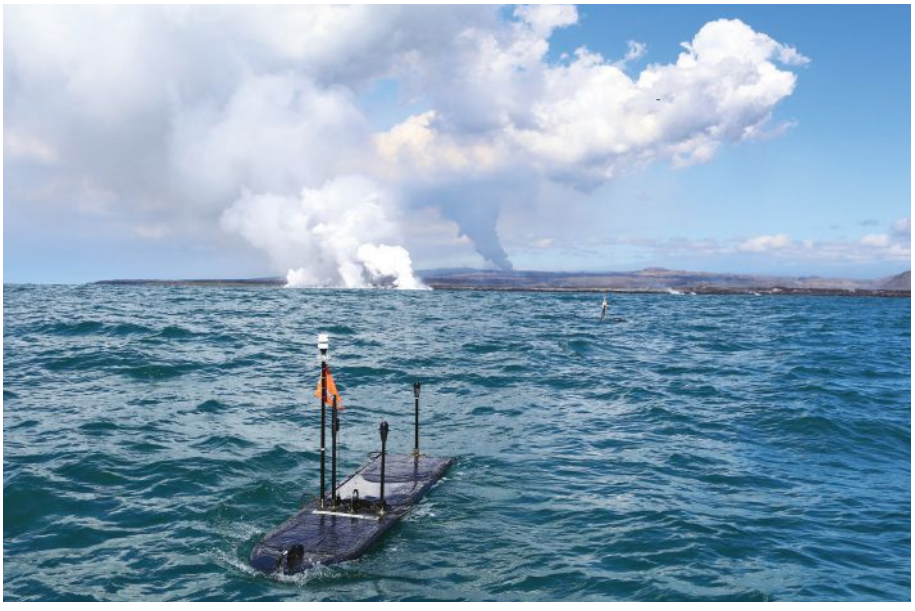
Initially the Wave Gliders were programmed to follow a pre-set zigzag path at a certain distance from the shore. But researchers were interested in studying differences between water inside the hot-water plume and water outside the constantly moving plume.

Liquid Robotics engineers contacted their colleagues at Monterey Bay Aquarium Research Institute who had developed software that would allow a Wave Glider to autonomously follow and map the boundary (front) between two distinct water masses in the ocean. In this method, the Wave Glider feeds seawater-temperature data to the software in real time. The algorithm compares the current temperature to the temperature measured when the Wave Glider was 300 meters behind its current position. If the temperatures are similar, the Wave Glider continues on its course.

If the difference is great enough, the software tells the Wave Glider to continue on its path for another few minutes until it is well past the boundary zone. Then the vehicle makes a sharp turn to (presumably) head back across the boundary into or out of the plume. In this way, the Wave Glider zigzags tightly back and forth across the front, collecting data. These data include high-resolution information about water properties on both sides of the front, as well as information about the location of the front itself.

During the Hawai'i experiment, the software not only had to instruct the Wave Glider to follow the front, it also had to make sure that the vehicle didn't get too close to shore or venture into water that was too hot. In either case, the Wave Glider automatically turned around and headed toward safer water. It worked. After more than a month at sea, the two Wave Gliders returned to shore in late July 2018, carrying huge volumes of new data.

For more information, visit
WWW.MBARI.COM



NOAA Satellites Gather Data on Changing Atlantic Ocean

The chemistry of our oceans is changing. NOAA satellites are gathering data that shows the coastline of the Atlantic is absorbing more carbon dioxide (CO2) than ever before in human history, mirroring the increase of the gas in our atmosphere. The result is something we can't always see with our eyes, or even notice from the coast.

An algae bloom near the Falkland Islands is shaped by meandering ocean currents. This image was acquired by the Visible Infrared Imaging Radiometer Suite (VIIRS) on board the Suomi National Polar-orbiting Partnership (SNPP) satellite on December 5, 2015. A new data resource, OCView, provides accessible tools for viewing and interpreting mapped satellite ocean color data.

In June 2018, NOAA scientists embarked on an Atlantic Ocean voyage to find out why these changes are occurring. Leaving Nova Scotia and heading south to Florida on board the NOAA ship *Henry B. Bigelow,* the crew will take local measurements of the ocean water and the sea life depending on it. They'll assess the growth of phytoplankton and the impact of sunlight on the sea surface to see what is contributing to the chemistry of the ocean.

In addition, by investigating how much CO2 very young fish are absorbing and how seafloor corals are changing in color, the scientists aboard the *Bigelow* will be able to confirm the impact of our changing planet. The mission will also revisit some sites for the third or fourth time, allowing the scientists to compare change over a short period of time.

Human powered measurements like those from the team on the *Bigelow* provide side-by-side data sets to test and compare to data from buoys and satellites. NOAA's STAR team sent a researcher aboard the *Bigelow* to investigate a very particular satellite ocean measurement called 'water leaving radiances.'

These light wavelengths are what our satellite space sensors measure when they image the oceans. The color of light from the ocean tells us about the amount of phytoplankton (chlorophyll) and other biological components of the oceans. Observations captured by NOAA's polar orbiting satellites, like NOAA-20, allow us to create a global image of the ocean water on Earth each day.

Learn more here: https://eos.org/project-updates/interactive-online-maps-make-satellite-ocean-data-accessible

An algae bloom near the Falkland Islands is shaped by ocean currents. Image credit. NOAA Visible Infrared Imaging Radiometer Suite (VIIRS) on board the Suomi National Polar-orbiting Partnership (SNPP).

ADVANCED NAVIGATION

www.advancednavigation.com

Advanced Navigation's USBL and Transponder **Redefine the Market**

Subsonus Tag is small enough to fit in the palm of your hand and has 18 months battery life.

Advanced Navigation is an Australian company specialized in navigation systems for sea, land and air. For well over a decade Advanced Navigation has been developing and manufacturing world leading navigation solutions across defence and commercial markets. The company's expertise stretches across numerous navigation technologies including MEMS, FOG, and Acoustic based Inertial Navigation systems. They are being used by industry leaders such as Fugro, Oceaneering and Teledyne.

Advanced Navigation's MEMS and FOG based solutions have become a mainstay across hydrography, AUV/ROV navigation and georeferencing.

The continuous search for technological innovation has yielded a new range of acoustic systems, designed to maintain high accuracy in shallow waters, noisy environments, while offering lower size, weight and power.

The integrated display helps operators make fast decisions above and below the water.

Subsonus is a next generation USBL that features an integrated INS (Inertial Navigation System).

Advanced Navigation's recently launched USBL and transponder have been well received by the market. Called Subsonus, the innovative USBL provides high accuracy position, velocity and heading at depths of up to 1,000 meters. Subsonus works on an inverted USBL scheme which allows it to provide accurate acoustic heading to a subsea vehicle. The system features an industry leading eight channel hydrophone array combined with an internal INS, all packed into a miniature titanium enclosure small enough to fit in the palm of your hand.

Subsonus also has the ability to measure the speed of sound through water using a revolutionary technique. This means that the system is self-tuning and no extra equipment or user intervention is required to setup the system, reducing the risk of operator errors.

Advanced Navigation's transponder, Subsonus Tag, is a cost-effective acoustic positioning device that operates with the Subsonus USBL. It features an integrated battery, wireless charging and a pressure tolerant display. Ultra-low-power consumption allows operation for up to 18 months on one charge, and up to 65,000 Tags can be tracked by one surface USBL. Subsonus Tag redefines the low-cost transponder market with massive savings from the hermetically sealed, connectorless design. This allows in number deployments for applications previously not feasible due to cost.

Thanks to their expertise across both hardware and software Advanced Navigation has a track record of custom developments for marine and subsea applications.

Käufer Blade Access System for Offshore Turbines Provides Fast, Safe Access

Käufer's K-BP-O platform was the first certified blade access platform especially designed for the offshore sector and usage at sea. It provides fast and safe access to wind turbine rotor blades for inspection and repair. The company has nearly thirty years of experience building and designing blade access systems. For more information, visit www.kaeufer.de.

Transatlantic Partners to Expedite Marine Storage

UK-based engineering company Blackfish has teamed up with its Canadian counterpart Venn Design Solutions to further explore development of storage systems for marine energy.

Venn is a multidisciplinary renewable energy design house, similar to Blackfish, but with specialist areas of knowledge in electrical engineering and energy storage solutions. With the continued growth of the marine energy sector in Canada and the need to explore energy storage solutions for renewable energy, the partnership positions both Venn Design Solutions and Blackfish Engineering to meet the industry's needs moving forward, the companies added. For more information, visit www.venndesign.ca and www.blackfishengineering.com.

Offshore Wind Event – October 2018

The 9th annual Offshore Wind Event – previously known as Offshore WIND Conference – brings together the entire offshore wind value chain to discuss current and future developments. In addition to key project updates, topics include future-proofing business models for subsidy-free offshore wind, redesigning electricity markets for abundant offshore wind and solutions for storage. Visit www.offshore-energy.biz to register.

Gen 3 Flow Machine from redT Will Support MIDAS Energy Project

U.K.-based energy storage solutions company redT energy has launched its third generation (Gen 3) flow machine that can be coupled with tidal energy generators to store energy. The new product is said to offer improved charge/discharge characteristics and increased efficiency within a more compact format, according to redT.

RedT states that the Gen 3 product will be used for energy storage for a large-scale tidal generation project in the UK – known as the MIDAS Project. Short for Marine energy Integrated with smart Distribution and Storage – the MIDAS project will seek to demonstrate the technical and financial feasibility of using tidal energy plus energy storage to provide reliable and renewable baseload energy. For more information, visit www.redtenergy.com .

Wave-Powered Buoy Reaches the Adriatic

U.S.-based Ocean Power Technologies (OPT) has shipped its PB3 PowerBuoy to Italy for the upcoming deployment for oil and gas operations in the Adriatic Sea.

The shipment marks OPT's first deployment into the oil & gas sector as the PB3 buoy will be used for Eni's subsea operations. The PowerBuoy will be used to demonstrate subsea battery charging and is intended for stand-alone charging and communications for long-term remote operation of AUVs. OPT will also provide deployment support, remote data collection and monitoring to the Italian oil & gas giant as part of Eni's Clean Sea initiative, according to OPT.

At the conclusion of the initial 18-month lease, and upon meeting technical metrics, Eni will have the option to either extend the lease for an additional 18 months or purchase the PB3 PowerBuoy, OPT noted.

OPT's PB3 PowerBuoy. Photo credit: OPT.

Will a New Deepwater Port in the Gulf of Mexico Boost Crude Exports?

On August 6, 2018, the Maritime Administration (MARAD) and the U.S. Coast Guard (USCG) announced that they have received an application for the licensing of a deepwater port. This comes on the heels of an EIA report that concluded that recent sustained growth in U.S. crude oil exports has happened despite the fact that U.S. Gulf Coast onshore ports cannot fully load Very Large Crude Carriers (VLCC), the largest and most economic vessels used for crude oil transportation.

TGTI's Proposal

Texas Gulf Terminals, Inc. (TGTI) is proposing to construct, own, and operate a deepwater port terminal in the Gulf of Mexico to export domestically produced crude oil. Use of the DWP would include the loading of various grades of crude oil at flow rates of up to 60,000 barrels per hour (bph). Approximately eight Very Large Crude Carrier (VLCC) vessels (or equivalent volumes) would be loaded per month from the proposed deepwater port. Loading of one VLCC vessel is expected to take 48 hours, including vessel approach, mooring, cargo transfer, and vessel departure.

The overall project would consist of three distinct, but interrelated components: (1) The "offshore" component; (2) the "inshore" component; and (3) the "onshore" component.

The proposed deepwater port (offshore component) would be located approximately 12.7 nautical miles off the coast of North Padre Island (Kleberg County, TX) and consists of 14.71 miles of two new parallel 30-inch diameter crude oil pipelines, which terminate at a single point mooring (SPM) buoy. The SPM buoy system would be positioned in water depths of approximately 93 feet and consist of a pipeline end manifold, catenary anchor leg mooring system, and other associated equipment. The SPM would be located in BOEM lease block number 823 at latitude 27°28'42.60" N and longitude 97°00'48.43" W.

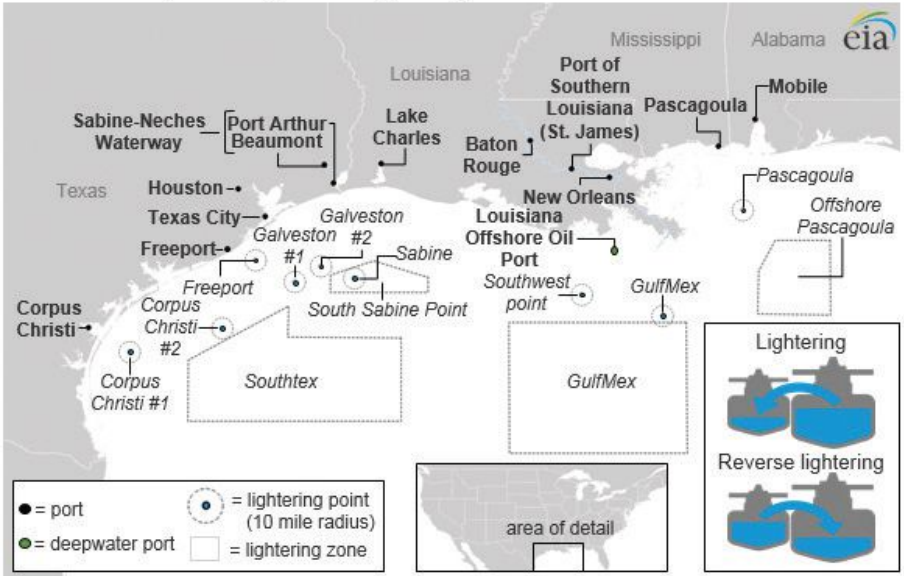
The inshore components associated with the proposed project include 5.74 miles of two new parallel 30-inch diameter pipelines and onshore valve stations used to connect the onshore project components to offshore project components. The inshore portions of the proposed pipeline infrastructure cross the Laguna Madre Bay complex, the Gulf Intracoastal Waterway, and extend across North Padre Island to the mean high tide line located at the interface of North Padre Island and the Gulf of Mexico. The inshore project components include the installation of an onshore valve station on North Padre Island to allow for the isolation of portions of the proposed pipeline infrastructure for servicing, maintenance, and inspection operations.

Onshore components associated with the proposed project include the construction and operation of an onshore storage terminal facility (OSTF), booster station, and approximately 6.36 miles of two new parallel 30-inch diameter pipelines located within Nueces and Kleberg Counties, TX.

The OSTF would occupy approximately 150 acres in Nueces County, TX and would consist of all necessary infrastructure to receive, store, measure and transport crude oil through the proposed inshore and deepwater port pipeline infrastructure. The proposed booster station would occupy approximately 8.25 acres in Kleberg County, TX and would consist of the necessary pumping infrastructure to support the transport of crude oil from the OSTF to the deepwater port. Onshore pipeline infrastructure would extend from the OSTF to the landward side of the mean high tide line located at the interface of the western shoreline of the Laguna Madre.

The license application is available for viewing at www.regulations.gov under docket number MARAD-2018-0114. Comments can be submitted electronically at that site.

U.S. Gulf Coast petroleum ports and lightering areas



Changing the Way Offshore Wind Turbines Are Inspected

A new company pioneering the use of artificial intelligence (AI) in wind turbine inspection, Clobotics announced on August 15, 2018 that it has closed an additional $11 million in funding in a continuation of its Series A round of financing. Venture capital raised in this round now totals $21 million. The company specializes in in intelligent computer vision solutions for the wind power industry.

Clobotics provides an end-to-end solution combining autonomous drone hardware with built-in computer vision, artificial intelligence and data analytics software for automated wind turbine inspections.

Using Clobotics Smart Wind solution, autonomous drones take high resolution photos to identify damaged or weakened components as small as one millimeter by three millimeters. Clobotics' AI engine parses its massive real-world dataset which includes fully-functional and minutely-damaged turbines and shares real-time telemetry to its customer cloud portal, completing an inspection in minutes rather than days.

The company says that its autonomously-flown drones offer a more stable, higher resolution, more comprehensive, and more cost-effective solution to capture high quality images of the blades. With onboard AI technology, Clobotics Smart Wind can detect tiny cracks of the blades and filter the data by severity. It will track the blade damage over time and enable wind farms to further improve operational efficiency throughout the wind turbine life-cycle.

New investors include Nantian Infotech VC and Wangsu, joining previous investments from KTB Network, GGV Capital and Capital Development Investment Fund Management Co., Ltd.

To learn more, visit
WWW.CLOBOTICS.COM

BLUE Hammer: Testing New Offshore Wind Installation Technology

The Carbon Trust and Fistuca, in conjunction with industry partners (E.ON, EDPR, EnBW, Equinor, Ørsted, Shell, Sif, SSE, Van Oord, and Vattenfall) announces the successful completion of the offshore test of the Fistuca BLUE 25M hammer as part of the Offshore Wind Accelerator BLUE PILOT project. The offshore test was carried out on August 13, 2018, using Van Oord's offshore heavy lift installation vessel, Svanen, off the coast of the Netherlands.

The BLUE Hammer is an innovative, new hammer utilizing a large water tank to provide a more energetic, but quieter blow for offshore installation. It is designed to reduce underwater noise levels by up to 20 dB (SEL) and is predicted to reduce the fatigue damage during installation on the pile by up to 90 percent.

This could not only remove the need for underwater noise mitigation, but also enable secondary steel to be pre-welded to the monopile before installation, potentially unlocking 'transition piece free' designs. Furthermore, by reducing the amount of time and number of operations carried out offshore, the innovative piling method improves health and safety, resulting in a significantly lower installation cost.

