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EVOLUTIONS IN SUBSEA FIBER OPTIC CONNECTORS:

A Review of Historical Uses
and Preview of the Future

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A large, light blue dolphin swims towards the camera through clear blue water. It is positioned above a vibrant coral reef. The reef consists of various types of corals, including large brain corals and smaller, branching ones. Sunlight filters down from the surface, creating a dappled light effect on the reef and the dolphin's body.

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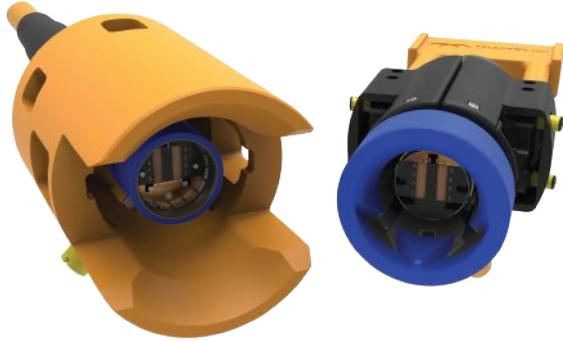
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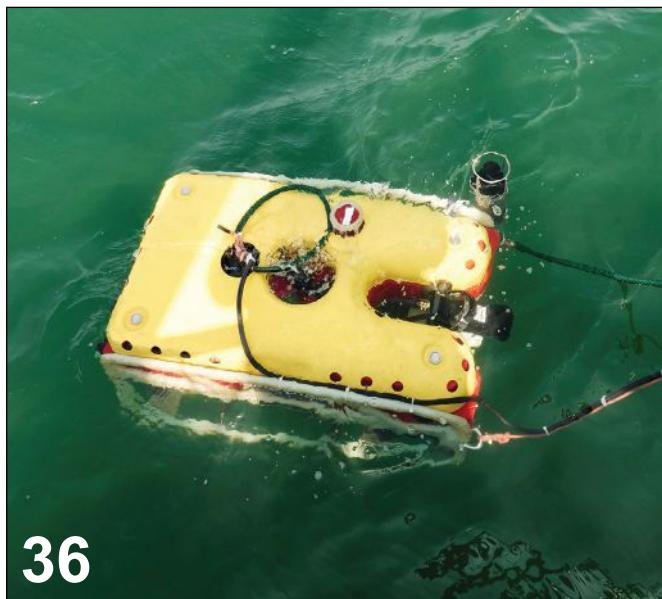
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Sixty-five kilometer umbilical prepared for quayside load out from Oceaneering's umbilical manufacturing facility in Rosyth, Scotland.

Photo Credit: Oceaneering International, Inc.

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By: John Manock
ON&T News Editor

Subsea Fiber: Strong and Healthy

Welcome to the March edition of Ocean News & Technology. The beginning of 2017 already has been an exciting time for the magazine as we have re-launched it with a new format and a heavy emphasis on digital technologies.

I have been a contributor to ON&T for several years, but 2017 has a new feel for me too as I am now the news editor. The March issue is of particular interest to me as it is the first with the new format to have Subsea Fiber as an editorial focus. I come from the submarine cable industry and am thrilled with the tremendous lineup that this issue has to offer on subsea fiber, including Teledyne Marine explaining the evolution of subsea fiber optic connectors, Ciena describing how subsea fiber has led to the development of “digital oil fields,” and Ocean Specialists Inc. discussing the importance of cable maintenance and protection.

It is worth taking a moment to look at the state of the submarine fiber optics industry. Since its beginnings in the 1980s, subsea fiber has been a boom and bust market—a boom of cable building followed by a bust caused by over-capacity, until demand grows again and causes the next boom.

In the past decade, however, the Internet has altered this reality. Insatiable demand for high-speed Internet access created a level of demand that seemingly could not be satiated. The booms and busts leveled out to more consistent demand year-on-year, with some occasional higher bursts or dry spells. In spite of the demand for bandwidth, the submarine cable market failed to take off completely, largely due to a limited pool of investment capital.

Since 2014, however, demand for new subsea fiber systems seems to have broken out of this steady-state period of moderate growth. Investors are coming to the conclusion that submarine cables are good money-making propositions. With more investment capital available and pent-up demand for additional bandwidth, the need for more reliable routing of cables and the number of unconnected markets thirsting for the economic and social benefits of high-speed Internet, there has been a new boom—the first true boom in nearly a decade—in submarine cable building throughout the world.

Markets that suffer through frequent boom and bust phases usually lack diversity. This is where the subsea fiber market in 2017 is shining. Cable systems are being built that cover every conceivable category: transoceanic, regional and local, international and domestic, built by traditional telecom carriers, newer competitors and over-the-top Internet providers. Funding is coming from equally varied places—the World Bank, family and infrastructure funds, national governments, private banks and pension funds—all of which see the benefits of investing in the market.

Subsea fiber is an attractive industry to be in right now. These cables, whether linking major financial hubs across oceans or connecting a single oil platform to the shore, make possible the full use of the Internet. It is a market that should remain strong and healthy.



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EVOLUTIONS IN SUBSEA FIBER OPTIC CONNECTORS:

A Review of Historical Uses and Preview of the Future

*By: John Flynn Vice President,
Marketing Communications & Branding, Teledyne Marine*

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Optical fiber has enabled greater bandwidth, more safety, and more configurability in subsea oil and gas systems. Wet-mate connector evolution launched widespread fiber use in the early 1990s, while the development of high-pressure fiber penetrations increased the reach of optics into subsea wells and pressure vessels in the early 2000s. Advancements in optical connector design, such as angled endfaces, have recently enabled a new era of optical sensing.

The future of subsea fiber optics lies in a systems-level design approach. Unique technologies, synergizing fiber optics with integrated electronics, are positioned to increase the efficiency of entire fields, reduce future project CAPEX, enhance reliability, and ensure the continued use of optical fiber, even in challenging market conditions.

Optical Wet-Mates

In response to the need for higher bandwidth and E&M-resistant communication on oceanographic and defense products, optical wet-mate connectors were developed in the late 20th century. Designers were, at the time, unable to rely on the spring/piston that worked so well for electrical connector sealing as the piston obstructed the light path. Some early designs leveraged expanded beam lenses, but these designs exhibited very high optical losses.

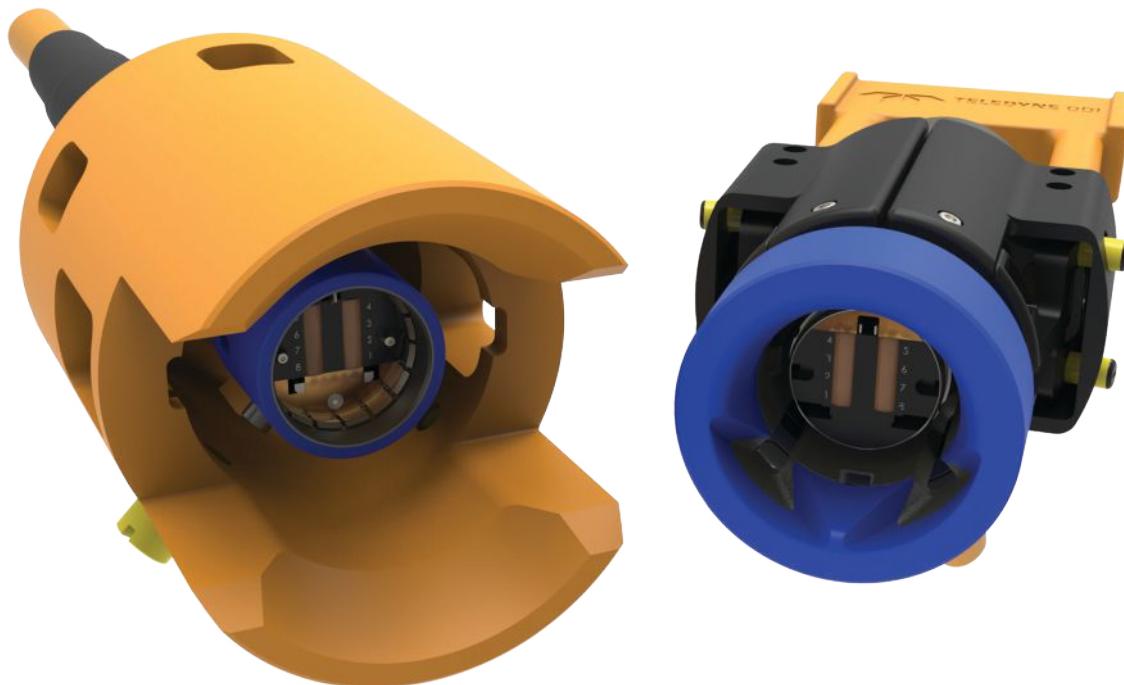
The lowest loss optical connectors, such as Teledyne's Rolling Seal connector released in 1995, utilized ITU-T G.652-compliant optical fiber and standard telecommunications-grade 2.5 mm optical ferrules, polished to a physical contact (PC) or ultra-physical contact (UPC) grade. Typical optical specifications were ≤ 0.5 dB insertion loss and ≥ 30 dB return loss. The innovative moving seals at the front of the connector trapped debris and rolled it out of the way before clean, oil-filled volumes were joined and the optical terminations made contact.

Low loss subsea optical connections greatly increased the usage of wet-mate optical connectors, particularly in the oil and gas industry. Now, virtually all subsea oil and gas umbilicals contain one or more gel-filled optical fiber tubes, typically containing 12 optical fibers for various uses subsea. Optical connectors are also present on the majority of subsea oil and gas structures, includ-

ing tree-mounted subsea control modules (SCMs), standalone subsea distribution units (SDUs), and a variety of other equipment, including router modules or subsea manifolds. The wet-mate optical connector now acts as a critical component in linking the communication network of a subsea field. Most early projects such as ConocoPhillips' "Little Dotty" in 1997 or Norsk Hydro's (now Statoil) "Troll Pilot" in 1998 utilized simple point-to-point jumpers, consisting of a wet-mate optical connector on each end, a pressure-balanced, oil-filled hose between them, and the mating connector halves mounted to a subsea bulkhead.