The offshore test provided significant insights and understanding for future commercial operations. Data was recorded on both acceleration levels on the monopile as well as underwater noise levels in the surrounding area which will now be analyzed and interpreted to validate studies that were undertaken prior to the test. This will allow Fistuca to optimize the hammer for future use on commercial offshore wind farms.

For more information, visit
WWW.CARBONTRUST.COM

Minesto Completes Marine Energy Kite Trials

Marine energy developer Minesto has completed the initial commissioning sea trials of its unique subsea kite technology called Deep Green off the coast of Holyhead, North West Wales. Through the initial trials, a range of functionalities such as the kite control system, launch and recovery systems, connections and communications have been tested and verified in various sea states.

The results of the initial commissioning tests have been analyzed and the main conclusion is that Minesto's DG500 marine energy kite, which produces renewable energy from tidal streams and ocean currents, is ready to commence "flying" full subsea trajectories.

Commenting on the progress, Minesto's Chief Operating Officer David Collier said: "This is a very significant step towards our ultimate goal of proving the complete DG500 system. I am very proud of the team as this accomplishment has been made possible only by the hard work and endeavor of everyone that has been involved in the design and development of the Deep Green technology over a number of years. The commissioning efforts have been performed in a safe and robust manner, which is especially important considering the many innovations involved in this first-of-its-kind project."

Minesto will next continue the commissioning program of the DG500 device to achieve the milestones of flying full subsea trajectories and verifying the power take-off system and electricity generation.

For more information, visit
WWW.MINESTO.COM

Dominion Energy and Ørsted to Develop Windfarm Offshore Virginia

On August 3, 2018, Dominion Energy filed with Virginia's State Corporation Commission (SCC) for approval to build the two six-megawatt turbines and grid infrastructure needed to connect Virginia's first offshore wind facility to the coast.

Denmark-based Ørsted, hired by Dominion Energy to build the Coastal Virginia Offshore Wind Project (CVOW), also announced that a research vessel will conduct the final ocean floor mapping needed before construction can begin. Ørsted is a premier offshore wind power developer with over 1,000 offshore wind turbines installed and operating around the world.

The offshore wind project will be located about 27 miles off the coast of Virginia Beach on 2,135 acres of federal waters leased by the Virginia Department of Mines, Minerals and Energy. The two six-megawatt turbines will sit in about 80 feet of water and rise over 550 feet above the ocean's surface – but will not be visible from the Virginia Beach shoreline. The facility is expected to begin generating emissions-free energy for customers by December 2020.

While officially a demonstration project, it would be the first constructed in federal waters through the Bureau of Ocean Energy Management's (BOEM) approval process. It will be the nation's second commercial-scale offshore installation, following one off the coast of Block Island, RI, operational since 2015.

The project will provide critical permitting, construction and operational experience, and could pave the way for 2,000 more megawatts of carbon-free generation in the adjacent 112,000 acre wind energy lease area – enough energy to power about half a million homes. Dominion Energy currently leases the massive acreage that would be needed for this facility from BOEM.
The $300 million project will be funded through existing base rates, enabled by the Grid Transformation & Security Act. Contingent on various regulatory approvals, onshore construction would start in 2019, followed by turbine installation and operation in 2020.

In July 2018, the Grid Transformation & Security Act became law, declaring offshore wind to be in the public interest.

In conjunction with Dominion Energy's filing for regulatory approval of the first phase of its Grid Transformation Plan in Virginia, the company committed last month to have 3,000 megawatts of new solar and wind, enough to power 750,000 homes, under development or in operation in Virginia by the beginning of 2022.

For more information, visit
WWW.DOMINIONENERGY.COM/CVOW

Global Wind Summit Gathers the World

The world's largest wind energy gathering, the Global Wind Summit, is scheduled for September 25-28, in Hamburg, Germany. The event comprises two parallel events: WindEnergy Hamburg's global on- and offshore Expo and the WindEurope 2018 global on- and offshore Conference.

The Expo will feature 1,400 exhibitors, with over 35,000 visitors from over 100 countries attending. The WindEurope 2018 Conference will showcase over 500 speakers and presenters and will be a unique opportunity to exchange with captains of industry, leading policymakers and wind energy experts and to get the full low-down on every aspect of wind and how it's transforming the global energy mix.

- **Day One** will tackle electrification and sector-coupling.
- **Day Two** will explore digitalization and other technology developments in wind.
- **Day Three** will focus on finance and the implications of an increasingly merchant environment.
- **Day Four** will look at new and emerging markets and the long-term outlook.

Anja-Isabel Dotzenrath, Chief Executive Officer, E.ON Climate & Renewables said: "The Global Wind Summit is where we can set the agenda for sector-coupling and electrification to plan for a cleaner, greener world."

Hans-Dieter Kettwig, Managing Director, Enercon said: "The wind industry is breaking new ground in every respect today: geographically and economically, technologically and even politically. The Global Wind Summit is where all stakeholders will gather around a unified vision for the industry, worldwide, to ensure we continue breaking new ground in the future."

Philippe Kavafyan, Chief Executive Officer, MHI Vestas said: "Recent years have seen rapid evolution in the wind industry. The Global Wind Summit is about harnessing all that innovation and creating new potential for wind, worldwide."

To register, visit https://windeurope.org summit2018/?ref=WindEurope.

Framo Technology Used to Install Wind Turbine Foundations

A total of 60 suction buckets have been pumped in place as foundation for the 20 wind turbines in Ørsted's new wind farm Borkum Riffgrund 2.

In June 2018, a team of specialists from Framo, the Norwegian Geotechnical Institute (NGI) and GeoSea installed the first of the 20 suction bucket jackets at the offshore wind farm. After periods of storm and high waves, the foundations of all 20 wind turbines were safely pumped into the seabed with the final jacket foundation installed on July 30, 2018. Full commissioning of the wind farm is planned for early 2019.

"The suction bucket jacket technology for offshore wind farms has gone from concept to reality during the last five years. Besides lowering costs due to the increased installation speeds compared to traditionally piled jackets, the concept provides for easier decommissioning and practically noise free installation." says Thomas Langford, Director for Offshore Energy at NGI.

Framo is a sub-contractor to NGI in the installation. The companies have collaborated on the installation of offshore anchoring and foundation elements around the world using suction/vacuum since the 1990s.

The windfarm Borkum Riffgrund 2 is located 54 kilometers off the coast of Lower Saxony, in the German North Sea. In the installation of the 56 wind turbines, 20 will use the suction bucket technology and 36 will be supported using monopiles. The three-legged foundations measure more than 50 meters in height and weighing 950 tons each.

"Compared with installing monopiles, suction anchor technology has a more environmentally friendly footprint. When pumped in place, the fish does not scare away during the installation process due to noise and it is easy to reverse the operation." says Theodorsen.

For more information, visit
WWW.FRAMO.COM

Kosmos Acquires Deep Gulf Energy

On August 6, 2018 Kosmos Energy announced an agreement to acquire Deep Gulf Energy (DGE), a deepwater company operating in the Gulf of Mexico, from First Reserve and other shareholders for a total consideration of $1.225 billion, subject to certain adjustments.

www.oceannews.com/news/energy/kosmos-acquires-deep-gulf-energy

Total Leaves South Pars

On August 20, 2018, a key Iranian official confirmed that France's Total is leaving the massive South Pars offshore field in response to U.S. sanction threats against companies that do business in Iran.

www.oceannews.com/news/energy/iran-confirms-total-leaves-south-pars

Massachusetts Legislature Votes to Double Offshore Wind Capacity

On July 31, 2018, the Massachusetts Legislature passed a bill that doubles the currently authorized amount of off-shore wind procurements for the Commonwealth of Massachusetts from 1,600 MW to 3,200 MW.

www.oceannews.com/news/energy/massachusetts-legislature-votes-to-double-offshore-wind-capacity

How Will the Incoming Mexican President Impact Oil Investments?

By Greg Leatherman, ON&T Editor In Chief

Mexico's President-elect Andres Manuel Lopez Obrador (often abbreviated as AMLO) has promised to invest around 175 billion pesos ($9.4 billion) into his nation's state-owned energy enterprise, Pemex. Whether this means he will increase cooperation with foreign-operated companies or further nationalize his nation's hydrocarbon resources remains to be seen.

Oil production from offshore Mexico has declined over the last decade, but deep-water reserves in the southern Gulf of Mexico hold great potential. In fact, the EIA says that, overall, Mexico holds at least 10 billion barrels of proven crude oil reserves.

In 2013-14, President Enrique Pena Nieto and the Mexican legislature put oil industry reforms into law that allowed foreign and private investment in Mexico's oil and gas industry for the first time in 75 years. Under those reforms, the Mexican government receives a 74 percent take on any new barrels. Considering the more than $220 billion invested by the international oil industry since then, and the $160 billion in future investment expected as a result of the 107 contracts already awarded for oil and gas exploration, substantial revision of those reforms could rattle markets.

Elected in July 2018, AMLO has repeatedly said that he wants to increase national content on upstream contracts. Just how he will accomplish this after his December inauguration on remains to be seen, but he does have the public's confidence. He won the election in a landslide and his party won a coalition majority in both chambers of congress, as well as five out of nine state governorships, and a majority of state-level legislatures. According to the Wilson Center's Mexico Institute, this gives AMLO the most legislative leverage of any leader in Mexico's modern democratic era.

WITH ALL THIS LEGISLATIVE MUSCLE, COULD AMLO REWRITE THE RULES?

The 2013-14 reforms put into law the legal framework that has enabled Pemex to grow in its balance sheets, even if the full benefits have yet to trickle down to the voting populace. Under those reforms, Mexico retains ownership of hydrocarbons in the subsurface, but competition is opened for exploration and production, downstream, midstream, and energy production. The reforms also increased transparency and accountability while promoting environmental sustainability.

However, while campaigning, the left-leaning AMLO repeatedly stated that the reforms need an overhaul due to widespread corruption, and that his administration would implement a more nationalistic hydrocarbons policy. For example, in his post-election victory speech, AMLO said that his administration would audit oil contracts for graft and corruption going back to 2015 and ask the Mexican congress and courts to pursue and prosecute offenders. He also threatened to suspend or cancel Mexico's oil bid rounds.

Other reasons for concern could include questions around who controls recently discovered offshore reserves in places previously thought to be played out.

For example, Pemex plans to drill a test well later this year in the Zama reservoir, a Talos-led discovery that they claim could overlap with a neighboring block controlled by Pemex. The oil in place for

Zama is expected to be between 1.4 and 2 billion barrels of oil equivalent.

The Sureste Basin, where the shallow-water Zama reservoir exists, reportedly emerged as a surprise to Pemex. It even garnered Talos the "Discovery of the Year 2017" award during WoodMackenzie's (WoodMac) annual exploration awards ceremony in June 2018. Talos' partners in the discovery are Premier Oil and Sierra Oil & Gas.

"Zama is a big find in a new play and looks set to be a company-maker," noted WoodMac in announcing the award. "It is also one of the first foreign-operated discoveries in Mexico since international oil companies returned to the country after an absence of over 70 years."

Such discoveries prove that the expertise and technology of foreign-operated companies can find major reserves even in shallow-water areas where Pemex has explored extensively. Could the bids that made such discoveries possible be included in the audits on which AMLO based some of his nationalist rhetoric? Would AMLO dare challenge the contracts for discoveries like Zama discovery (or Eni's 1 billion-barrel Amoca prospect in the same basin)? Most observers say that AMLO is unlikely to challenge sealed contracts, which partly explains aggressive bidding by companies like Total, Shell, Eni and DEA on eight blocks of the Sureste Basin offered up in March 2018.

Talos says they are closing in on approval from Mexico's National Hydrocarbons Commission for testing, coring and sampling in the reservoir. In July, the company sought approval from Mexico's Ministry of Energy (SENER) to enter a preliminary agreement with PEMEX for a potential unitization encompassing the Zama field in block 7 and the PEMEX grant to the east. Talos says that the agreement would clear the way for development, with first production from the field set for 2022. Meanwhile, Eni has announced the Commission's approval of their development plan for Amoca, Miztón and Tecoalli, all located in the shallow waters of the Campeche Bay.

However, the Commission has delayed auction awards scheduled for September 2018 until February 2019 so that the incoming administration can review and potentially revise contracts. This has raised a good many questions about what these audits entail, since the contracting process was transparent by international standards.

This delay comes on the heels of Pemex filing complaints in July 2018 against individuals they say posed as company officials in order to obtain fraudulent contracts, an issue that reminds some of pre-reform fraud, wherein billions of dollars of deals granted by the state oil conglomerate were revealed to be corrupt. AMLO also plans to appoint his top campaign energy advisor, Rocio Nahle as Mexico's energy minister. Nahle is said to favor a more nationalistic approach to energy policy, as does AMLO's choice to run Pemex, Octavio Romero Oropeza.

WILL REVENUE OUTWEIGH ELECTION RHETORIC?

Whatever AMLO and his powerful coalition does in terms oil reserves will be watched closely by foreign investors and global markets. If he voids any of the previous reforms, or cancels contracts already signed by his administration's predecessors without an obvious consensus, investment volatility could follow.

However, recent analysis from Duncan Wood, Director of the Wilson Center's Mexico Institute, suggests that such drastic action is unlikely, due to the fact that many of the contracts and investments made between 2014 and now are expected to begin paying dividends in terms of increased oil production by 2021. The resulting fiscal revenue will be key to accomplishing some of AMLO's other campaign promises, from building refineries to balancing the budget.

Since the election, AMLO's incoming chief of staff, Alfonso Romo, has sought to temper nervousness from international investors by promising that that the new administration would not try to overhaul 2014 reform laws, and that private investments would not be hurt.

"Mexico has a necessity for lots of money for offshore drilling," Romo told Bloomberg in early July. If oil output returns and drives growth "no one will fight success."

SELECTED RESOURCES:

National Hydrocarbons Commission Information Center: https://portal.cnih.cnh.gob.mx/?lng=en_US

Wilson Center Report: www.wilsoncenter.org/publication/changing-the-guard-mexico-amlos-opportunities-and-challenges

2014 Mexico Oil Industry Reforms: www.eia.gov/conference/2014/pdf/presentations/carrera.PDF

Pemex 2Q18 Financial Info: www.pemex.com/en/press_room/press_releases/Paginas/2018-064-national.aspx

Pre-reform Fraud: www.reuters.com/investigates/special-report/pemex-contracts/

PROTECTING SUBSEA CABLES

By Greg Leatherman, ON&T
Editor in Chief

Subsea cables work in punishing conditions but are required to function perfectly for up to forty years. While they are rigorously tested before installation, no design can prevent every possible risk to subsea cables. What are some of these risks? And what is being done to mitigate them?

Damage to cables constitutes both a security issue and a major cost in the energy sector. Whether damage is from a third-party accident, improper installation, or even due to corrosion damage to connectors at a landing station, the cost to the energy sector is substantial—and it's growing. Just take a look at some of the major subsea power cable projects under construction or in the planning stage:

- IFA2 is a 1,000 MW high voltage direct current (HVDC) electrical interconnector currently under construction that will use high voltage subsea cables from Normandy in France to Hampshire in Great Britain.
- Celtic Interconnector is a proposed 700 MW HVDC submarine power cable between the southern coast of Ireland and the north-west coast of France.
- Viking Link is a planned 1,400 MW HVDC submarine power cable between Bicker Fen in Lincolnshire, the United Kingdom and Revsing in southern Jutland, Denmark.
- The Biscay Gulf Interconnector is a 370 km submarine interconnection between Spain and France that will increase the exchange capacity between the two nations from 2,800 to 5,000 MW.

The construction of these interconnectors is a tremendous technical challenge, but the risk does not begin under the ocean.

HOW CABLES ARE DAMAGED

Damage to subsea cables can occur during the transport, construction, or service phases. In deeper water, the damage is usually the result of natural causes such as current abrasion, underwater landslides, and underwater seismic activity. But in depths of less than 200 meters man-made causes are often responsible. In fact, it's been estimated that around 70 percent of all cable faults are caused by fishing and anchoring activities.

With much of the world committed to generating a higher percentage of power from offshore renewable energies, and cross-border interconnectors using subsea cables, it is critical that we enact solutions to mitigating subsea cable damage.

HOW CAN WE MITIGATE THE POTENTIAL DAMAGE?

First, installation and burial contractors need detailed survey information to select appropriate installation and protection methods. Issues resulting from unexpected seabed conditions can increase both the cost and difficulty of cable installation operations.

Second, any nearby debris must be removed from the cable route. Third, to avoid damage from shipping-related incidents, cable routes must be clearly marked on maritime maps.

In vulnerable areas, cable can be wrapped in concrete (mattressed). For example, cables were wrapped during the installation of the Horns Rev commercial wind farm in the North Sea. CWind (part of the Global Marine Group) not only buried cables to a target depth of two meters below the seabed, they also performed 174 mattress installations.

Protecting cables upfront is a wise investment, but what if the cable is damaged during transport or installation? Such damage can be caused by something as simple as bending cable beyond specifications, rough handling, or allowing excessive

Image by Josh Bauer, National Renewable Energy Laboratory (NREL).

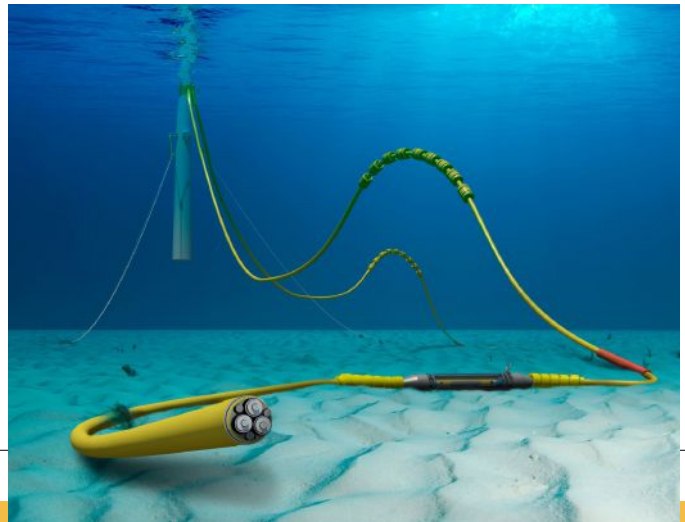


Photo credit: Stiftung Offshore Windenergie.

tension during installation. This type of damage can be difficult to detect unless it is spotted as it occurs. For this reason, cable handling monitoring is important during installation.