Hybrid Connections

The development of hybrid connectors containing optical and electrical circuits in the late 1990s represented a significant step forward in connector design, joining two enabling technologies into a convenient single package. Hybrid connectors enabled the delivery of electrical power along with high-bandwidth optical communication. Powered temperature, pressure, flow, or erosion sensors on pipelines and trees could now be read topside in virtual real time. Teledyne's Nautilus Rolling Seal Hybrid (NRH) joined the Rolling Seal optical technology with the already widely used Nautilus electrical pins in order to provide optical connectivity and electrical up to 30A and 1kV. Though used more frequently for oceanographic/communication programs such as Japan's Dense Oceanfloor Network System for



Earthquakes and Tsunamis (DONET) system or Ocean Networks Canada's Neptune nodal science project located off the west coast of Vancouver Island, British Columbia, NRH connectors have also enabled cost savings on oil and gas projects, such as Total's 2013 ultra-deep flagship field Egina off the coast of Nigeria.

Cable Terminations & Penetrations

Fiber optic subsea connectors have always required ancillary products, such as the aforementioned pressure-balanced oil-filled hose that constitutes the subsea jumper. One such ancillary product is the cable termination. In order for the topside or shore-side team to communicate with the field, an umbilical cable, typically many kilometers long, must be terminated to the first in a series of wet-mate connectors; this occurs at cable termination assembly.

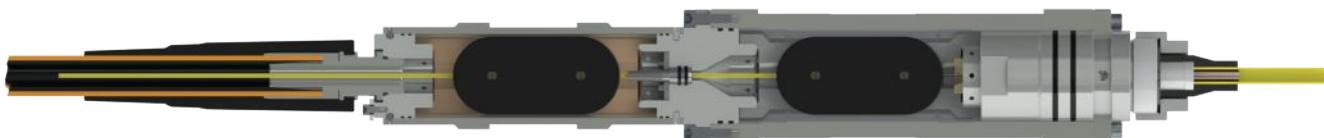
Early designs for cable terminations incorporated fully pressure-compensated housings. However, these designs have pressure, and therefore, depth limitations, due to the risk of pressure driving the compensation fluid up the length of the umbilical cable. Teledyne took a leap forward with the release the field assembled cable termination (FACT), which leverages a robust optical penetration to allow the separation of the low-risk, factory-tested, pressure-balanced portion of the assembly from the field-assembled cable-breakout portion. The volumes exposed to the cable are kept at 1 ATM, and no fluid is driven into the cable. This volume isolation methodology is also viable for hybrid cable terminations, employing both optical and electrical breakout regions in order to transform the hybrid umbilical into a hybrid wet-mate connector.

insulation material over a conductive element. Optical penetrations were a greater challenge due to the fragility of optical fiber in bending and the threat of bend losses during operation. Early optical penetrations, primarily developed before 2000, were often epoxy-based, providing pressure integrity only up to approximately 5,000 psi. Advancements in bonding and sealing to optical fiber have enabled truly hermetic, reliable optical penetrations up to 10,000 psi as a standard. As a result, not only can 1 ATM housings and cable terminations survive at deeper depths, the increased reliability of the sealing methods means less operational downtime and fewer overall system interventions.

High Temperature, High Pressure Applications

Fiber optic sensing has grown over the past 20 to 30 years to include a full suite of core technologies, Distributed Temperature Sensing (DTS), Distributed Acoustic Sensing (DAS), and discrete Fiber Bragg Grating (FBG) sensors to name a few. If used within a subsea well, not only must the optical fiber cable and/or sensor housing survive the pressure and temperatures, often greater than 15,000 psi and 120°C), but a reliable penetration and connection method is required at the X-tree/Tubing Hanger (XT/TH) interface.

The release of the 2007 Intelligent Well Interface Standardization (IWIS) joint industry project (JIP) marked a milestone in alignment between major oil and gas operators on a vision for subsea wells. Key market drivers at the time were an increase in recoverable reserves, reduced intervention, and improved viability for brown-field projects—many of which are still relevant. Chief among the technolo-



Penetrations, like those used within the FACT design, have also been required more frequently as optical and electrical communication equipment is marinized. Many active and some passive optical components cannot tolerate extreme subsea pressures. Thick-walled pressure vessels are used to contain these components in a 1 ATM volume. However, optical and electrical signals must be able to traverse the pressure vessel wall. Electrical penetrations were easily developed in the mid-20th century by sealing a mechanically robust

gies required to bring IWIS to life, was an Optical Feed-through System (OFS), combining an optical wet-mate connector with a penetrator and possibly dry-mate connector in the subsea well. Despite great leaps in technology, a successful OFS deployment has not yet occurred. Suitable 30-year HTHP material choices, non-epoxy fiber termination, and high temperature pressure-compensation are a few of the remaining technical hurdles to overcome before a truly viable OFS comes to market.

IWIS eventually made way for the Subsea Fiber Optic Monitoring (SEAFOM) group, which released the detailed OFS qualification and acceptance testing standard TQP-01 in 2011, providing a new level of standardization for potential OFS manufacturers. Ongoing JIPs continually provide a forum for operators and all levels of equipment manufacturers to collaborate, draft industry specifications, review recent deployments, share lessons learned, or advertise. Because of these efforts, work still actively continues on OFS technology, though the current cost environment has noticeably slowed the market growth.

Looking Forward

In recent years, wet-mate optical connector improvements have continued to push optical technology boundaries, integrating some technology already common in the terrestrial telecom industry. Angled physical contacts (APC), a standard of terrestrial connectors (e.g., FC/APC or SC/APC), are a requirement for wider adoption of distributed sensing technologies and low-reflectivity FBG-based systems. The 8° angle on the end-face directs reflected light out of the fiber waveguide, thereby improving the connector return loss (RL). For wet-mates, this improved the RL from ≥30 dB to ≥45 dB, a reflection noise floor suitable for reflective sensing as described above. Teledyne's APC Rolling Seal supported the all-optical 4D Life of Field Seismic monitoring in Petrobras' Jubarte field in 2010. The system consisted of more than 35 km of sensing cables arranged over an area of 9 sq. km. In total, 96 wet-mate optical contacts supported over 700 4D sensing stations.

Additionally, optical connector manufacturers are increasing channel counts to support more wells per single optical connector. In one scenario, a single 24-channel optical connector could be used to terminate all available optical fibers from an umbilical cable. That connector could then support six X-trees, each with subsea electronics modules (SEMs) requiring two fibers each. While such a solution seems to offer a substantial cost savings, it also presents a single point failure condition, a consideration that persists as a concern as channel count and contact density continue to increase.

When evolutionary changes, such as increasing channel count, are made to qualified product lines, overall reliability must remain at the forefront of the product development process. The epoxies, thermoplastics, and metals used in the system must be rated for at least 30 years in the host environments. Standard Arrhenius acceleration models offer an initial guide to material compatibility testing of new designs. However, building on API 17N the reliability and risk management volume of the API 17-series, Teledyne has begun to leverage more advanced analysis techniques, such as Weibull analysis, Chi-squared analysis, and step-stress Accelerated Life Testing models, in order to provide a more complete picture of reliability and give operators true confidence in material, product, and system lifetime.

Finally, as the oil and gas industry struggles to cope with depressed prices, progressive architecture changes offer a new, deeper level of cost savings. Teledyne



FEATURE STORY



has recently qualified the Electrical Optical Flying Lead (EOFL) to be initially deployed in 2018. In a traditional system, communication signal and power came into the Umbilical Termination Assembly (UTA) from the surface and it was then distributed to the router module for electrical to optical conversion; the system encompassing two redundant router modules for every six X-trees. The router modules were then connected to each X-tree. With the introduction of the EOFL, it is now possible to remove both subsea router modules from the field, replacing each with a line-retrievable flying lead assembly containing the media converter, saving close to an estimated \$2,000,000 per six-well distribution system.

The unique EOFL product combines a Nautilus 12-pin electrical wet-mate connector on one end with a Nautilus Rolling Seal Hybrid on the opposite end and a 1-ATM canister containing ISO 13628-6-tested electrical-to-optical conversion boards. Fully qualified optical and electrical penetrations ensure 30-year integrity of the 1-ATM housing.

Though subsea connection technology continues to march forward, systems-level approaches and re-considerations of connection philosophy, along with more traditional product cost-cutting techniques, will ensure the continued use of fiber optics in the world of subsea oil and gas.

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Wärtsilä Joins Seabin Project in the Battle against Ocean Plastics

The Finnish technology group Wärtsilä has signed an agreement with the Seabin Project to join their global pilot program, which addresses the worldwide littering problem affecting our oceans. The project aims at approaching the challenge from multiple angles with a key emphasis on education, research, and technology.

Wärtsilä will work in cooperation with the Seabin Project for the next three years and has sponsored both the city and port of Helsinki's involvement with the program. The Wärtsilä—Seabin partnership aims at dynamic and versatile actions using Wärtsilä's experience, established technologies, and know-how in environmental product development.

The partnership with Seabin is part of Wärtsilä Corporation's Finland 100 year centennial program. The company is celebrating 100 years of Finland's independence by giving something back to the country, part of which is the sponsorship of the city and port of Helsinki.

The Seabin is a floating rubbish bin that is located in the

water at marinas, docks, yacht clubs, and commercial ports, collecting all floating rubbish. Water is sucked in from the surface and passes through the catch bag filter inside the Seabin. The water is then pumped back into the marina leaving litter and debris trapped in the catch bag to be disposed of properly. The Seabin also has the potential to collect a percentage of oils and pollutants floating on the water surface. The team at Seabin Project are currently using 12-volt submersible water pumps, which have the option to use alternative and cleaner energy sources. This may be using solar, wave or wind power technology depending on the geographical location and current technologies available.

Seabin's global pilot program will be launched in April 2017 with the presentation and installation of the latest prototype (V5 Hybrid) in different locations around the globe. Helsinki will be one of these locations and is to date the only one in the Nordic countries. During the three-month test period, user experience and data will be gathered from the pilot partners before commercial sales of the Seabins commence.



In order to work for cleaner maritime environments, Wärtsilä has also signed an agreement with the city of Helsinki and the Port of Helsinki to donate two pre-series Seabins for testing in Helsinki during the trial period. Four additional Seabins can then be installed after commercial sales begin. The city of Helsinki and the Port of Helsinki will manage daily maintenance of the Seabins.

Wärtsilä is a member of the Sustainable Shipping Initiative and a signatory to the UN Global Compact and is shaping the traditional marine and energy markets with sustainable and renewable solutions, all aimed at improving the environmental footprint of marine transport and power production.

Wärtsilä provides cutting edge technology for reducing emissions from ships by providing exhaust gas cleaning systems and dual-fuel hybrid engines designed primarily for liquefied natural gas fuel, a cleaner and purer alternative to diesel or bio diesel. Wärtsilä also designs, supplies, and installs clean technology for ballast water management to reduce the amount of pollutants being discharged into our oceans, thereby benefiting marine ecosystems globally. Wärtsilä's remote monitoring and fleet management helps in optimizing vessel operations.