Given the potential delays, it can cost millions of dollars to replace a damaged cable if caught in time, but it's even more expensive once installed. What's more, once a damaged cable is put in place, it might be years before the damage causes a failure.

Once an installed cable sustains damage, weather can play a part in delaying a repair. For example, subsea cables in northern latitudes can be difficult to reach during winter months. In such cases, a delay of months could stretch all the way into the following year. Furthermore, locations far offshore tend to be more prone to unfavorable weather conditions.

Another challenge is that the vessels used to service subsea cables are specialized and, therefore, are not always available. Unless managers have supplier agreements in place with vessel operators, it could take weeks or even months to procure the equipment needed to repair damage done to a cable. For example, when the Basslink Interconnector (linking Victoria and Tasmania in Australia), returned to service in June 2018 after a two-month outage due to third-party damage, Basslink's CEO cited "the highly specialized nature of the equipment needed for the repair" as well as "logistics and scheduling challenges" as reasons for the extended downtime.

Subsea power cables are a vital part of supplying the energy needed for prosperous future. With the offshore wind market set to exceed $60 billion by 2024, and the continued expansion of interconnected grids, the critical nature of these installations will only grow.

The companies making this future possible are some of the most capable in the world and the lessons they have taught us can be boiled down into five key areas: improved survey data, adherence to manufacturer specifications, technical due diligence, better contingency plans, and the collection of post-installation data to support continued improvement. The risk mitigation that results from these applied lessons can play a major role in reducing the levelized cost of energy for all types of electricity generation.

To get the latest analyses of the submarine cable industry, visit www.subcableworld.com.

The introduction of 66Kv cables doubled the voltage of the previous standard for offshore wind transmission, reducing the levelized cost of energy for offshore wind. Image courtesy of JDR Choice.

Deepwater Wind Begins Ocean Floor Survey for Offshore Wind Site

Deepwater Wind is beginning a new phase of work on its South Fork Wind Farm and Revolution Wind projects. The company deployed from Quonset Point in August.

The start of this five-month long suite of detailed offshore surveys at Deepwater Wind's federal lease site off New England will begin with the work of a 132-foot specialized liftboat and a support vessel, plus 25 local personnel, including geotechnical specialists, engineers, biologists, archaeologists and mariners. Their work will help inform the design and locations of the turbines at the South Fork Wind Farm and Revolution Wind.

"We're embarking on this major scientific endeavor so we can better understand the seafloor where we'll build these next windfarms," said Deepwater Wind CEO Jeffrey Grybowski. "When we're done, we'll know more about this part of the ocean than ever before. Local laborers, mariners and scientists will help us get the job done."

Area piledrivers from Local 56 were busy this week at Specialty Diving Services' quayside at Quonset Point preparing components on the Seacor liftboat, *Supporter*, which traveled from the Gulf of Mexico for the job.

With its distinctive 200-feet long jack-up legs, the *Supporter* is designed to work in offshore waters. It is a vessel similar to the pair of liftboats that helped transport components for the Block Island Wind Farm from ProvPort to the wind farm site.

Deepwater Wind commissioned the Providence, Rhode Island office of the engineering design firm GZA to perform this survey – the same local team who completed this work for the Block Island Wind Farm. GZA experts will oversee offshore sampling operations and then conduct the geotechnical analysis on these samples.

The 104-foot offshore support vessel *Matthew Hughes* will carry equipment and personnel back and forth from Quonset Point to the *Supporter*. Together, the vessels will be busy with geotechnical surveying offshore for the next month or so.

Deepwater Wind's extensive studies will continue this fall, with additional geophysical surveys between September and December to support the development of the South Fork and Revolution Wind farms.

Deepwater Wind will conduct a specialized high-resolution geophysical survey of the site to identify any boulders buried in the seafloor. This highly specialized survey will inform the specific location of turbines. In addition, Deepwater has commissioned a separate team of experts to conduct a large-scale geophysical survey at the site.

A full suite of high-tech survey technology will be used in the geotechnical and geophysical surveys, including sonar, magnetometers and tools to measure the depth and slope of the seafloor. Marine biologists aboard will use monitoring systems and thermal imaging cameras to alert the team of any marine mammals in the area.

The South Fork Wind Farm and Revolution Wind projects are located in Deepwater Wind's federal lease site, more than 15 miles south of the Rhode Island coast and more than 30 miles off Montauk, New York. Once permits are in-hand, local construction work on the 90 megawatt (MW) South Fork Wind Farm would begin in 2021, with the wind farm in operations in 2022.

Construction would start as early as 2020 on the 400 MW of power from Revolution Wind to serve Rhode Island, and in 2021 on the 200 MW of power from Revolution Wind to serve Connecticut. Revolution Wind is planned to begin operations in 2023.

A similar survey effort is already underway off the coasts of Maryland and Delaware to inform the design and construction of Deepwater Wind's 120 MW Skipjack Wind Farm.

For more information, visit
WWW.DWWIND.COM

DEEPWATERWIND

Kraken Receives $9 Million Deep-sea Battery Order, Plus Military Contracts

Kraken Robotics Inc. announces that Ocean Infinity has agreed to purchase $9 million of Kraken's deep-sea batteries with delivery dates expected between Q4 2018 and Q4 2019. Kraken will arrange for these batteries to be built by Kraken Power GmbH ("Kraken Power"), an entity in which Kraken currently holds a 19.9 percent interest. The first purchase order has been issued for $2.5 million and the subsequent purchase order of $6.5 million is expected in early Q1 2019.

The company also announced that it has been awarded a contract valued at over CAD 450,000 by a leading military customer for its AquaPix® Miniature Synthetic Aperture Sonar system. Due to the confidential nature of the application, the customer's name will not be disclosed. Delivery is expected in Q4 2018.

Meanwhile, its wholly owned subsidiary, Kraken Robotic Systems Inc., has signed a Cooperative Research and Development Agreement (CRADA) with the U.S. Navy's Naval Undersea Warfare Center – Division Newport (NUWCDIVNPT). The CRADA covers the operation of Kraken's high-speed actively controlled towed Synthetic Aperture Sonar, KATFISH, for multi-mission applications, including mine countermeasures.

The CRADA defines a joint research and development relationship between NUWCDIVNPT and Kraken. The overall objective is to provide NUWC with experience operating the KATFISH, Kraken's commercial off-the-shelf actively controlled, high-speed towed Synthetic Aperture Sonar from a surface vessel of opportunity. In the case of this CRADA, the vessel used will be manned; however, the towed system will also be operated from a remote station to simulate unmanned operation (i.e., operation from an unmanned surface vehicle).

For more information, visit
WWW.KRAKENROBOTICS.COM

Tech Safe Completes Seven Tether Winches for New ROVs

ROV support equipment specialist, Tech Safe Systems Ltd (TSS LTD) of Greater Yarmouth, U.K., have announced completion of seven Mk8 tether winches for new observation class ROVs.

The Mk8 is unique in its ability to provide operators of small and medium sized ROVs up to 1,100 meters of tether storage, in a durable and light weight platform. Unlike many small tether winches, the Mk8 is electrically driven and can be incorporated with an optional automatic spooling system. The winch is designed to house many proprietary slip rings, combining conductor and optical passes to suit the ROV requirement. The Mk8 platform covers from the smallest to the largest of vessels, with versions covering operational voltage ranges from 110v – 480v and 50/60 Hz.

Designed to work with ROVs launched from small vessels in a free-swimming configuration, the Mk8 has proven very reliable since its first outing in 2014. Applications over the years have included remote platform installations for Oil & Gas, dam and tunnel inspections inshore, along with a variety of ports and harbor work. The main area of operation however, has been related to the burgeoning offshore renewables sector in the U.K. and Europe. Wind farm Crew Transfer Vessels (CTVs) and other small survey craft, have found the Mk8s compact versatility of great benefit in assisting a multitude of launch methods. The health and safety benefits of correctly managing the ROV tether during normal ROV operations have been noted by numerous operators. This is particularly true of smaller vessels where deck space can be at an absolute premium.

While the best-selling Mk8 is popular as a standalone unit with regular repeat orders, its flexibility also lends it to incorporation in other equipment. From the TSS LTD range, this would include the company's 'SV eLARS' (Small Vessel 'electric' Launch and Recovery System) and 'CLS Cabin' (Containerised Launch System). These solutions can be purchased for existing Mk8's or complete with a new unit. For more information, visit www.techsafe.co.uk.

JFSE Celebrates 1st Anniversary of its Revolutionary Jetting System

James Fisher Subsea Excavation (JFSE) is celebrating the first anniversary of its innovative jetting system having successfully completed 12 contracts since launching the revolutionary new method.

The high velocity jet significantly increases the soil-cutting abilities of JFSE's excavators as the system – which utilises central jets instead of the standard side positioned jets – can facilitate the excavation of harder soils than was previously possible.

As a result, clients benefit from time and cost efficiencies on projects which could not previously have been completed by traditional Controlled Flow Excavation (CFE) methods.

The global subsea excavation specialist, part of James Fisher & Sons plc, designed and developed the enhanced technique in response to client demand. It was introduced a year ago and has been fitted on a number of CFE tools, stationed at strategic hubs in the U.K., UAE, Singapore, Venezuela, USA, Brazil, China and Mexico. JFSE holds exclusive worldwide rights to the central jetting system.

Managing director Kenneth R. Mackie commented that, "Cutting capabilities can be doubled using this method, as it dramatically reduces the degradation of the high velocity jet of water, and clients are already seeing the benefits and increased efficiency in projects with hard soil excavation requirements."

The system has proved invaluable in particularly challenging environments, said JFSE technical director Graham Murdoch. "One project we successfully tackled involved stiff clay with a sheer strength of up to 280kPa which had resisted other trenching methods. As a result of deploying of our patented, tried and tested high velocity water jetting we were able to demonstrate that we are the only Controlled Flow Excavation company in the world that could have completed the work."

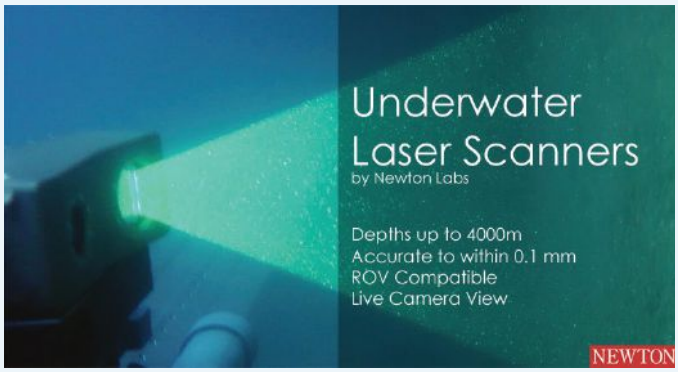
For more information, visit
WWW.JFSUBSEAEXCAVATION.COM

Subsea 7 Utilizes Newton Labs Underwater Laser Scanner

Last year, Newton Labs introduced very high-resolution laser scanner systems rated for subsea depths of up to 500 meters. The company says the high precision scanners will be available to depths to 4,000 meters later this year. Upon learning this news, the i-Tech Services Division at Subsea 7 approached Newton Labs about utilizing the M500UW to create very high precision scans for a Hess Corporation project.

The Hess Corporation work specifically required scan resolutions at 500 Meters depth in the range of 0.1 milimeter resolution to solve a unique maintenance issue with an underwater Hub. The i-Tech Division of Subsea 7 chose to utilize the precision of the Newton Labs M500UW as it allowed for necessary correction of a burr and damage on the interior of the Hub. This damage needed to be brought to exact tolerances. With the high-resolution data measurements created by the Newton Labs M500UW, the i-Tech Services team was confidently able to scan, polish and re-scan the burr until the required dimensions were successfully achieved.

The ability to achieve such high-resolution scanning with conversion to measurable 3D CAD models at subsea depths of more than 100 meters has never previously been available to the market. With the introduction of the M500UW and the upcoming deployment of models rated to depths of 4,000 meters, Newton Labs is continuing forward as a true innovator in the subsea industry. For more than 11 years, we have proudly offered the most extensive and widely deployed line of precision underwater laser scanner solutions in the entire world.



For more information, visit WWW.NEWTONLABS.COM

CBO Isabella Upgrades to Sonardyne 6G

Sixth generation (6G) underwater positioning technology from Sonardyne Brasil Ltda. has been chosen by vessel owner and operator Companhia Brasileira de Offshore (CBO) to meet Brazil's stringent new contracting specifications for subsea positioning.

The multi-functional Compatt 6 transponders and Ranger 2 USBL (Ultra-Short BaseLine) HPT transceivers that make up the order will be utilized alongside existing Sonardyne technology onboard the ROV support vessel *CBO Isabella* in support of a wide variety of subsea operations, including structure installation, pipeline metrology and ROV tracking.

On long-term contract to Petrobras since 2010, the *CBO Isabella* opted to have available two independent acoustic positioning systems so that operations can continue in the event of a single system failure. For the past few years, this requirement has been met through a combination of Sonardyne's Fusion LBL, Optimized Ranger 2 USBL and SPRINT INS technologies, providing the vessel with the flexibility to meet virtually any project requirement in any water depth, including Sparse LBL, full LBL and acoustically aided inertial navigation for the vessel's work-class ROV.

Replacing the *CBO Isabella*'s previous generation through-hull transceivers with fully digital HPT transceivers completes her upgrade to 6G, and means the vessel can exploit the full benefits of Sonardyne's 6G technology. This is proven to offer stable and precise positioning for DP, reliable structure and vehicle tracking in any water depth and support for simultaneous vessel operations using shared seabed transponder arrays already deployed in the field.

The work to equip the vessel's inventory of Compatt 6 LBL transponders, with high specification DigiQuartz pressure sensors, was carried out at Sonardyne's service, support and training center in Macaé, Brazil.

For more information, visit WWW.SONARDYNE.COM

Fugro Wins ALB Best Practices Award and a New Contract

Fugro has been presented with the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) LCDR Peter Johnson Best Practices Award 2018 for its successful completion of a large, multi-year hydrographic survey in the Red Sea.

The vast survey project covered over 113,000 square kilometers and resulted in more than 192 billion soundings. With more than one million exposure hours on the project, Fugro completed the work without a lost-time incident.

Both vessel-based acoustic multibeam and airborne lidar bathymetry (ALB) technologies were used to complete the survey. For the ALB component, Fugro performed approximately 650 days of aerial survey operations using three aircraft to acquire high resolution bathymetry data over 20,451 square kilometers of shallow water. It is among the largest ALB surveys ever undertaken. 2018 marks the third time Fugro has received the LCDR Peter Johnson Best Practices Award.

Marine Lidar Bathymetry Contract Win: New South Wales, Australia

Fugro also won a new contract to collect seafloor data for the Office of Environment and Heritage (OEH), on behalf of the New South Wales (NSW) Government, Australia. The project involves the collection of high resolution, seamless bathymetry across the New South Wales coastal and marine environment.

The data will assist in mapping the seafloor and sediment compartments along the NSW coast. This will enable decision-makers to better understand nearshore processes and model coastal hazards at a local scale with far greater accuracy than traditional marine survey methods. The data will also shed light on the structure and range of habitats on the seafloor off NSW beaches.

Fugro is utilizing ALB sensors to conduct the work, capturing data along the shore to depths of around 30 meters. For more information, visit www.fugro.com.

Norwegian Petroleum Directorate Maps Deep Sea Mineral Deposits

After the Ministry of Petroleum and Energy assumed administrative responsibility for mineral deposits on the continental shelf, the Norwegian Petroleum Directorate (NPD) has been assigned the task of mapping potential deposits.

The NPD is now starting an extensive data acquisition expedition in the deeper areas of the continental shelf in western parts of the Norwegian Sea.

The NPD has engaged Swire Seabed AS, who partners with Ocean Floor Geophysics Inc, to carry out mapping of potential sulphide minerals on the seabed over the Mohns Ridge. This is a spreading ridge in the Atlantic Ocean that separates two oceanic plates, where potential valuable minerals have been formed through hot volcanic sources.

The focus of the expedition is not the active hydraulic systems such as "black smokers," but rather non-active extinct systems that are now left as mineral-rich piles of gravel on the seabed.

The mapping will be carried out using an autonomous underwater vehicle, a Kongsberg Hugin AUV, which maps the seabed using a number of instruments: bottom-penetrating echo sounder, multibeam bathymetry, synthetic aperture sonar data, magnetometry and spontaneous potential field data.

Kongsberg Hugin AUV

After the data is processed on board, mineral samples will be taken from the seabed where the data indicates the presence of deposits. Sampling will be carried out using an underwater ROV. This will be lowered down to the seabed, which could be as deep as 3,000 meters, and will pick up test material of the minerals.

The expedition will be underway throughout August and into September. For more information, visit www.npd.no.