Entering the solar energy sector has proved invaluable to the already impressive Wärtsilä offering. By expanding the portfolio with new sustainable innovations, Wärtsilä helps its customers to reduce their carbon emissions. Wärtsilä is the first company to offer utility-scale solar hybrid plants. The hybrid solution couples a solar PV park with an ultra-flexible Wärtsilä Smart Power Generation power plant. The two units operate in synchronization to reduce the engines' fuel consumption.

"Wärtsilä is proud to join the Seabin Global Pilot Program. As one of the marine industry's leading solutions suppliers, it is our responsibility to supply efficient products that help our customers protect the environment. Environmental actions need to take place now and everyone can play a role, corporations as well as individuals," says Jaakko Eskola, president & CEO of Wärtsilä Corporation.

"We are excited that Wärtsilä has joined the program and even more proud that they are sponsoring an entire city with Seabins. We expect to see some amazing and dynamic collaborations in the very near future with Wärtsilä to further develop the technology, and to get the Seabins off the dock and into the waters," says Pete Ceglinski, Co-founder and Managing Director at Seabin Project.

The effect that plastic is having on our environment and ecosystems is staggering. It is estimated that by 2025 there will be 1 ton of plastic in the ocean for every 3 tons of fish. Furthermore, by 2050, oceans are expected to contain more plastics than fish by weight (source: Ellen MacArthur Foundation, 2016). Over the last 10 years, we have produced more plastic than during the whole of the last century. Plastics cause more than US\$13 billion of damage to marine ecosystems per year. Animals ingest and become entangled in our discarded rubbish. Local marine environments suffer, leading to lower fish and seafood stocks. Shipping and tourism industries can be damaged, while humans unwittingly consume harmful pollutants when eating contaminated seafood.

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Better Navigation and Diver Awareness with Diver6

If you have ever been in charge of monitoring a group of divers underwater, you know that this means watching the divers' bubbles from the surface. For surface support and diver communication systems, this can mean a series of line pulls or vocal commands, but that is only if the diver is aware and conscious. If there is an accident, that can often mean trying to find the diver by conventional search pattern methods—and, sadly, many of these searches end in recoveries rather than rescues.

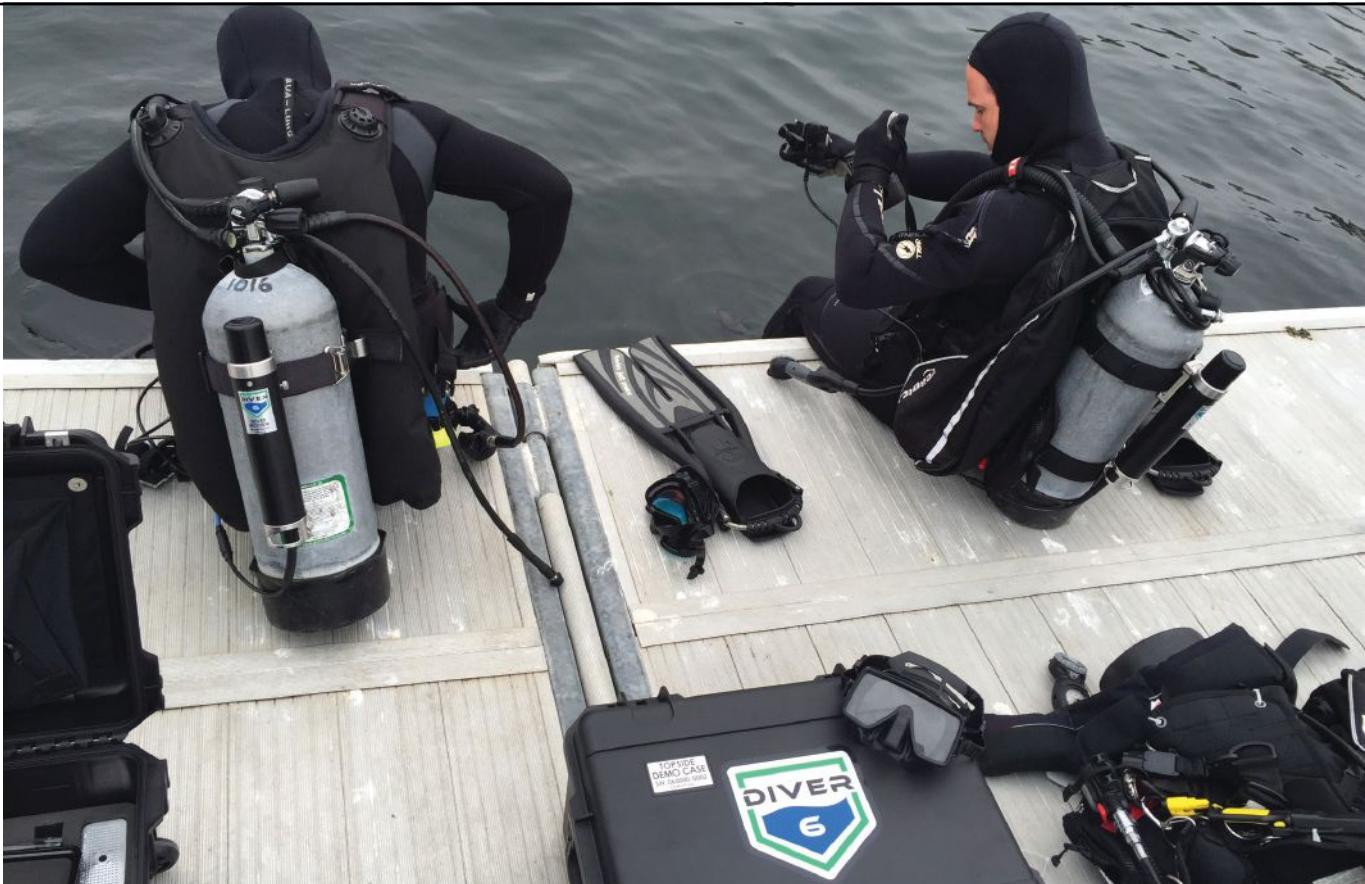
Staying together and adhering to the buddy system underwater helps dive supervisors (including instructors, public safety divers, scientists, and military personnel) keep track to a certain extent, but divers often separate, and tracking them in low visibility this can be even more challenging. Now, Diver6 has changed all of that—it uses acoustic wave technology to transmit data between topside and diver. The single topside modem is both an acoustic modem and an Ultra Short Baseline (USBL) acoustic system using multiple transducers packaged into a single housing to detect the range and bearing to the diver.

The integration of Diver6 and Shearwater, who designs and manufactures computers for divers, provides greatly enhanced communication between the diver and dive supervisor. With this integration, divers have access to air pressure and assist and distress features. Diver6 has changed the game for diver and dive operations mobile support system. This ADVISORY system allows dive supervisors to monitor and track divers beneath the surface of the water for greater situational awareness.

Diver6 provides up-to-date information on the divers in the water, allowing the dive supervisor to make faster, safer, and more accurate decisions.

Diver data are transmitted via an acoustic modem to a receiving unit on the surface. Data are then transmitted





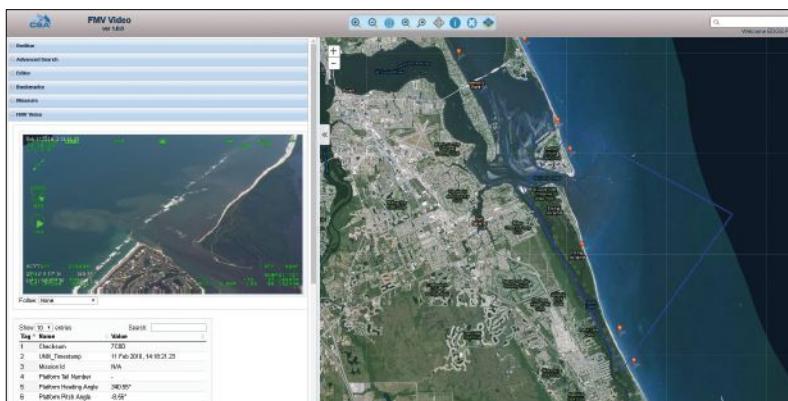
to a monitoring computer that records, calculates, and displays various parameters. This allows a dive supervisor to closely track each diver's status, depth, and location.

Diver6 enables a dive supervisor to create a dive plan that assists in the monitoring and management of diving operations. All monitoring aspects of the dive are recorded and can be used for later analysis and audit.

The system is based on input from a broad range of real-world subject matter experts: U.S. Navy SEALs, EOD, salvage divers, Coast Guard, and public safety and commercial divers.

The system can track and monitor divers in water up to 1,000 m. It provides Situational Awareness on divers in the water and logs a diver's aqua-spatial information for analysis. There are diver recall and assist features as well as 2D and 3D views of divers in the water. Diver6 features customizable diver alarm conditions with standard dive tables provided for reference. There is an intuitive touch screen application for quick dive plan setup, operation, tracking, and monitoring.

For more information, visit www.diver6.com.



CSA Presents Advanced Coastal Aerial Image Analysis Techniques

At the 2017 National Conference on Beach Preservation Technology in Stuart, Florida, scientists from CSA Ocean Sciences Inc. (CSA) described the collection, processing, and analysis of subsea and aerial imagery using Full Motion Video (FMV) tools and other software to examine local and regional environmental issues along our Florida shorelines and waterways, including algal blooms, hardbottom and seagrass mapping, and beach dynamics.

<http://ont.news/2mnj6DS>

Gas Hydrate Breakdown Unlikely to Cause Massive Greenhouse Gas Release

A recent interpretive review of scientific literature performed by the U.S. Geological Survey and the University of Rochester sheds light on the interactions of gas hydrates and climate. The breakdown of methane hydrates due to warming climate is unlikely to lead to massive amounts of methane being released to the atmosphere, according to a recent interpretive review of scientific literature performed by the U.S. Geological Survey and the University of Rochester.