Aker Solutions to Deliver Power Umbilical Systems to CNOOC

Aker Solutions has won orders valued at more than NOK 350 million to deliver power umbilical systems to China National Offshore Oil Corporation's (CNOOC) Liuahua oil fields in the South China Sea, off Hong Kong. The work includes more than 35 kilometers of dynamic and static power umbilicals linking the subsea development to a new floating production, storage and offloading (FPSO) unit.

www.oceannews.com/news/subsea-intervention-survey/aker-solutions-to-deliver-power-umbilical-systems-to-cnnoc

Aleron Subsea Receives First Contract for Its New Hybrid TRACKROV

Aberdeenshire-based ROV and tooling engineering firm, Aleron Subsea, has announced its first contract win for its new hybrid TRACKROV technology which will see it supporting unexploded clearance work on a major renewables project in The Netherlands.

www.oceannews.com/news/subsea-intervention-survey/aleron-subsea-receives-first-contract-for-its-new-hybrid-trackrov

ASV GlobaL and Terrasond Complete Unmanned Survey

ASV Global and TerraSond have completed an unmanned hydrographic survey for charting off the coast of Alaska. The 10,649 km survey was carried out by an ASV Global C-Worker 5 unmanned vessel alongside the Q105 survey ship. Fitted with a multibeam echosounder, the C-Worker 5 carried out 53% of the survey.

www.oceannews.com/news/subsea-intervention-survey/asv-global-and-terrasond-complete-5-639km-unmanned-survey

MMT Receives 10 New Contracts

This summer, MMT has received 10 new subsea survey and inspection projects within the offshore wind, renewable energy and oil and gas industries. Some of the new contracts are in collaboration with Reach Subsea, such as survey solutions using their Surveyor Interceptor ROV.

www.oceannews.com/news/subsea-intervention-survey/mmt-receives-10-new-contracts

» Project Natick's Northern Isles datacenter is partially submerged and cradled by winches and cranes between the pontoons of an industrial catamaran-like gantry barge. At the deployment site, a cable containing fiber optic and power wiring was attached to the Microsoft datacenter, and then the datacenter and cable lowered foot-by-foot 117 feet to the seafloor. Photo by Scott Eklund/Red Box Pictures.

» Project Natick's Northern Isles datacenter is barged under a gantry crane in preparation for deployment on the seafloor near the Orkney Islands in Scotland. Photo by Scott Eklund/Red Box Pictures.

» Spencer Fowers (L), senior member of technical staff for Microsoft's special projects research group, and Eric Peterson (R), a Microsoft mechanical engineer, check 12 racks of servers to be loaded into Project Natick's 12.2-meter long Northern Isles datacenter at a Naval Group facility in Brest, France. Photo by Frank Betermin.

PROJECT NATICK GOES DEEP

Under the sea, Microsoft tests a datacenter that's powered by renewable energy, cooled by the sea, and leverages technology usually found in submarines.

Microsoft is developing self-sufficient underwater datacenters that can deliver cloud services to coastal cities. Already, an experimental, shipping-container-size prototype is processing workloads on the seafloor near Scotland's Orkney Islands.

The deployment of the Northern Isles datacenter at the European Marine Energy Centre marks a milestone in Microsoft's Project Natick, a research effort to investigate manufacturing and operating environmentally sustainable, prepackaged datacenter units that can be ordered to size, rapidly deployed and left to operate lights out on the seafloor for years.

FROM FRANCE TO SCOTLAND

Project Natick's 40-foot long Northern Isles datacenter is loaded with 12 racks containing a total of 864 servers and associated cooling system infrastructure. The datacenter, which has roughly the dimensions of a standard cargo container, was assembled and tested in France and shipped on a flatbed truck to Scotland where it was attached to a ballast-filled triangular base for deployment on the seabed.

The datacenter was towed out to sea partially submerged and cradled by winches and cranes between the pontoons of an industrial catamaran-like gantry barge. At the deployment site, a remotely operated vehicle retrieved a cable containing the fiber optic and power wiring from the seafloor and brought it to the surface where it was checked and attached to the datacenter, and the datacenter powered on.

The most complex task of the day was the foot-by-foot lowering of the datacenter and cable 117 feet to the rock slab seafloor. The marine crew used 10 winches, a crane, a gantry barge and a remotely operated vehicle that accompanied the datacenter on its journey.

Once the datacenter made it to the seafloor, the shackles were released, winch cables hauled to the surface and operational control of the Northern Isles passed to the shore station. The researchers expect to learn much about operating underwater datacenters from the deployment, operations, and eventual recovery in June 2019.

POWERED BY RENEWABLE ENERGY

The European Marine Energy Centre is a test site for experimental tidal turbines and wave energy converters. Tidal currents there travel up to nine miles per hour at peak intensity and the sea surface regularly roils with 10-foot waves that whip up to more than 60 feet in stormy conditions.

Onshore, wind turbines and solar panels generate more than enough electricity

» *Microsoft's Project Natick team gathers on a barge tied up to a dock in Scotland's Orkney Islands in preparation to deploy the Northern Isles datacenter on the seafloor. Pictured from left to right are Mike Shepperd, senior R&D engineer, Sam Ogden, senior software engineer, Spencer Fowers, senior member of technical staff, Eric Peterson, researcher, and Ben Cutler, project manager. Photo by Scott Eklund/Red Box Pictures.*

« *Spencer Fowers, senior member of technical staff for Microsoft's special projects research group, prepares Project Natick's Northern Isles datacenter for deployment off the coast of the Orkney Islands in Scotland. The datacenter is secured to a ballast-filled triangular base that rests on the seafloor. Photo by Scott Eklund/Red Box Pictures.*

TO PROVIDE RELIABLE DATA

to supply the island with 100 percent renewable energy. A cable from the Orkney Island grid sends electricity to the datacenter, which requires just under a quarter of a megawatt of power when operating at full capacity.

Colocation with marine renewable energy is a step toward realizing Microsoft's vision of datacenters with their own sustainable power supply. Energy self-sufficient datacenters could be deployed anywhere within reach of a data pipe, bringing Azure cloud services, for example, to regions of the world with unreliable electricity, and eliminating the need for costly backup generators in case of power grid failures.

DATACENTER AND SUBMARINE SYNERGY

To help determine whether the Project Natick concept is practical, Microsoft chose to work with Naval Group, a 400-year old France-based company with global expertise in engineering, manufacturing and maintaining military-grade ships and submarines as well as marine energy technologies.

The Microsoft team presented Naval Group with general specifications for the underwater datacenter and let the company take the lead on the design and manufacture of the vessel deployed in Scotland.

Submarines are essentially big pressure vessels that house complex data management and processing infrastructure for ship management and other systems integrated according to stringent requirements on electricity, volume, weight, thermal balance and cooling. In fact, Naval Group adapted a heat-exchange process commonly used for cooling submarines to the underwater datacenter. The system pipes seawater directly through the radiators on the back of each of the 12 server racks and back out into the ocean. Findings from phase 1 indicate water from the datacenter rapidly mixes and dissipates in the surrounding currents.

APPLIED RESEARCH

The Project Natick team will spend 12 months (June 2018 – June 2019) monitoring and recording the performance of the datacenter, keeping tabs on everything from power consumption and internal humidity levels to sound and temperature levels. The world's oceans at depth are consistently cold, offering ready and free access to cooling, which is one of the biggest costs for land-based datacenters. Underwater datacenters could also serve as anchor tenants for marine renewable energy such as offshore wind farms or banks of tidal turbines, allowing the two industries to evolve in lockstep.

For now, Project Natick is an applied research project, focused on determining the economic viability of operating containerized datacenters offshore near major population centers to provide cloud computing for a world increasingly dependent on internet connectivity. For more information, visit natick.research.microsoft.com.

ITC Global Signs Three-Year Contract Extension with Shelf Drilling

ITC Global, a leading provider of satellite communications to remote and harsh environments, has signed a three-year contract extension with Shelf Drilling, Ltd., for continued service and expanded crew welfare capabilities for its fleet of 39 jack-up drilling rigs in 11 countries. Shelf Drilling is the world's largest contractor of jack-up rigs focused on shallow water drilling services. Headquartered in Dubai, Shelf Drilling has rig operations across four major regions – India, MENAM (Middle East, North Africa & Mediterranean), Southeast Asia and West Africa.

"Following the commencement of our communications partnership in August 2014, ITC Global successfully migrated services to Shelf Drilling's globally dispersed fleet from the incumbent provider over a nine-month period," said Richard Elson, vice president, Global Energy Sales and Business Development at ITC Global. "As a result, we were able to minimize downtime and significantly enhance the end-user experience on the rigs. Since this service deployment, we have consistently maintained a high level of service while at the same time providing flexibility in what has been a challenging marketplace."

ITC Global's fully managed communications system was custom-designed for Shelf Drilling to support its corporate and crew communications through a Time-Division Multiple Access (TDMA) private network solution. As an addition to the existing service agreement, crew welfare applications are being incorporated on two sites via ITC Global's Crew LIVE solution, with the mutual intention to expand these deployments to additional sites in the future. ITC Crew LIVE provides dedicated crew internet and Video-On-Demand capabilities to remote site staff and crew. As part of the contract, ITC Global also provides Shelf Drilling with the option to deliver connectivity services to onboard clients at its sites, as deemed necessary.

For more information, visit WWW.ITCGLOBAL.COM/CREWLIVE/

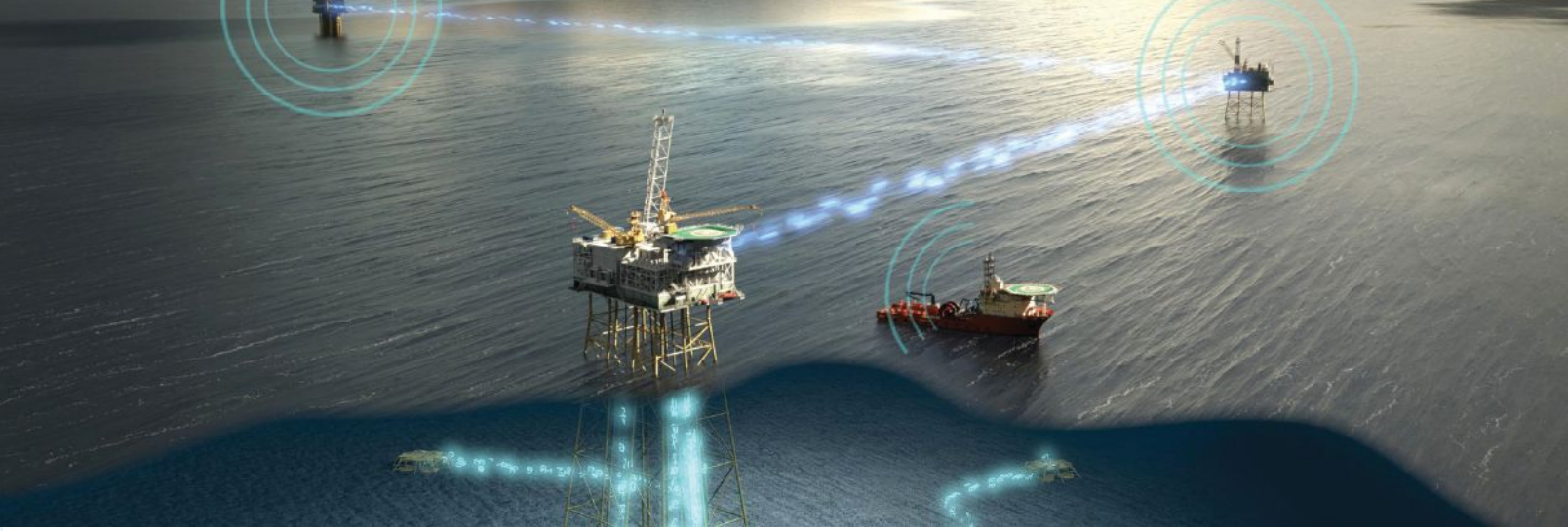
Marlink Signs Partnership Agreement with Transmetrics

Marlink has signed an agreement with Transmetrics to establish a strategic business partnership aimed at predictive logistics optimization for maritime customers. The agreement will enable Transmetrics, a Forbes-awarded start-up, to leverage Marlink's broadband satellite communications network, digital solutions and contacts to further develop maritime logistics innovations. As part of its Smart Connectivity strategy, Marlink seeks to support new partners and applications to work together to enable its customers' digitalization and business efficiency.

Transmetrics unlocks the power of big data to optimize empty container logistics. With extensive experience in demand forecasting and predictive optimization for cargo transport industry, the company has developed an innovative predictive asset management tool called AssetMetrics. Based on applying AI algorithms for data cleansing and demand forecasting, the AssetMetrics software suggests the optimal storage, repositioning and maintenance strategy for empty containers as well as the optimal levels of 'safety stock' at each location. It is estimated that with the AssetMetrics software, shipping companies can expect about 10-15 percent cost reduction of empty assets logistics.

In a partnership with Transmetrics, Marlink contributes its experience and interconnected technologies, which support customers to navigate digital transformation in shipping and logistics. This pilot is strategically important for Marlink as it allows the company, jointly with Transmetrics, to support global maritime shipping companies and help them predict shipping volumes, optimize empty container moves and achieve savings, while making transport more efficient and environmentally friendly.

For more information, visit WWW.MARLLINK.COM



Tampnet Announces the Completion of the 4G LTE Network Coverage in the Gulf of Mexico

Tampnet has announced the completion of the 4G LTE network coverage program that has been ongoing for the past two years.

Tampnet has built a carrier grade 4G LTE network in the Gulf of Mexico (GoM), with geo-redundant EPC cores as well as distributed core equipment offshore. The roll out of the current LTE network started two years ago and has been a tremendous success, currently serving production platforms, rigs, vessels and personal mobile subscribers along the coast of Texas, Louisiana, Mississippi and Alabama, as well as the offshore GoM area. While the legacy 2G coverage has already been replaced by 4G LTE, Tampnet continues to build coverage backhauled on fiber, particularly in the Deepwater region.

The LTE coverage enables new and innovative ways of operating offshore platforms, increasing productivity, safety, environmental awareness and response as well as welfare for workers in the offshore industry. Furthermore, Tampnet's GSM and LTE roaming agreements with the major mobile operators in the US, ensures seamless connectivity between onshore and offshore networks without the need for changing SIM cards.

The new LTE communication standards will also be the key enabler for the Internet of Things (IoT) ecosystem offshore. Tampnet has started the transition towards 5G and will enable both NB-IoT and Cat-M1, providing optimized connectivity to sensors and tracking devices, to meet customer requirements within the rapidly growing digitalization domain.

The Tampnet LTE network offshore in the Gulf of Mexico is unique, and Tampnet is the only provider able to carry its LTE traffic to shore on a redundant subsea fiber optic infrastructure, complementing a vast network of cutting edge microwave radio links. The exclusive access to this fiber infrastructure gives Tampnet and its customers a great advantage, both with regards to resilience and future capacity needs.

Per Helge Svensson, Tampnet CEO said, "The market is clearly ready for this game-changing technology shift in the Gulf, replacing high latency VSAT and mobile-unfriendly, low bandwidth WiMAX systems that are still widely used in the region. 4G/LTE is a very well proven and globally adopted technology that our customers are familiar with onshore, and now expect to also be able to use offshore. The technology has been welcomed in the offshore environment, and we look forward to enabling the full capability of the mobile technology ecosystem to our customers."

For more information, visit WWW.TAMPNET.COM

NSW Awarded Contract for Northwester 2 Offshore Wind Farm

NSW, a subsidiary of General Cable which recently became part of Prysmian Group, has been awarded a contract by Northwester NV for the development of a submarine inter-array power cable system for the Northwester 2 offshore wind farm, located in the Belgian North Sea, approximately 50 kilometers north-west of Oostende.

NSW will design, produce and deliver 25 kilometers of 33 kV submarine power cables for the inter-array cabling of the Northwester 2 offshore wind farm developed by Parkwind, a company that develops, finances, builds and operates offshore wind farms. NSW will also be responsible for pre–operation cable termination and testing. The submarine cables are scheduled for delivery in summer 2019. The Northwester 2 offshore wind farm comprises 23 MHI Vestas Offshore Wind 164-9.5 MW turbines, which will generate 219 MW. Once completed in 2020, the wind farm will provide renewable energy to more than 220,000 homes.

"This is a clear indication of how NSW's experience and know-how in submarine and offshore cable systems can further strengthen Prysmian Group leadership in the offshore wind market, leveraging also on a wider portfolio of products, technologies and assets," comments Hakan Ozmen, EVP Projects BU, Prysmian Group.

Prysmian boasts an ever-growing number of offshore wind power connections in its project portfolio, including inter-array cable systems for the Borssele III & IV, Wikinger and Horns Rev 3 wind farms.

First U.S. to Cuba Cable Could Become a Reality

By John Manock, SubCable World, Editor

In early August, the FCC reported that ARCOS-1 USA, Inc. and A.SurNet, Inc. (ASN), two units that own the ARCOS-1 Caribbean submarine cable system through relationships that include Liberty Media, Cable & Wireless Communications and Columbus Networks, had applied for a license to land a submarine cable in Cuba.

Arcos-1 is an 8,700-kilometer cable system extending throughout the Caribbean with landings in Florida, Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Curaçao, Puerto Rico, Dominican Republic, Turks and Caicos Islands, and the Bahamas.

The application calls for an extension to Cojimar, Cuba, from an existing branching unit 56 kilometer off the Cuban coast on a segment of ARCOS running from Florida to Mexico. The cable station will be owned by Empresa de Telecomunicaciones de Cuba S.A. (ETECSA), the incumbent, state-owned telecommunications provider in Cuba.

The extension will consist of two fiber pairs and have an

initial capacity of 100 gigabits per second (Gbps) and planned capacity of 1.6 terabytes per second (Tbps). ARCOS-1 USA Inc. and ASN and their affiliates will own 96% of the capacity, with the remaining four percent to be offered to the 18 ARCOS-1 consortium members corresponding to their ownership interests in the cable system. No timeframe for completion is given, but project dates are rarely included in these applications.