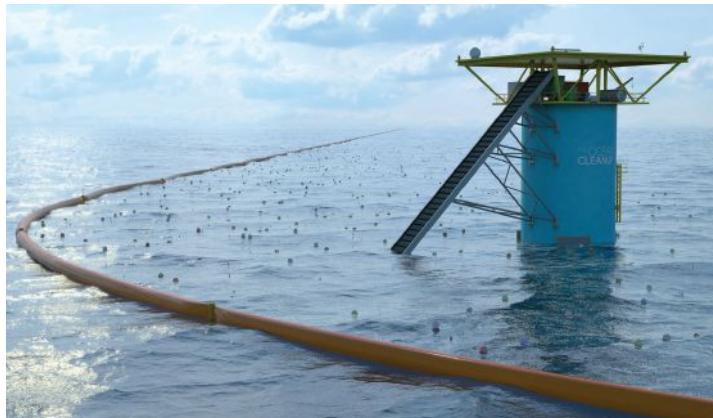
<http://ont.news/2ls1UZY>



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Plastic Pollution Demands Response

An unusual and sad sight greeted the people of Sotra in Norway this month, as a rare goose-beaked whale repeatedly beached on the island shoreline. The stricken animal eventually had to be put down, leading to a grizzly find that, argues Nor-Shipping Director Birgit Liodden, should act as a wake-up call to spur society into action. "This beautiful two ton animal was on the brink of death as its stomach was full, but devoid of nutrition," she states. "Instead of food it had eaten a variety of rubbish, including some 30 plastic bags which had clogged its digestive system."

<http://ont.news/2ISv5X0>

Honda Establishes Marine Science Foundation for Coastal Preservation

Inspired by the Japanese concept of sato-um—the convergence of land and sea where human and marine life can harmoniously coexist—Honda announced the establishment of the Honda Marine Science Foundation, a new initiative to address marine ecosystem restoration and the impact of humans and climate change on oceans and intertidal areas. Committed to marine conservation, the foundation will support science-based programs that improve and preserve coastal areas for future generations. Its first initiative is the Southern California Native Oyster Restoration Project.

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NORTH SEA PATHWAYS:

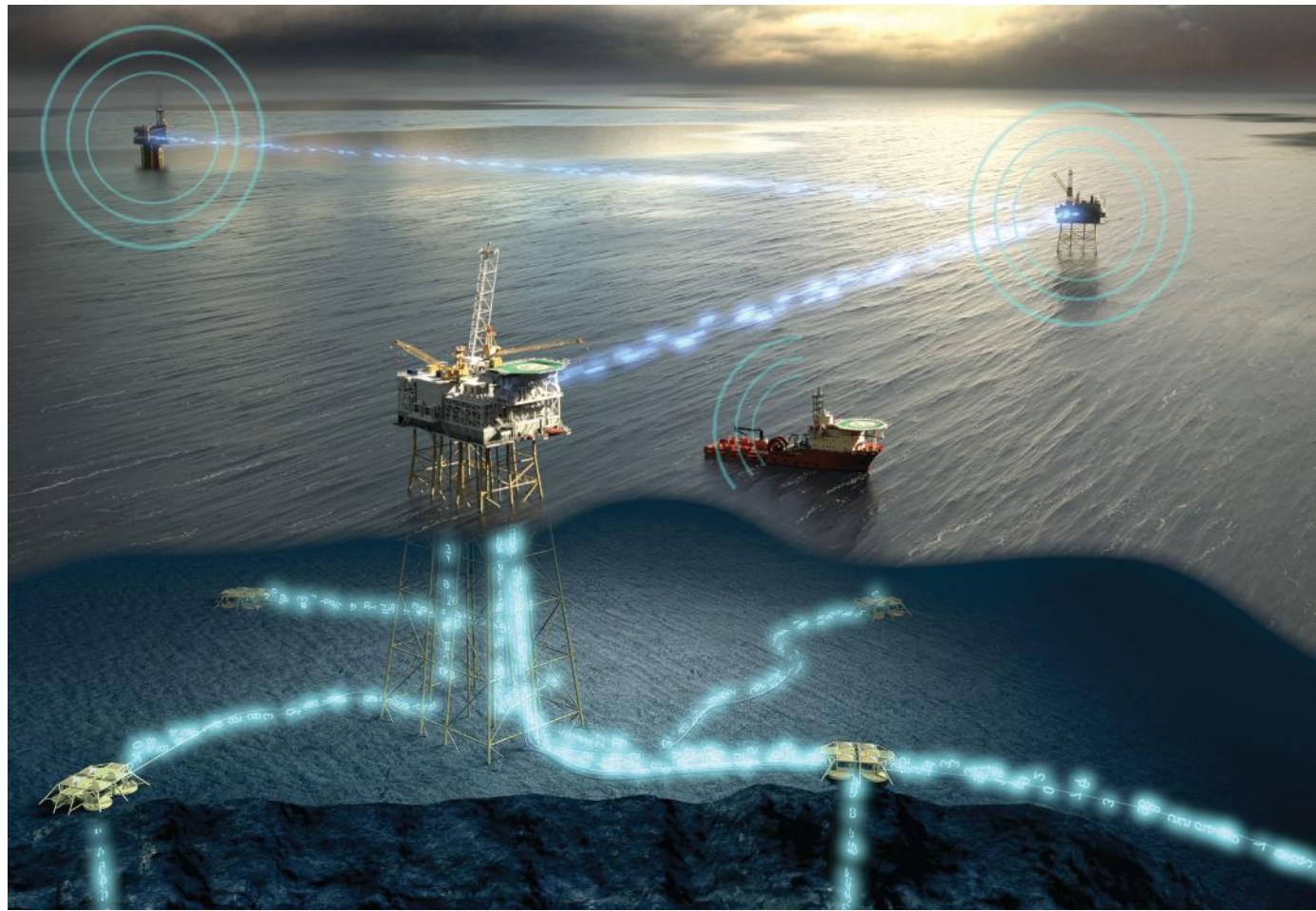
Digital Oilfields to Ultra-Secure Data Centers