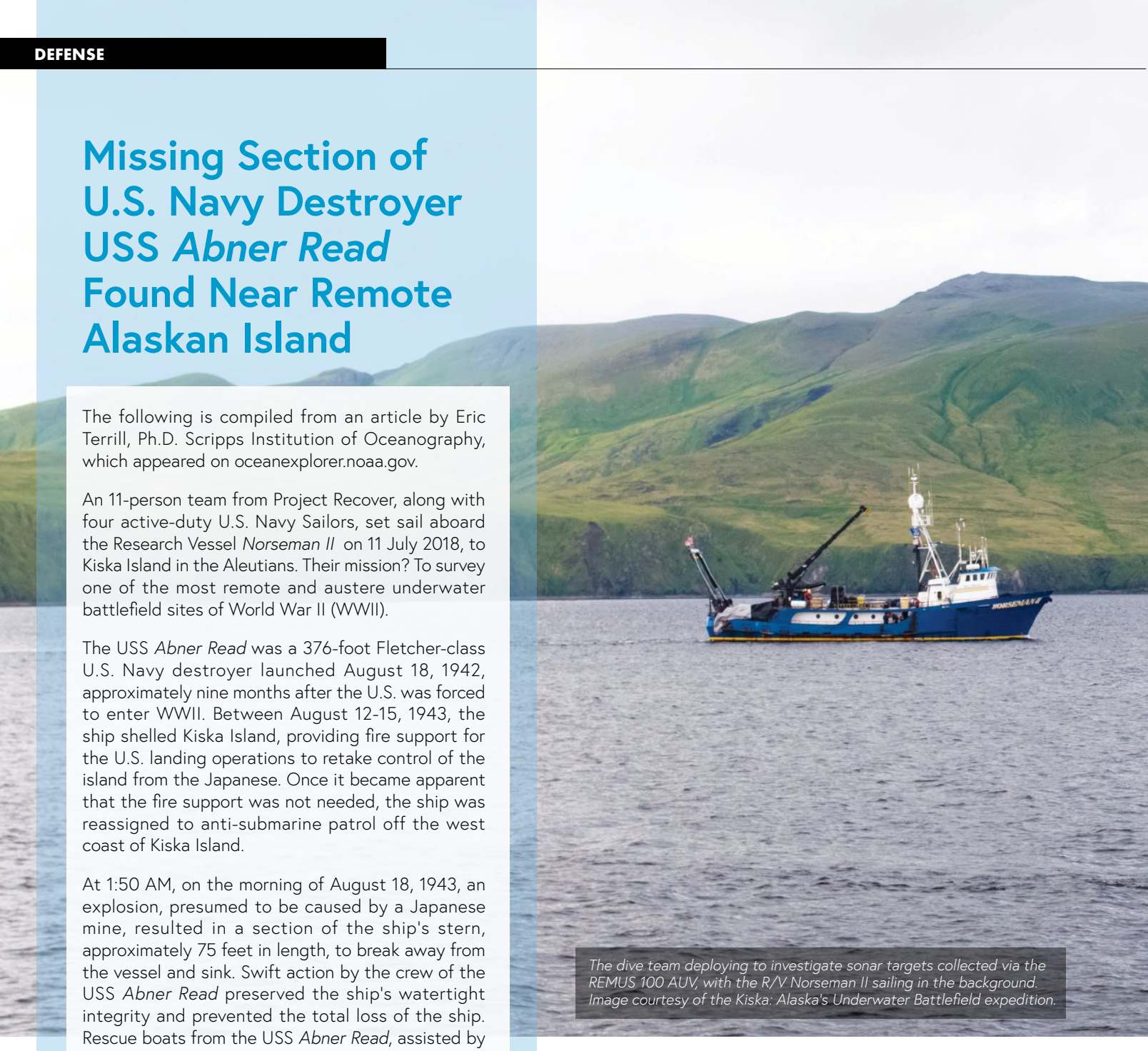
ARCOS could become the first fiber optic cable to directly connect the U.S. and Cuba. There are no longer any legal restrictions (barring a change in U.S. policy) preventing a U.S.-Cuba cable and the project is being proposed by an established cable owner by extending an existing system.

With a population of over 11 million and a potentially huge pent-up demand for internet services due to government restrictions on Cubans using the internet and the Alba-1 cable's poor performance record, Cuba represents a promising market.

Note that when we say that this project could be the first connecting the U.S. and Cuba, we are not counting an existing cable between Florida and the U.S. Guantanamo Bay Naval Base or a cable under development from Guantanamo Bay to Puerto Rico. These cables serve only the base and not the Cuban population, despite being on the island of Cuba. The U.S. Guantanamo Bay Naval Base has been leased by the U.S. government since 1903 under an agreement that has no expiration date, so is essentially in perpetuity.

For more information, visit
WWW.SUBCABLEWORLD.COM

Missing Section of U.S. Navy Destroyer USS *Abner Read* Found Near Remote Alaskan Island



The dive team deploying to investigate sonar targets collected via the REMUS 100 AUV, with the R/V Norseman II sailing in the background. Image courtesy of the Kiska: Alaska's Underwater Battlefield expedition.

The following is compiled from an article by Eric Terrill, Ph.D. Scripps Institution of Oceanography, which appeared on oceanexplorer.noaa.gov.

An 11-person team from Project Recover, along with four active-duty U.S. Navy Sailors, set sail aboard the Research Vessel *Norseman II* on 11 July 2018, to Kiska Island in the Aleutians. Their mission? To survey one of the most remote and austere underwater battlefield sites of World War II (WWII).

The USS *Abner Read* was a 376-foot Fletcher-class U.S. Navy destroyer launched August 18, 1942, approximately nine months after the U.S. was forced to enter WWII. Between August 12-15, 1943, the ship shelled Kiska Island, providing fire support for the U.S. landing operations to retake control of the island from the Japanese. Once it became apparent that the fire support was not needed, the ship was reassigned to anti-submarine patrol off the west coast of Kiska Island.

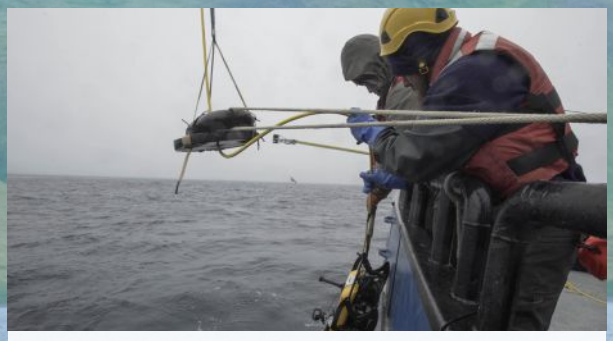
At 1:50 AM, on the morning of August 18, 1943, an explosion, presumed to be caused by a Japanese mine, resulted in a section of the ship's stern, approximately 75 feet in length, to break away from the vessel and sink. Swift action by the crew of the USS *Abner Read* preserved the ship's watertight integrity and prevented the total loss of the ship. Rescue boats from the USS *Abner Read*, assisted by the USS *Bancroft*, pulled 20 men from the water. The USS *Ute* and USS *Bancroft* towed the stricken vessel to Adak for repairs. In total, 47 men were injured, and 71 Sailors lost their lives, 70 of which are listed as Missing in Action as result of sinking with the aft section of the vessel, which included berthing/sleeping quarters.

Using logbooks from the USS *Abner Read*, the team was able to determine the location that they were put into tow, providing valuable clues for bounding the search box for where the encounter with the mine and the loss of the stern occurred.

Due to the range of water depths in the area, the team used a multibeam sonar mounted to the side of the vessel using a long steel pole. The sonar can hop across different acoustic frequencies, allowing us to optimize settings for a given water depth. Multibeam was chosen as it would allow us to 'see' to deep depths should the *Abner* be located at a depth beyond the 100-meter operating range of the four unmanned underwater vehicles brought on the expedition. The downside of multibeam is that the imaging resolution is coarse relative to the high-frequency sidescan sonar on our vehicle and provides primarily anomalies which must be further prosecuted for identification. However, we were optimistic that an approximately 75-foot section of missing ship, if still a single section, would be a clear signal in our sonar data.

The team established a set of survey tracks on the ship's navigation computer and surveyed the seabed. Driving in a 'mow the lawn' pattern perpendicular to the estimated drift

Team members launch one of the project's four REMUS 100 autonomous underwater vehicles from R/V Norseman II for a survey of the seafloor. Image courtesy of Kiska: Alaska's Underwater Battlefield expedition.



Team member Matt Breece lowers the project ROV over the side of Research Vessel Norseman II. Image courtesy of Kiska: Alaska's Underwater Battlefield expedition

Wreckage of the USS Abner Read captured by the project's ROV. Image courtesy of Kiska: Alaska's Underwater Battlefield expedition.

track, we worked from the starting point of our survey to a few kilometers offshore, carefully looking at data from the 512 beams that comprise the sonar image.

After exhausting an offshore search box in the first three hours of the search, the search was adjusted to move into shallower waters. On the second pass of the inshore leg, we found a sonar target that was assessed by our team to be that of the missing ship, with the high-frequency multibeam data clearly showing the aft section of a ship.

On the following day, we used a combination of high-frequency sidescan sonar operated from our unmanned underwater vehicles to acoustically image the hull. While the water was too deep to anchor our vessel near the wreckage, the captain of the *Norseman II* was able to expertly hold station in the wind and waves for several hours while we lowered our remotely operated vehicle (ROV) so that we could capture high-definition video of the wreck site.

Needless to say, it was a humbling experience for all onboard as the ROV glided alongside and above the wreck site, clearly imaging the broken stern section, stern gun, and rudder control of this watery gravesite for the sailors who had been lost for close to 75 years. With the intention to honor and remember these heroes who lie at this site, we held a ceremony on the fantail of the *Norseman II*, placing a wreath of remembrance over the wreck site while Taps was played. Two active duty U.S. Navy divers sailing with us folded a U.S. flag in honor of those lost.

Rim of the Pacific Exercise 2018 Concludes

The world's largest international maritime exercise concluded August 2, 2018, following more than a month of training events conducted in and around the Hawaiian Islands and Southern California.

Twenty-five nations, 46 surface ships, five submarines, 17 land forces, and more than 200 aircraft and 25,000 personnel participated in Rim of the Pacific exercise 2018. This year's RIMPAC iteration marked the 26th in the series that began in 1971 and is now held every two years.

Hosted by U.S. Pacific Fleet, RIMPAC 2018 was led by U.S. Vice Adm. John D. Alexander, commander of the U.S. 3rd Fleet, who served as the combined task force (CTF) commander. Royal Canadian Navy Rear Adm. Bob Auchterlonie served as deputy commander of the CTF, and Japan Maritime Self-Defense Force Rear Adm. Hideyuki Oban was the vice commander. Fleet Marine Force was led by U.S. Marine Corps Brig. Gen. Mark Hashimoto. Other key leaders of the multinational force included Commodore Pablo Niemann of Armada de Chile, who commanded the maritime component, and Air Commodore Craig Heap of the Royal Australian Air Force, who commanded the air component.

Alexander said the involvement of so many different countries working together to successfully accomplish RIMPAC was a strong reminder of the unity coalition forces can exhibit in a real-world situation.

"Multinational operations are complicated," he said. "It takes skill to assemble an international team and have it be successful. Throughout the duration of the exercise, from the planning conferences to the ships returning to port, this team proved they work great together and can adapt quickly to a dynamic environment."

The exercise included forces from Australia, Brunei, Canada, Chile, Colombia, France, Germany, India, Indonesia, Israel, Japan, Malaysia, Mexico, Netherlands, New Zealand, Peru, Republic of Korea, Republic of the Philippines, Singapore, Sri Lanka, Thailand, Tonga, United Kingdom, United States and Vietnam.

For the first time since RIMPAC 2002, U.S. 3rd Fleet's Command Center relocated from San Diego to Pearl Harbor to support command and control of all 3rd Fleet forces in 3rd Fleet's area of responsibility, to include forces operating forward in the Western Pacific.

International navy ships assemble in formation during a photo exercise off the coast of Hawaii during Rim of the Pacific (RIMPAC) exercise, July 26, 2018. U.S. Navy photo by Mass Communication Specialist 1st Class Arthurgwain L. Marque.

Cmdr. Russ Moore, guided-missile destroyer USS The Sullivans (DDG 68) commanding officer, left, shakes hands with a member of the Iraqi visit, board, search and seizure team during a trilateral exercise with Iraq and Kuwait. U.S. Navy photo by Mass Communication Specialist 2nd Class Samantha P. Montenegro.

US, Iraq, Kuwait Complete Trilateral Exercise

The U.S. Navy and Coast Guard completed a trilateral exercise with Iraqi navy and Kuwaiti navy partners in the Northern Arabian Gulf, on August 5, 2018. The exercise focused on improving collective proficiency in maritime security tactics between the three nations and ensuring the freedom of navigation throughout the U.S. 5th Fleet area of operations. Participants included the guided-missile destroyer USS *The Sullivans* (DDG 68), U.S. coastal patrol ships USS *Tempest* (PC 2) and USS *Chinook* (PC 9), U.S. Coast Guard Island-class patrol boat USCGC *Monomoy* (WPB 1326), Iraqi navy patrol boat *P-303*, and Kuwaiti navy patrol boat KNS *Al-Garoh* (P-3725). *The Sullivans* led command and control of each event throughout the exercise.

Exercise events included live fire gunnery exercises, visit, board, search and seizure team training, maritime infrastructure protection drills, search-and-rescue training, and high-value unit protection operations.

The exercise was led by Task Force (TF) 55 and is part of a routine theater security cooperation engagement serving as an opportunity to strengthen tactical proficiency in critical mission areas and support long-term regional stability. TF 55 controls surface forces in the 5th Fleet area of operations, such as U.S. Navy patrol craft, U.S. Coast Guard patrol boats and independently deployed ships.

Lockheed Martin and EIC Invest in Ocean Aero

Ocean Aero, Inc.—builder of environmentally-powered, autonomous, unmanned, underwater and surface vehicles (AUUSV) — has secured multi-million-dollar strategic investments from both Lockheed Martin Ventures and Energy Innovation Capital (EIC) in a Series B funding round. This is Lockheed Martin Ventures' second investment in Ocean Aero and the initial investment for EIC in the unmanned maritime systems market. Both companies join Teledyne Marine as the primary investors behind Ocean Aero.

Ocean Aero's signature product is the Submaran®, the first hybrid wind and solar-powered surface and subsurface vehicle designed for extended ocean observation and data collection. The Submaran participated with Lockheed Martin on a successful, multi-domain unmanned systems technology demonstration during a naval technology exercise at the Naval Undersea Warfare Center in Newport, Rhode Island. The Submaran relayed instructions to Lockheed Martin's Marlin® autonomous underwater vehicle, instructing it to launch Vector Hawk, a small, unmanned aerial vehicle.

Lockheed Martin Ventures' investment continues to increase the company's maritime capabilities with a focus on intelligence, surveillance and reconnaissance (ISR).

EIC's investment will provide Ocean Aero with significant growth opportunities in the energy and other commercial sectors. In addition, Kevin Skillern, an EIC managing partner, will join Ocean Aero's Board of Directors.

Built for persistence, speed, and environmental efficiency, the Submaran recently completed a rigorous, 11-day endurance test, autonomously navigating its way along the California coast from Monterey Bay to the Channel Islands near Long Beach. For more information, visit www.oceanaero.us.

Ocean Aero's Submaran®

How Much Funding Do Unmanned Vehicles Receive in the Newly Signed Defense Budget?

By Greg Leatherman, ON&T Editor in Chief

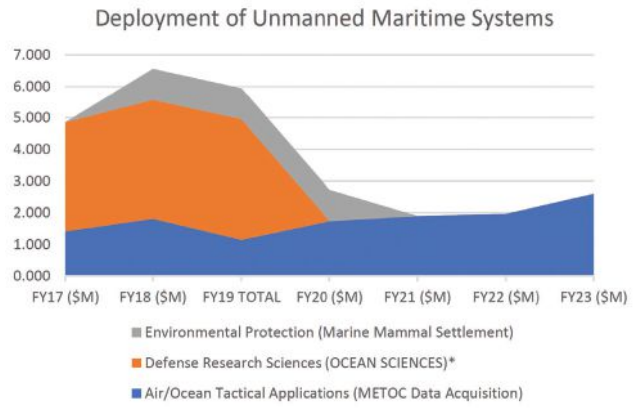


Image credit: David Klein, AUVSI

President Donald Trump signed the $717 billion John S. McCain National Defense Authorization Act for Fiscal Year 2019 on 13 August 2018. The bill passed with bipartisan support. It funds a total of 13 new Navy vessels, including three littoral combat ships, a fourth Ford-class aircraft carrier, a Columbia-class ballistic missile submarine, and six icebreakers.

The Act also reflects a greater emphasis on unmanned vehicles, including in the marine domain. Not only does it fund the development of several such vehicles, it directs the President of the United States to submit to Congress a report indicating whether he has raised the issue of unmanned (and other) systems with the Russian Federation under the new START Treaty. This includes the Russian nuclear-armed autonomous underwater vehicle (AUV) known as "Status 6."

According to a report by David Klein of the Association for Unmanned Vehicle Systems International (AUVSI), the requested funding for all unmanned maritime vehicles in FY2019 totals $1.3 billion across all agencies in the DoD.

Each of the three main services show increases in funding from FY2018 to FY2019 with the Army showing the largest growth followed closely by the Navy. The Navy has the largest budget request for unmanned systems and the highest number of unique programs. The Navy is working to provide solutions for interoperability and teaming of unmanned vehicles across multiple domains as they support over half of the projects involving operations in all domains (air, ground, and maritime).

The MK18 Unmanned Undersea Vehicle (UUV) has the largest funding request for unmanned maritime vehicles with $75 million in FY2019. The MK18 family of systems (FOS) consists of the mod 1 (modified REMUS 100 UUV) and mod 2 (modified REMUS 600 UUV) and are used mainly for Mine Counter Measure (MCM) operations by the U.S. Navy. Over 95 percent of the total MK18 funding is for the mod 2.

Concerning components, integrated sensors and payloads received the largest budget request. This is followed by platform development, which has the largest growth with an increase of approximately 68 percent from FY2018 to FY2019. The growing importance of autonomy on the battlefield is reflected, with over half of navigation & control projects involving or working to implement some level of autonomous operation.

The MK18 UUV family of systems consists of modified REMUS UUVs.

The Navy's Undersea Warfare Applied Research program, which funds academic partnerships for undersea unmanned warfare research and energy technology has its funding increased by $20 million. However underwater explosive ordinance disposal programs, which utilize robotics, are reduced by $5.8 million. The Navy's Large Unmanned Undersea Vehicles budget are reduced by $21 million in the signed budget. Both applied research and advanced development of innovative Naval prototypes, which includes unmanned and autonomous systems get a budget increase.

The budget also includes a limitation, which states that not more than 50 percent of the 2019 funds for the "ghost fleet overlord unmanned surface vehicle program" may be obligated or expended until the Navy certifies to Congress that the project accelerates development of the future unmanned surface vehicle program of the Navy; and is properly coordinated and not duplicative of the "unmanned surface vehicle sea hunter" program of the Navy.

To access the entire text of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, visit www.congress.gov/bill/115th-congress/house-bill/5515.

To access, Unmanned Systems & Robotics in the FY2019 Defense Budget by David Klein, Research Analyst, AUVSI, visit www.auvsi.org/%E2%80%8Bunmanned-systems-and-robotics-fy2019-defense-budget.

The Navy's Large Unmanned Undersea Vehicles budget is reduced by $21 million in the signed budget.

Navy Reports to Congress on Littoral Combat Ship (LCS) Program

An August 2018 report to the U.S. Congress by the nation's Navy states that:

"The Navy's proposed FY2019 budget . . . requests $646.2 million for the procurement of one LCS. . . The LCS program has been controversial over the years due to past cost growth, design and construction issues with the first LCSs, concerns over the survivability of LCSs (i.e., their ability to withstand battle damage), concerns over whether LCSs are sufficiently armed and would be able to perform their stated missions effectively, and concerns over the development and testing of the modular mission packages for LCSs. The Navy's execution of the program has been a matter of congressional oversight attention for several years. Issues for Congress for the LCS program for FY2019 include the following: the number of LCSs to procure in FY2019; the Navy's proposal to procure a final LCS in FY2019 and then shift to procurement of FFG(X) s starting in FY2020; a July 2018 Department of Defense (DOD) Inspector General (IG) report regarding IOC dates for LCS mine countermeasures (MCM) mission package systems; survivability, lethality, technical risk, and test and evaluation issues relating to LCSs and their mission packages; and LCS deployments in 2018."

The full report is available at: https://news.usni.org/2018/08/23/report-congress-littoral-combat-ship-program-3.

Official U.S. Navy file photo of USNS Brunswick (T-EPF 6). This ship is in the same class as PCU Burlington (EPF 10).

Burlington (EPF 10) Successfully Completes Acceptance Trials

The Navy's 10th Expeditionary Fast Transport ship, *Burlington*, successfully completed Acceptance Trials, on August 3, 2018 after two days of underway evaluation in the Gulf of Mexico. The ship will now begin preparations for delivery to the Navy later in 2018.

www.oceannews.com/news/defense/burlington-epf-10-successfully-completes-acceptance-trials

Official U.S. Navy file photo of USS Carl Vinson (CVN 70).

Three Aircraft Carriers to Change Homeports

The U.S. Navy announced on August 2, 2018 that three Nimitz-class aircraft carriers, USS *Carl Vinson* (CVN 70), USS *Abraham Lincoln* (CVN 72) and USS *John C. Stennis* (CVN 74) will conduct homeport shifts. USS *Abraham Lincoln*, currently located in Norfolk, Virginia, will rejoin the Pacific Fleet, making San Diego its homeport. *John C. Stennis*, currently homeported in Bremerton, Washington, will change to Norfolk in advance of its midlife refueling, or reactor complex overhaul (RCOH) at Newport News Shipbuilding. USS *Carl Vinson* (CVN 70) will conduct a homeport change to Bremerton in advance of its docking-planned incremental availability (DPIA) at Puget Sound Naval Shipyard.

Chief of Naval Operations (CNO) Adm. John Richardson visits with leadership in the Brazilian navy while aboard the multipurpose amphibious ship NDM Bahia (G40). U.S. Navy photo by Chief Mass Communication Specialist Elliott Fabrizio.

CNO Visits Naval Partners in Brazil, Deepens Strategic Relationship

Chief of Naval Operations (CNO) Adm. John Richardson visited Brazil, July 31 to August 1, 2018 where he met with Brazilian navy leadership, discussed deepening the US-Brazil naval partnership and gave remarks at the Brazilian Naval War College.

www.oceannews.com/news/defense/cno-visits-naval-partners-in-brazil-deepens-strategic-relationship

thyssenkrupp

Cooperation Between thyssenkrupp and German Naval Yards

thyssenkrupp Marine Systems and German Naval Yards Kiel have entered into an exclusive cooperation agreement for the further bidding process in the MKS 180 multi-role combat ship procurement project for the German Navy.

www.oceannews.com/news/defense/thyssenkrupp-marine-systems-and-german-naval-yards-in-cooperation

COMPLACENCY HAS BEEN REPLACED WITH CONTAGION FEARS

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

Anyone paying attention to the recent business news, and even world political developments, is aware of the ramping up of activity and rhetoric over tariffs being imposed on products imported into the United States. This policy is creating retaliation by foreign governments on U.S. products they import. President Donald J. Trump is using tariffs as a weapon to force allies and enemies to reassess their policies for trading with the United States to become more equitable.

Initially, the tariffs were limited in scope and targeted at specific products that would impact the most economic pain on the targeted countries. The retaliatory tariffs are impacting a broader range of products and at a greater dollar amount of global trade. From tariff skirmishes, the fear is we are heading toward a full-scale trade war, which will disrupt global supply chains, impact international trade, and slow global and regional growth. Slowing growth – the contagion concern – means reduced demand for oil and gas to power manufacturing plants. That is not good news for oil and gas prices.

Staying on the theme of crude oil, when China retaliated against imports from America, it was thought one target would be crude oil. In recent years, China has become a significant buyer of U.S. light oil exports, which are growing due to the shale revolution. Light oil has become a desirable import as China works to shift its economy to lighter oil products with fewer carbon emissions as the country battles carbon emissions blight. While light oil represents only about 3 percent of China's refineries' needs, it accounts for nearly 70 percent of China's local consumption.

Chinese purchased slightly over 13 million barrels of U.S. oil in May (latest data available), becoming the largest buyer by a wide margin. Canada was second with nearly nine million barrels purchased, while the UK was a distant third at just over six million barrels. U.S. crude oil prices have been falling making the product more competitive. Recently, the tariff battle has strengthened the value of the U.S. dollar, offsetting some of the benefit from the oil price decline. Still, U.S. light oil is now competitive with China's traditional suppliers from the Middle East and Russia.

As our oil price chart shows, Brent spiked to $80 a barrel last spring, with WTI also breaking above $70 a barrel, but the rally ended and prices fell back. Brent rallied back in June, but not to the levels achieved in the spring. WTI spiked to the upper $70s a barrel before declining in a stairstep pattern.

Surprising builds in U.S. oil crude oil and gasoline inventories in recent weeks suggests the summer driving season has not been as strong as anticipated. The prospect of weaker oil demand, even at the margin, means oil prices are at increased risk of further declines, especially with concerns growing about global economic growth slowing due to the emerging trade war.

Natural gas prices are also being impacted by supply and demand considerations, but market conditions are helping strengthen the case for higher prices, as gas storage volumes are not growing as rapidly as anticipated. While natural gas storage volumes fell to the second lowest level in the last five winters, the rapid recovery this spring suggested there was plenty of supply available, therefore, prices did not need to rise to induce producers to boost output in order to rebuild storage before next winter. As we learned in a recent examination of storage growth, the industry has been injecting volumes at near record levels.

Examining the injection rate since the start of the storage rebuilding season, we calculated it was growing at 8.7 billion cubic feet per day, slightly ahead of the rate seen in the 2017 season. However, that calculation ignored the fact that during the first three weeks of the injection season gas volumes continued to be withdrawn. When we measured the injection rate from the absolute low storage point, the rate jumped to over 12 billion cubic feet per day. At that level of daily injections, there was little pressure for higher gas prices.

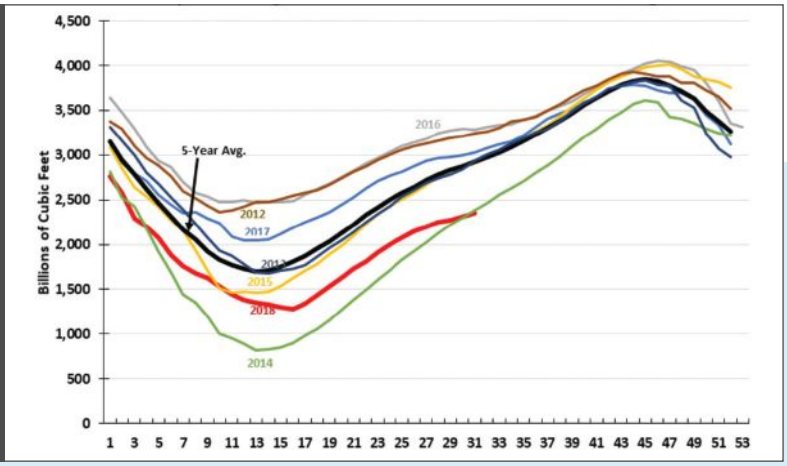
Given another month's worth of gas injection data, we recalculated the average daily injection rate for the season so far. We now have an average daily injection rate of 10.2 billion cubic feet, down from the record level previously calculated. So, while the season-ending storage volume implied when we applied the record injection rate put the volume comfortably within hailing distance of the beginning winter storage volumes of the past three years, with the new, lower rate, we are now estimating a starting level about 10 percent lower. That projected winter storage volume is barely more than the volume with which the industry started the 2014-15 winter. A very cold winter could send gas storage volumes to record low levels, possibly impairing our economy.

As we see from the gas storage volume chart, 2018's total volume is now behind 2014's same week level. This dip has caused a jump of about 20-cents per thousand cubic feet in current gas futures prices. They are now flirting with the $3 per thousand cubic feet threshold, a level that has been an impenetrable barrier since late January. That was the last month the industry enjoyed a price beginning with a three. If weekly injections continue to be weak, we expect gas prices to rise further in order to

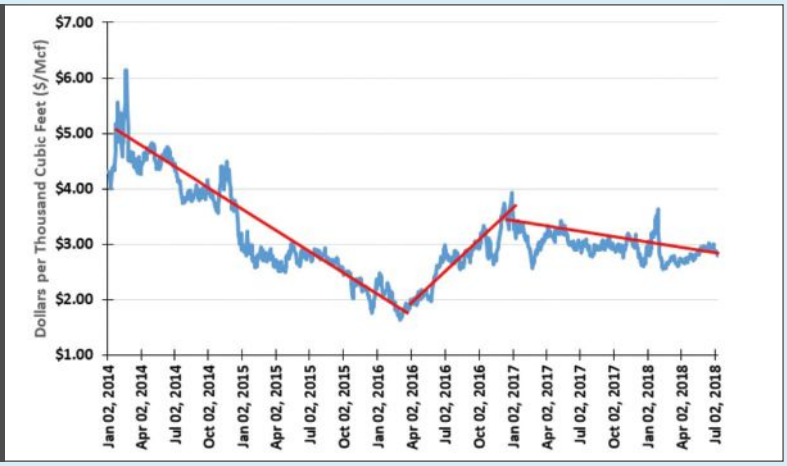
encourage greater injection volumes from producers while also meeting domestic demand and LNG export needs.

Commodity markets, like all other actively traded markets, constantly vacillate between people's fears and their greed. Traditionally, greed is satisfied by bouts of fear. No one knows whether the contagion concerns emerging from the early days of the tariff skirmish will actually become reality. Until then, oil and gas prices are likely to remain volatile and subject to events with a wide range of issues – global and regional energy demand, geopolitical developments, supply disruptions and perceptions of the commodities attractiveness for short-term trading profits. The pendulum is swinging toward fear, but it could reverse quickly if developments fail to deliver the worst outcomes currently envisioned.

1. WEEKLY GAS STORAGE vs. PAST YEARS and 5-YEAR AVERAGE



2. NATURAL GAS PRICES STRUGGLE in FACE of GROWING SUPPLY



3. CRUDE OIL MARKETS ARE CHANGING AGAIN

CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF AUGUST 13, 2018

WTI Spot Prices jumped nearly $8/barrel in just one week in July to more than $74/barrel – the highest it has been since late 2014. Prices, however, struggled to maintain that momentum due to concerns about sanctions on Iran. Prices drifted downward in July to just under the $70 mark, coming in on August 6 (the most recent data available at press time) at $69.01. This is still notably higher than prices at the start of 2018, which were hovering below $60/barrel.

Natural gas prices have retreated in the last month. After spending most of June in the $2.90-2.99/million BTU range, including one day breaking the $3.00 mark, prices slipped back to the upper $2.70s before rising to $2.86 by August 6.

WEEKLY WTI CRUDE & NATURAL GAS SPOT PRICES

Last 52 Weeks

Cushing, OK WTI Spot Price

$69.01

$73.73 previous month

TRENDING UP

Henry Hub Spot Price

$2.86

$2.91 previous month

TRENDING UP

KEY EQUITY Indexes

PRICES IN US DOLLARS AS OF AUGUST 13, 2018

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

The Dow Jones Industrial Average moved upward in July and early August, but fell in mid-August as the financial crisis in Turkey pulled stocks downward. As of August 13, the Dow was up only slightly from a month earlier. For 2018, as we have noted in the past, the Dow has been basically flat. In spite of some wild swings, the index is up only 265.02 from the beginning of the year.

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 crisis worsened. The S&P 500, unlike the Dow, has not experienced the wild swings upward and downward. Still, it is basically flat for 2018, up only a little more than 100 points.

The PHXL Oil Services Index (OSX) has struggled since May, when oil prices experienced a spike. Since then it has trended steadily downward, closing at 142.77 on August 13. It had broken the 160-point mark in May.

SELECTED EQUITY INDEXES

CUMULATIVE PERCENTAGE CHANGE

Last 52 Weeks

25,187.70

Up **123.34** from previous month

TRENDING UP

DJIA

142.77

Down **9.91** from previous month

TRENDING DOWN

OSX

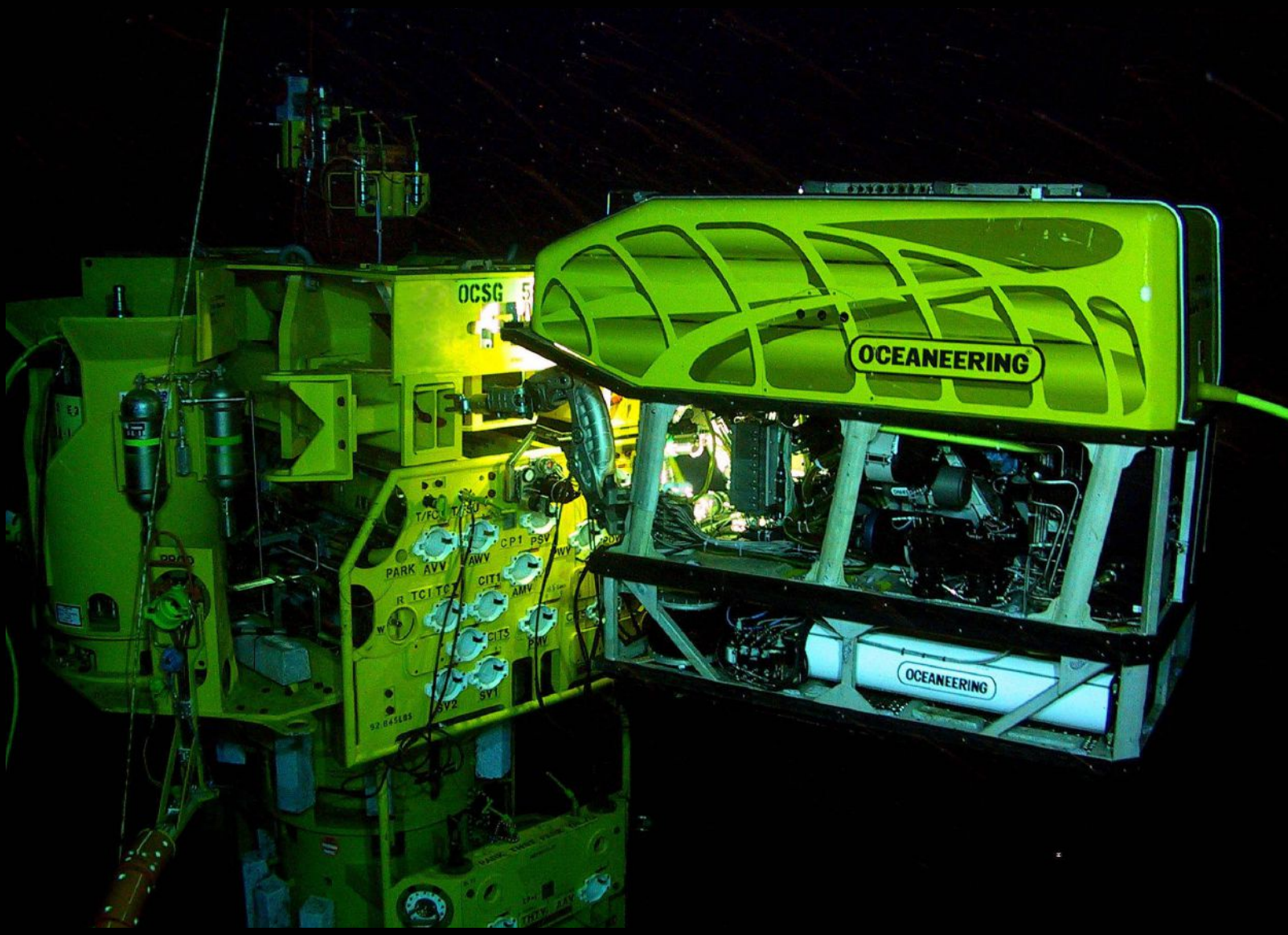
2,821.93

Up **23.50** from previous month

TRENDING UP

S&P 500

ON&T ROV Photo Contest



Ocean News & Technology has launched its first #ROVatWork photo competition.

Three winning photographers will be announced and profiled alongside their images in the Nov/Dec issue of ON&T magazine, including information about the ROV technology they have captured.

For details, visit https://ont.news/2EGiYE0

Int'l Cable Connectivity Symposium
Providence, RI
October 14-17
www.iwcs.org

AWEA Offshore Windpower
Washington, DC
October 16-17
www.awea.org/events/event.aspx?eventid=50111&navItemNumber=8237

Ocean Energy Europe
Edinburgh, UK
October 30-31
www.oceanenergy-europe.eu/event/oee-2018/

Offshore Energy
Amsterdam, The Netherlands
October 22-24
www.offshore-energy.biz

Pacific Marine Expo
Seattle, WA
November 18-20
www.pacificmarineexpo.com

RENEW
Lisbon, Portugal
October 8-10
www.centec.tecnico.ulisboa.pt/renew2018

OCEANS'18
Charleston, SC
October 22-25
www.charleston18.oceansconference.org

ITST
Lisbon, Portugal
October 15-17
www.itst2018.org

BlueTech Week
San Diego, CA
November 5-9
www.bluetechweek.org

WindTech Summit
Porto, Portugal
October 28-29
windtech.global

OilComm & FleetCom
Houston, TX
October 3-4
2018.oilcomm.com

Clean Gulf
New Orleans, LA
November 13-15
2018.cleangulf.org

Autonomous Underwater Vehicle Symposium
Porto, Portugal
November 6-9
www.auv2018.lsts.pt

MTS Dynamic Positioning
Houston, TX
October 9-10
dynamic-positioning.com

International Workboat
New Orleans, LA
November 28-30
www.workboatshow.com.

Arctic Technology Conference
Houston, TX
November 5-7
www.otcnet.org/arctic

Teledyne Marine Technology Workshop
Cannes, France
October 9-11
www.teledynemarine.com/events/TMTW2018

Wave & Tidal Energy
Valdivia, Chile
November 20-23
www.waveandtidal.cl

Rio Oil & Gas
Rio de Janeiro, Brazil
September 24-27
www.riooilgas.com.br/?lang=en

Baltic Clean Technology
Szczecin, Poland
October 17-18
www.baltic-clean-technology.com

WindEnergy Hamburg
Hamburg, Germany
September 25-28
www.windenergyhamburg.com/en

WindEurope
Hamburg, Germany
September 25-28
www.windeurope.org/summit2018

ADIPEC
Abu Dhabi, UAE
November 12-15
www.adipec.com

Oi China
Qingdao, China
October 23-25
www.oichina.com.cn/en/Home

China Offshore Oil & Gas
Beijing, China
October 30-31
www.giccgroup.com/cos

Future Energy Asia
Bangkok, Thailand
December 12-14
www.futureenergyasia.com/

MAST Indo-Asia
New Delhi, India
October 28-30
www.mastconfex.com/indoasia2018/

Power Week Asia
Singapore
November 12-16
www.power-week.com/Asia

Cyber Security for Maritime
Singapore
November 12-15
www.equip-global.com/cyber-security-for-maritime-summit-2018

OSEA
Singapore
November 27-29
www.osea-asia.com

Asia Deep Sea Mining
Singapore
November 28-29
www.asia.deepsea-mining-summit.com/

AORES
Perth, Australia
November 20-22
www.aores2018.com.au

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

Take the First-Ever Virtual Tour of an Offshore Gas Platform

For the first time ever, a camera crew was allowed full-access, in order to create a virtual tour of an offshore gas platform. The resulting interactive website allows users to explore the Cygnus Alpha installation at the largest producing gas field in the whole U.K. sector.

Located 95 miles from the coast of Lincolnshire, U.K., Cygnus is the biggest gas discovery in the North Sea the last 30 years, and the largest single producing gas field in the whole U.K. sector. It consists of two installations – Alpha & Bravo. The Alpha installation has three platforms: one for drilling and extracting gas; one for processing and exporting it; and one for accommodation and support services.

Via a series of candid video interviews with staff onboard, you can discover what it's actually like to live on a platform in the middle of the North Sea. You'll find the virtual tour here: www.spirit-energy.com/cygnus/.

Dr. Teresa Thorpe Joins 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, has announced that Dr. Teresa Thorpe has joined the team at CSA's headquarters in Stuart, Florida, as the new Proposal Coordinator. Dr. Thorpe will take charge of managing and coordinating all aspects of CSA's proposal efforts and provide technical and scientific editing support for the diverse studies produced by CSA scientists. For more information, visit www.csaocean.com.

Ocean Signal Strengthens Team

Ocean Signal has strengthened its expanding sales and product team with the appointment of Steve Moore as its new Product Manager. Moore brings more than 25 years of technical and marketing experience in the marine industry in both the commercial and leisure sectors to the role, in addition to a strong background in integrated marine electronics. He joins Margate-based Ocean Signal following a seven-year spell with international marine electronics company Raymarine. For more information, visit www.oceansignal.com.

Teledyne Oceanscience and Survey Equipment Services Team Up

Teledyne Marine has announced the addition of Survey Equipment Services (SES) out of Katy, TX, as the first authorized Value Added Reseller (VAR) under Teledyne Oceanscience for the Z-Boat 1800 unmanned surface vessel. For more information, visit www.oceanscience.com.

Trelleborg Breaks Ground on New UK Hyperbaric Testing Facility

Trelleborg's offshore facility based in Skelmersdale, U.K., has broken ground on its new 630m² / 2,066ft² testing facility that will house two state-of-the-art hyperbaric test chambers. The new equipment will be able to simulate extreme deepwater pressure conditions, enabling accurate testing of subsea and drilling equipment. For more information, visit www.trelleborg.com/offshore.

Pacific Drilling Announces Settlement

Pacific Drilling S.A. has announced that its plan of reorganization filed on July 31, 2018 now has the full support of the Company's majority shareholder, Quantum Pacific (Gibraltar) Limited ("QP"). The Plan was already supported by all of the Company's major creditor interests. Pursuant to the Plan, the Company expects to raise $1.5 billion of new capital comprised of $1.0 billion in a combination of first and second lien secured notes and $500 million of equity through a rights offering and a private placement. Under the Plan, existing holders of Pacific Drilling common shares would receive no recovery. www.pacificdrilling.com/Investor-Relations/News/News-Details/2018/Pacific-Drilling-Announces-Settlement-in-Mediation-Between-Quantum-Pacific-and-Ad-Hoc-Group-of-Creditors/default.aspx

Seatronics Doubles Stock of R2 Sonic Multibeam Systems to Rental Fleet

Seatronics, an Acteon company, global leaders in the rental and sale of marine electronic equipment has doubled its stock of Sonic 2024 Multibeam Echosounders with the acquisition of eleven new systems from long-term supplier R2 Sonic. Over the last 18 months, the increased projects within the Oil & Gas industry and the booming activity in the offshore windfarm sector have seen a rise in hydrographic surveys all around the world. Responding to this increased need and to serve their customers with innovative solutions, Seatronics have more than doubled their stockholding of Sonic 2024 systems with an investment in excess of $2 million. For more information, visit www.r2sonic.com.

Sonardyne Appoints Global Business Manager for Subsea Asset Monitoring

Underwater engineering and technology company Sonardyne International Ltd. has announced the appointment of Stephen Auld as its new Global Business Manager for Subsea Asset Monitoring. Stephen, who joined Sonardyne last June (2017), takes over the role from Stephen Fasham, who has been promoted to a newly created role within the business focusing on growth and investment opportunities. Before joining Sonardyne, Stephen was Business Development Manager at Liquid Robotics Oil and Gas, which was a joint venture between oilfield services company Schlumberger and Liquid Robotics Inc. For more information, visit www.sonardyne.com.

Tyne Subsea Hyperbaric Facility Completes First Commercial Test

Tyne Subsea, a multi-million-pound research and testing facility being developed in the UK, has successfully completed its first commercial test in one of Europe's largest commercially available hyperbaric pressure testing chambers. The facility, which is being developed by engineering group British Engines and Newcastle University, will offer customers world-leading pressure testing services in an integrated facility in Killingworth. Tyne Subsea will operate nine chambers of varying specifications, including a chamber which will test pressures past the deepest known point on Earth, for components which will explore the Mariana Trench. For more information, visit www.tynesubsea.com.

ACOUSTIC SYSTEMS

APPLIED ACOUSTIC ENGINEERING LTD

Marine House, Gapton Hall Road
Great Yarmouth. NR31 0NB, UK
Tel: + 44 (0) 1493 440355
Fax: +44 (0) 1493 440720
E-mail: gavinwilloughby@appliedacoustics.com
Website: www.appliedacoustics.com
Contact: Gavin Willoughby

Manufacturer of fully integrated USBL acoustic tracking systems, both portable and vessel based, high quality multi-system compatible beacons for acoustic positioning and release, and seismic sub-bottom profiling systems for coastal, offshore or geohazard surveys. All products are supported by a network of overseas representatives providing a first class service on a global scale.

HIGH TECH, INC

21120 Johnson Road
Long Beach, MS 39560, United States
Tel: 228 868 6632
Email: high_techinc@bellsouth.net
Website: www.hightechincusa.com
Contact: Glenn Pollock

Experts in rugged marine sensor systems utilized in geophysical surveys, anti-submarine warfare, marine mammal monitoring and downhole applications. Products include data acquisition systems, hydrophones, array cables, pressure vessels and peripherals related to marine systems.

OCEAN SONICS LTD.

11 Lornevale Road
Great Village, NS, B0M 1L0
Tel: +1 902 655 3000
E-mail: info@oceansonics.com
Website: www.oceansonics.com

Ocean Sonics designs and manufactures the icListen, 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.

Creating Acoustic Arrays is now simple. Connect two or more icListen hydrophones together and they self-synchronize, operating as one. Ocean Sonics offers a wide range of geometries, including vertical, horizontal, autonomous, very small geometrical arrays, or spread out over many kilometres.

RTSYS

25 rue Michel Marion
56850 Caudan, France
Tel: +33 297 898 580
E-mail: info@rtsys.eu
Website: www.rtsys.eu

- Acoustic Monitoring: EASDA14, Embedded Multichannel Passive Acoustic Recorders
- WiFi remote Buoy: BASDA14, Multi-sensor & Rechargeable Acoustic Buoy accessible in Real-time
- Sediment Characterization: INSEA, Acoustic Velocimeter for Sediment Characterization

We provide advanced embedded acoustic products in the environmental research, surveying and monitoring areas. With Synchronized Multichannel Acquisition and accepting a broad range of Acoustic Transducers and Hydrophones from 3Hz to more than 1MHz, our solutions allow the user a new range of applications.

TELEDYNE RESON

Fabriksvangen 13
3550 Slangerup, Denmark
Tel: +45 4738 0022
E-mail: reson@teledyne.com
Website: www.teledynemarine.com/reson/
Contact: Shannon Searing

Teledyne RESON together with Teledyne BlueView and Teledyne Odom provides a range of high quality underwater acoustic hardware and software solutions for underwater imaging within Teledyne Marine. These solutions are delivered through recognized brands such as SeaBat, BlueView, Odom, HydroSweep and ParaSound Multibeam Echosounder and Teledyne PDS software suite.

Teledyne Marine is a group of leading-edge subsea technology companies that are part of Teledyne Technologies Incorporated. Through acquisitions and collaboration over the past ten years, Teledyne Marine has evolved into an industry powerhouse, bringing Imaging, Instruments, Interconnect, Seismic, and Vehicle technology together to provide total solutions to our customers.

ADCP/DVL

NORTEK AS

Vangkroken 2
1351 Rud, Norway
Tel: +47 67 17 45 00
E-mail: inquiry@nortek.no
Website: www.nortekgroup.com

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.

ROWE TECHNOLOGIES, INC.

12655 Danielson Ct., Suite 306
Poway, CA 92064
Tel: 858 842 3020
E-mail: sales@rowetechinc.com
Website: www.rowetechinc.com
Contact: Chris Arends, Global Sales Director

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.

BUOYS

METOCEAN TELEMATICS
21 Thornhill Drive Dartmouth,
Nova Scotia B3B 1R9 Canada
Tel: +1 902 468 2505
Fax: +1 902 468 4442
E-mail: emily@metocean.com
Website: www.metocean.com
Contact: Emily MacPherson

MetOcean Telematics designs and manufactures drifting buoys, environmental platforms, and the world renowned NOVATECH locator beacon product line. In addition to providing complete end-to-end telematics services, and one of the few manufactures in the world to achieve ISO 9001 certification. MetOcean Telematics's drifting buoy family consists of environmental and weather monitoring, oil spill response, and search and rescue drifters: NOVA profiling float, Iridium SVP (iSVP), iSPHERE, Argosphere, SLDMB, and iSLDMB.

BUOYANCY PRODUCTS

DEEPWATER BUOYANCY, INC.
394 Hill Street
Biddeford, ME 04005
Tel: +1 207 502 1400
Fax: +1 207 221 5718
E-mail: sales@deepwb.com
Website: www.DeepWaterBuoyancy.com
Contact: Dan Cote, Sales Manager

DeepWater Buoyancy creates subsea buoyancy products for leading companies in the oceanographic, seismic, survey, military and offshore oil & gas markets. Thousands of customers have relied on our products for over thirty-five years, from the ocean surface to depths exceeding six thousand meters.

NAUTILUS MARINE SERVICE GMBH
Alter Postweg 24
Buxtehude, 21614, Germany
+49 (0) 41618 66250
info@nautilus-gmbh.com
Website: www.vitrovex.com
Contact name: Steffen Pausch

Nautilus Marine Service provides the finest VITROVEX® glass housings that are capable of operating in the most extreme regions of the Earth. VITROVEX® glass enclosures offer the dual advantage of buoyancy and pressure proof housings - a perfect combination for small and autonomous underwater instrumentation packages.

Simple, reliable and affordable.

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North Kingstown, RI 02852
Phone: 401-884-8801
Fax: 401-884-8868
E-mail: richard@subsalve.com
Website: www.subsalve.com
Contact: Richard Fryburg

Since 1977 Subsalve USA has been America's #1 manufacturer of standard and custom flotation devices and we are the innovators in buoyancy and engineered inflatables. Our products include: Professional, Commercial, Standard, Shallow Water, Enclosed Flotation Bags, Cable & Pipeline Floats, Water Load Test Bags, Rapid Recovery & Mark V/ORCA EOD Systems.

CABLES

CORTLAND COMPANY
10333 Richmond Ave
Suite #1000
Houston TX 77042-4128
Tel: +1 (832) 833-8000
Fax: +1 (832) 833-8002
E-mail: cortland@cortlandcompany.com
Website: www.cortlandcompany.com
Contact: Marco Cano

Cortland has more than 30 years of manufacturing experience supplying custom-designed electro-optical-mechanical cables. We provide solutions that meet the challenges posed by harsh environments, hydrostatic pressures, and high mechanical stresses.

We manufacture custom EOM cables assemblies for various subsea applications which include CTDs, hydrophones, magnetometer, tow cables, ocean bottom, ROV cables, and other custom application. Our global presence and industry-leading design engineers, manufacturing facilities, and management teams, work together to implement integrated solutions with unsurpassed reliability that support the needs of customers worldwide. Visit us online at cortlandcompany.com

FALMAT CABLE
1873 Diamond Street
San Marcos, CA 92078
Toll Free: 800 848 4257
Tel: +1 760 471 5400
Fax: +1 760 471 4970
E-mail: sales@falmat.com
Website: www.falmat.com
Contact: Shawn Amirehsani

For over 50 years, Falmat Cable has been a key supplier and a solution provider to many global OEMs and end users supporting a wide range of marine applications. We design and manufacture high performance cables for use in harsh and demanding environments. Our rugged Xtreme cables are known and preferred worldwide for superior reliability and durability in commercial and military projects. We offer XtremeMarine cables with precision coaxial components for use with SD/HD video requirements, wet rated submersible pump cables, miniature fiber optic cables, a comprehensive range of highly engineered ROV Tethers plus our well recognized Xtreme Ethernet cables. Falmat is a Certified ISO9001/AS9100 organization. Visit our web site: www.falmat.com.

SOUTH BAY CABLE CORP
54125 Maranatha Drive
P.O. Box 67
Idyllwild, CA 92549
Phone: (951) 659-2183
Fax: (951) 659-3958
E-mail: Sales@southbaycable.com
Website: www.southbaycable.com
Contact: Gary Brown, Sales Manager

Since 1957, South Bay Cable Corp has designed and manufactured specialized electrical, electro-mechanical and electro-optical-mechanical cables for use in demanding marine environments. Cables are designed to meet customer requirements and include tether and umbilical cables for ROVs, tow cables, video inspection, faired cables and a host of other customer specific applications.

CONNECTORS

BIRNS, INC.
1720 Fiske Place
Oxnard CA 93033-1863 USA
Int'l: +1 805 487 5393
Fax: +1 805 487 0427
USA: +1 888 BIRNS 88 (+1 888 247 6788)
E-mail: service@birns.com
Website: www.birns.com
Contact: Eric Birns

BIRNS, Inc. has been serving the subsea industry since 1954, and is an ISO 9001:2008 certified global leader in the design and manufacturing of high performance connectors, custom cable assemblies and lighting systems. With a NAVSEA PRO-020 certified molding facility, the company leads the industry with sophisticated connector lines, including exceptional 6km-rated electrical, electromechanical, coaxial, electro-coax, optical, electro-optical and electro-opto-mechanical hybrid options. BIRNS provides the industry's highest volume of cost-effective hydrostatic and helium pressure testing, and has a wide range of ABS Product Design Assessment (PDA) certified fiber optic and electrical penetrators. BIRNS also delivers brilliant LED and tungsten-halogen marine, chamber, security and commercial diving lights trusted in the world's most extreme environments.

BIRNS AQUAMATE LLC
122 Waltham St.
Pawtucket, RI 02860 USA
Tel: +1 (401) 723 4242
Fax: +1 (401) 753 6342
E-mail: sales@birnsaquamate.com
Website: www.birnsaquamate.com
Contact: Eli Bar-Hai

Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry connectors such as the 5500 Series, SC, MC, LP, FAWL/FAWM, Rubber Molded, etc. BIRNS Aquamate is the only underwater connector producer that guarantees compatibility with other manufacturers. Birns also specializes in fast turn-around for custom design of special connector solutions. Stocking dealers in the U.K., South Africa and Holland as well as dealers in Canada, Germany, Belgium, Norway, China, and Brazil.

SEACON
1700 Gillespie Way
El Cajon, CA 92020 USA
Tel: +1 619 562 7071
Fax: +1 619 562 9706
E-mail: seacon@seaconworldwide.com
Website: www.seaconworldwide.com

The SEACON Group are world leaders in underwater connector technology and provide an extensive and diverse range of electrical, optical and hybrid connector assemblies, submersible switches and cable system solutions for many applications within the Oceanographic, Defense, Oil and Gas and Environmental markets. With locations in California and Texas, USA, Mexico, Brazil, the United Kingdom and Norway and a worldwide network of agencies and representatives, SEACON is able to supply very quick solutions to any requirements across the globe.

TELEDYNE MARINE INTERCONNECT SOLUTIONS
1026 N. Williamson Blvd.
Daytona Beach, FL 32114
Tel: 386-236-0880
E-mail: TeledyneMIS@teledyne.com
Website: www.teledynemarine.com

Teledyne Marine Interconnect Solutions integrates the resources of ODI, DGO, Impulse, and Cable Solutions into a single organization that supplies innovative, high-performance solutions for harsh environment interconnect. Solutions for these harsh environments include wet-mate, splash-mate and dry-mate connectors, pressure boundary penetrators, cable assemblies, cable terminations, and custom-engineered encapsulation and molding. TMIS contains a broad portfolio of field-proven, time-tested electrical, optical, and hybrid interconnect capabilities optimized for applications where performance and reliability are imperative. Products are available as stand-alone items, or as complex solutions that integrate technologies into advanced, value-added systems.

DESIGN & ENGINEERING

HYDRO LEDUC NA, INC.
19416 Park Row, Ste. 170
Houston, TX 77084
Tel: 281-679-9654
E-mail: bogden@hydroleduc.com
Website: www.hydroleduc.com

Hydro Leduc is a specialist in the design and manufacture of hydraulic piston pumps, hydraulic motors, hydro pneumatic accumulators, and customized hydraulic components satisfying customer needs with reliable products from a reliable source. As the leader in micro hydraulics, it is feasible to obtain several tons of force from a minimal power source within a restricted space envelope. The techniques of micro hydraulics allow simple solutions to problems that are often beyond the limits of traditional mechanical options. Hydro Leduc's expertise is at your service in varied applications such as oil service tools, oceanographic instrumentation, aeronautics, and any extreme working condition of temperature, pressure, medium, and environment.

EQUIPMENT RENTAL

OKEANUS SCIENCE & TECHNOLOGY, LLC
2261 Denley Road
Houma, LA 70363
Tel: 985-346-4666
Fax: 985-346-8444
E-mail: Bleblanc@okeanus.com
Website: www.okeanus.com
Contact: Benton LeBlanc

Okeanus is the premier rental provider for oceanographic and marine scientific research equipment utilized in nearshore and offshore projects around the world. Focused on providing industry-leading customer service, Okeanus offers advanced, high-quality technology coupled with knowledgeable and experienced staff that can deliver dedicated support regardless of a project's location.

SeaCatalog Vendor

FIBER OPTIC PRODUCTS/SERVICES

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8502 SW Kansas Ave
Stuart, FL 34997
Tel: +1 772 219 3000
Fax: +1 772 219 3010
Email: contact@oceanspecialists.com
Website: www.oceanspecialists.com

Ocean Specialists, Inc. (OSI) is a developer of undersea cable projects and technology with global project capabilities. OSI works with clients during all project phases of subsea network development, from planning and design to procurement and implementation. Our customers, primarily representing Oil and Gas, Telecommunications and Ocean Observing, recognize the value of fiber optic networks to their field and services solutions, and look to OSI to deliver the skills and experience that developing these networks require.

GYRO COMPASSES

KONGSBERG SEATEX AS
Pirsenteret
N-7462 Trondheim, Norway
Tel: +47 73 54 55 00
Fax: +47 73 51 50 20
E-mail: km.seatex.sales@kongsberg.com
Website: www.km.kongsberg.com/seatex
Contact: Finn Otto Sanne at finn.otto.sanne@kongsberg.com

Kongsberg Seatex is a leading international marine electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems. Our commitment is to provide quality products and solutions for safe navigation and operations at sea in the commercial offshore, maritime, hydrographics and defence industries.

LIQUID STORAGE

AERO TEC LABORATORIES, INC. (ATL)
45 Spear Road Industrial Park,
Ramsey, NJ 07446 USA
Tel: +1 201 825 1400
Fax: +1 201 825 1962
E-mail: atl@atlinc.com
Website: www.atlinc.com
Contact: David Dack

ATL specializes in the design/manufacture of custom bladder-type fluid containment systems, including tanks, inflatables, pillows and bellows for surface and subsea. ATL's flexible fluid containers boast unparalleled chemical tolerance, abrasion resistance, and remarkable durability - used with methanol, diesel fuel, gases, ethyleneglycol, hydraulic fluids and chemical cleaning cocktails. Expedited deliveries are also available.

MARINE ENVIRONMENTAL CONSULTING SERVICES

CSA OCEAN SCIENCES INC.
8502 SW Kansas Avenue
Stuart, FL 34997
Tel: +1 772 219 3000
Fax: +1 772 219 3010
E-mail: gstevens@conshelf.com
Website: www.csaocean.com
Contact: Gordon Stevens

CSA Ocean Sciences Inc. (CSA) is a marine environmental consulting firm specializing in multidisciplinary projects concerning potential environmental impacts of activities throughout the world. With extensive experience in environmental sciences and technical field operations, CSA is staffed and equipped to offer a complete range of services for projects in offshore, nearshore, estuarine, wetland, and freshwater environments.

MARINE VENTURES INTERNATIONAL, INC. (MVI)

8524 SW Kansas Avenue
Stuart, FL 34997
Tel: +1 772 419 9627
Fax: +1 772 419 9628
E-mail: bpudney@marineventures.com
Website: www.marineventures.com
Contact: Bruce Pudney

Marine Ventures International, Inc. (MVI) provides high quality, marine environmental and technical experts to conduct coastal and offshore field operations worldwide. We leverage our wealth of talent and resources to bring you a customized team of independent contractors, subject matter experts and specialized equipment to get the job done. Our professionals work in a variety of sectors from submarine cable projects and engineering services to protected species observation and environmental consulting.

MOTION SENSING EQUIPMENT

KONGSBERG SEATEX AS

Pirsenteret
N-7462 Trondheim, Norway
Tel: +47 73 54 55 00
Fax: +47 73 51 50 20
E-mail: km.seatex.sales@kongsberg.com
Website: www.km.kongsberg.com/seatex
Contact: Finn Otto Sanne at
finn.otto.sanne@kongsberg.com

Kongsberg Seatex is a leading international marine electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems. Our commitment is to provide quality products and solutions for safe navigation and operations at sea in the commercial offshore, maritime, hydrographics and defence industries.

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ADVANCED NAVIGATION

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EVOLOGICS GMBH

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E-mail: sales@evologics.de
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Pirsenteret
N-7462 Trondheim, Norway
Tel: +47 73 54 55 00
Fax: +47 73 51 50 20
E-mail: km.seatex.sales@kongsberg.com
Website: www.km.kongsberg.com/seatex
Contact: Finn Otto Sanne at
finn.otto.sanne@kongsberg.com

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Pirsenteret
N-7462 Trondheim, Norway
Tel: +47 73 54 55 00
Fax: +47 73 51 50 20
E-mail: km.seatex.sales@kongsberg.com
Website: www.km.kongsberg.com/seatex
Contact: Finn Otto Sanne at
finn.otto.sanne@kongsberg.com

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Website: https://rbr-global.com/

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Tel. +1 (902) 466-7000
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E-mail: Sales@romor.ca
Website: www.romor.ca
Contact: Darrin Verge, President & CEO

ROMOR Ocean Solutions provides instrumentation solutions for the geophysical, oceanographic, defense, security, oil & gas, and renewable energy industries. By partnering with world renowned manufacturers, ROMOR is able to offer technical knowledge, value added services, logistics expertise, and the most reliable instrumentation on the market.

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13431 NE 20th St.
Bellevue, WA 98005
Tel: +1 425 643 9866
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Contact: Calvin Lwin, Sales

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Skeidaras 12, 210
Gardabaer, Iceland
Tel: +354 533 6060
Fax: +354 533 6069
E-mail: baldur@star-oddi.com
Website: www.star-oddi.com
Contact: Baldur Sigurgeirsson

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Echologger represents the best quality sonar products in the market. We are a leading developer/manufacturer of high-end ultracompact echosounders and high resolution scanning sonar that are equipped with state-of-the-art features and essential functionalities to match customers' needs in affordable price.

Founded in 2009 and a company located in South Korea, and with a brand name Echologger, EofE Ultrasonics Ltd. is a knowledge-based company that continuously designs, develops and manufactures high technology sonar devices and solutions to meet the changing needs of the customers. Having been in the industry for years, the company understands how the industry operates and what works best for the benefit of our valued customers.

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E-mail: info@edgetech.com
Website: www.edgetech.com
Contact: Amy LaRose

EdgeTech designs, manufactures and sells industry-leading side scan sonars, sub-bottom profilers, bathymetry systems and combined sonar systems. Additionally, the company produces world class underwater actuated and transponding solutions including deep sea acoustic releases, shallow water and long life acoustic releases, transponders, reliable USBL acoustic tracking and positioning systems, and custom-engineered acoustic products.

MARINE SONIC TECHNOLOGY
120 Newsome Dr. Suite H, PO Box 1309
Yorktown VA 23692-1309
Toll Free: +1 800 447 4804
E-mail: Regan.Lipinski@na-atlas.com
Website: www.marinesonic.com

Marine Sonic Technology builds high quality, high resolution side scan sonar systems.

Located in Yorktown, Virginia, Marine Sonic has been in business for more than 25 years.

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E-mail: info@saivas.com
Website: www.saivas.no
Contact: Gunnar Sagstad

- STD/CTD, Sound Velocity probes/recorder with optional multi-parameter facilities; Turbidity, Fluorescence, Oxygen etc. The new CTD/STD model SD208 with wireless communication and high accuracy: 0.002 mS/cm, 0.002 °C.
- Precision pressure /depth (0.01% accuracy) and temperature sensors/recorders. Applications: hydrographic profilings, installation on ROVs and towed systems, etc. Robust and compact designs are combined with accuracy and "plug and play" compatibility. Output format for sonar equipment, e.g. EM1002, EM3000, SSP, HiPAP and Reson 8125.

SUBSEA FABRICATION

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Contact: Bill New

New Industries provides quality fabrication services to the offshore oil & gas and marine industries focusing on large diameter pressure vessels, suction piles, DNV buildings and deepwater subsea production equipment such as jumpers, PLETs, PLEMs and manifolds.

SUBSEA TECHNOLOGY

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Strandpromenaden 50
NO-3183 Horten
Norway
Tel: +47 33 03 41 00
Website: www.km.kongsberg.com

Kongsberg Maritime is a marine technology company providing innovative solutions for all marine industry sectors including merchant, offshore, subsea, naval and fisheries. The company delivers systems that cover diverse maritime applications. Within subsea, Kongsberg Maritime's sonars, Sub-bottom profilers, multibeam and single beam echo sounders, cameras, positioning and underwater communication & monitoring systems, instruments, software and Marine Robotics are used in survey and inspection operations worldwide. Working closely with customers to develop technology that pushes the limits in subsea applications, Kongsberg Maritime is also dedicated to developing innovative environmental monitoring solutions such as the K-Lander system in addition to cutting-edge Marine Robotic platforms such as the futuristic Eelume vehicle.

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Contact: Adam Mara

General Dynamics Mission Systems' Bluefin Robotics products provide undersea capabilities for defense, scientific and maritime customers worldwide. Bluefin Robotics products offer a range of systems and configurations that can operate in the open ocean and in constrained waterways. Our core autonomous product line includes Bluefin SandShark, Bluefin-9, Bluefin-12, and Bluefin-21, Hovering Autonomous Underwater Vehicle (HAUV), and Subsea Power technologies.

The Bluefin Robotics AUV family shares a free-flooded, modular, and open architecture backbone that has enabled the integration of 70+ sensors. We have developed and delivered AUVS worldwide to research institutes and industry and have provided AUVS to the United States' and International Navies.

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Tel: +1 508 563 6565
Fax: +1 508 563 3445
E-mail: sales@hydroid.com
Website: www.hydroid.com
Contact: Hydroid Sales Department

Located in the U.S. and a subsidiary of Kongsberg Maritime, Hydroid is the world's most trusted manufacturer of advanced Autonomous Underwater Vehicles (AUVs). Our Marine Robotics systems provide innovative and reliable full-picture solutions for the marine research, defense, hydrographic and offshore/energy markets. Our products represent the most advanced, diversified and field-proven family of AUVs and AUV support systems in the world.

Developed by a veteran team of engineers, the innovations of Hydroid and Kongsberg Maritime provide a safe and reliable answer to the challenges that have hampered ocean exploration and security. For more information on REMUS technology, please visit www.hydroid.com.

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1734 Broadway Street,
Port Coquitlam, BC, V3C 2M8
Tel: 1-604-942-5223
E-mail: info@ise.bc.ca
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International Submarine Engineering Ltd. (ISE) is a world leader in the design and integration of autonomous and remotely operated robotic vehicles and terrestrial robotics. Over our 40+ years in business, we have accumulated a great deal of expertise in the design, manufacture, and maintenance of:

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Tel: +1 508 678 0550
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Website: www.iver-auv.com
Contact: Jim Kirk

L3 OceanServer, Inc. is one of the leading manufactures of unmanned underwater vehicles (UUVs) with over 300 units delivered to customers around the world.

The Iver UUV is an affordable, simple to operate commercial system for military, survey, water quality, and research applications.

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Contact: Shannon Searing

Teledyne Oceanscience supplies the oceanographic community with deployment platforms for echosounders and environmental monitoring instrumentation. Our major products are remotely-controlled Q-Boats and tethered instrumentation deployment Riverboats for echo sounders and ADCP's, remotely controlled Z-boats for hydrographic surveys in shallow or hard to access areas, the UnderwayCTD that provides affordable and compact profiling from a moving vessel, and the popular Sea Spider and Barnacle seafloor platforms.

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9970 Carroll Canyon Road
Suite B
San Diego, CA 92131 USA
Tel: +1 619 450 4000
Fax: +1 619 450 4001
E-mail: SeaBotixInfo@Teledyne.com
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Contact: Jamie Carrig

Teledyne SeaBotix is a world leading manufacturer of capable underwater MiniROVs that perform a multitude of tasks including maritime security, search and recovery, hull and pipeline inspection, hazardous environment intervention, aquaculture, sensor deployment and oceanographic research. The Little Benthic Vehicle systems have become the benchmark in compact ROVs around the world and ROV equipment for over 30 years. We recognize that no two jobs are the same and specialize in products that are customizable for your specific applications.

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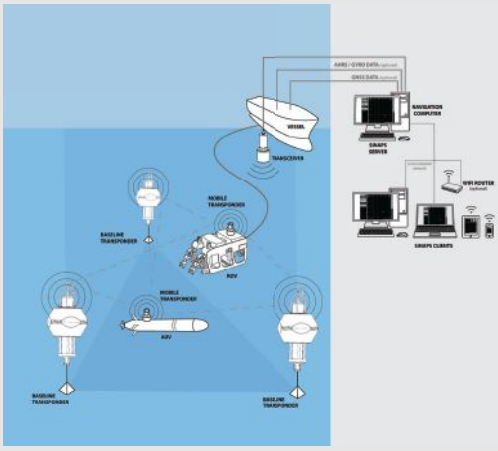

EvoLogics GmbH
Ackerstrasse 76,
13355 Berlin, Germany

tel.: +49 30 4679 862-0
fax: +49 30 4679 862-01

sales@evologics.de
evologics.de

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