Tampnet is a Norwegian-based global operator of oilfield telecommunications, wholesale capacity, and mobile LTE services. Tampnet operates the largest offshore multi-terabit, low-latency optical network in the North Sea, which reliably serves over 240 offshore assets such as mobile rigs; floating production, storage, and offloading (FPSO) platforms; and exploration rigs. Reliable, high-speed, low-latency network services are the primary goals of their network, which includes 2,500 km of subsea fiber optic links, multiple strategically located 4G LTE base stations, and a multitude of traditional point-to-point radio links. The state-of-the-art optical network employs an all-optical Colorless-Directionless-Contentionless (CDC) design that achieves the lowest latency possible with a Layer 0 Control Plane that is both OTN and mesh capable for sub-100G services rates.

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Fiber-based, high-speed, low-latency IT infrastructure required for the modern oil field. Image by Tampnet.

Backdrop: The Digital Offshore Oilfield.

Big data analytics, remote exploration, and the Internet of Things (IoT) are market trends set to impact a wide array of industries. For the oil and gas industry, these new advances are reality today. Fiber optic networks and the digital resources that they interconnect are facilitating this technological transformation by allowing the entire offshore energy ecosystem to more efficiently manage resources, such as oil drilling platforms.

Energy corporations leverage submarine networks, like Tampnet's, to connect offshore assets to onshore assets and realize a variety of operational benefits to help differentiate via operational efficiency. Some of the important benefits that interconnected offshore digital oilfields offer are listed below.

- Constant and reliable access to onshore experts located anywhere in the world via connections to the global internet, allowing for faster and improved decision-making for optimal business practices.
- Significantly improved efficiency of offshore operations, coupled with vastly reduced downtimes.
- Improved operational safety/security for offshore personnel and assets via continuous communications.
- Ongoing communications between onshore and offshore personnel to expedite critical decisions.
- Near real-time visibility, control, and oversight to best manage exploration activities and drilling assets.

To maximize the inherent value of the big data collected from multiple offshore assets, broadband and mobile LTE connectivity must be provided via modern submarine telecommunication networks to ensure a constant flow of an immense amount of actionable data to and from offshore assets and onshore data centers.



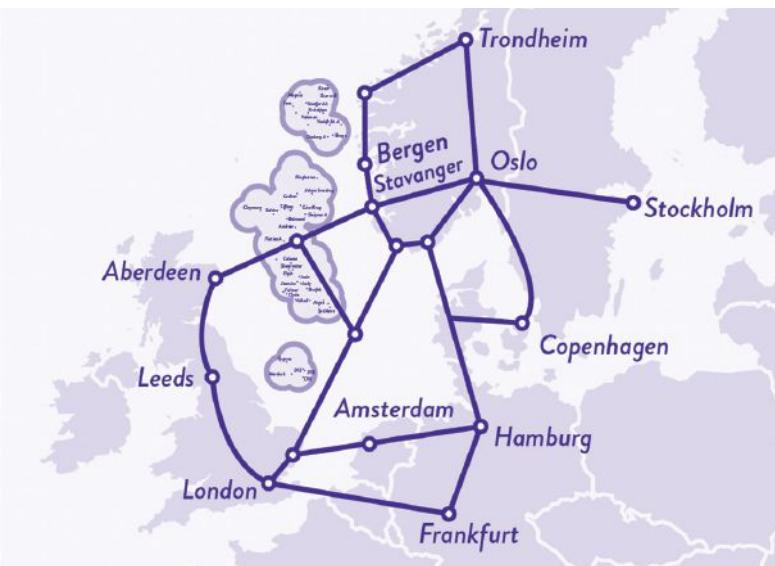
Tampnet North Sea and Gulf of Mexico network assets and connectivity. Image by Tampnet.

Opportunity: Connecting Critical Destinations Beyond the Digital Oilfields

The recent emergence of Sweden, Norway, and Finland as superior data center markets is highlighted by Cushman and Wakefield's annual study of global data center markets. In 2013, all three countries placed in the top 10 globally. Today, just 3 years later, the same study placed all three countries in the top 5 of all markets globally for data center attractiveness—and this region has effectively become a premier data center hub for the world.

It's not hard to see why, as these countries collectively possess a vibrant, educated workforce; access to green and secure energy; low operating costs; and the support of local and national governments and industry. For almost any measure—total operating costs, available energy in terms of megawatts already deployed, modernization, and physical security of the facilities themselves—the Nordic region has quite possibility the most advanced portfolio of data centers in the world.

Until recently, access to the Nordic region data center market was constrained by congested and non-diverse routes from mainland Europe through Denmark and Sweden. This has now been changed as Tampnet enters the market for the wholesale connectivity. Markets such as London and Dublin, even Amsterdam and Paris, can now access the region via Tampnet's direct North Sea routes. Furthermore, Tampnet also has direct continental access via its system to Denmark. Together with Tampnet's northern route to Aberdeen, southern route to Lowestoft (UK), and direct route to Denmark, Tampnet can offer customers the ultimate in diversity—three diverse and direct routes from the data center markets in the Nordics to the rest of Europe. No other network in place can offer this capability today, placing Tampnet and its customers in an enviable competitive position.



The North Sea as a Strategic Route Offering Critical Diversity to Key Markets in Europe

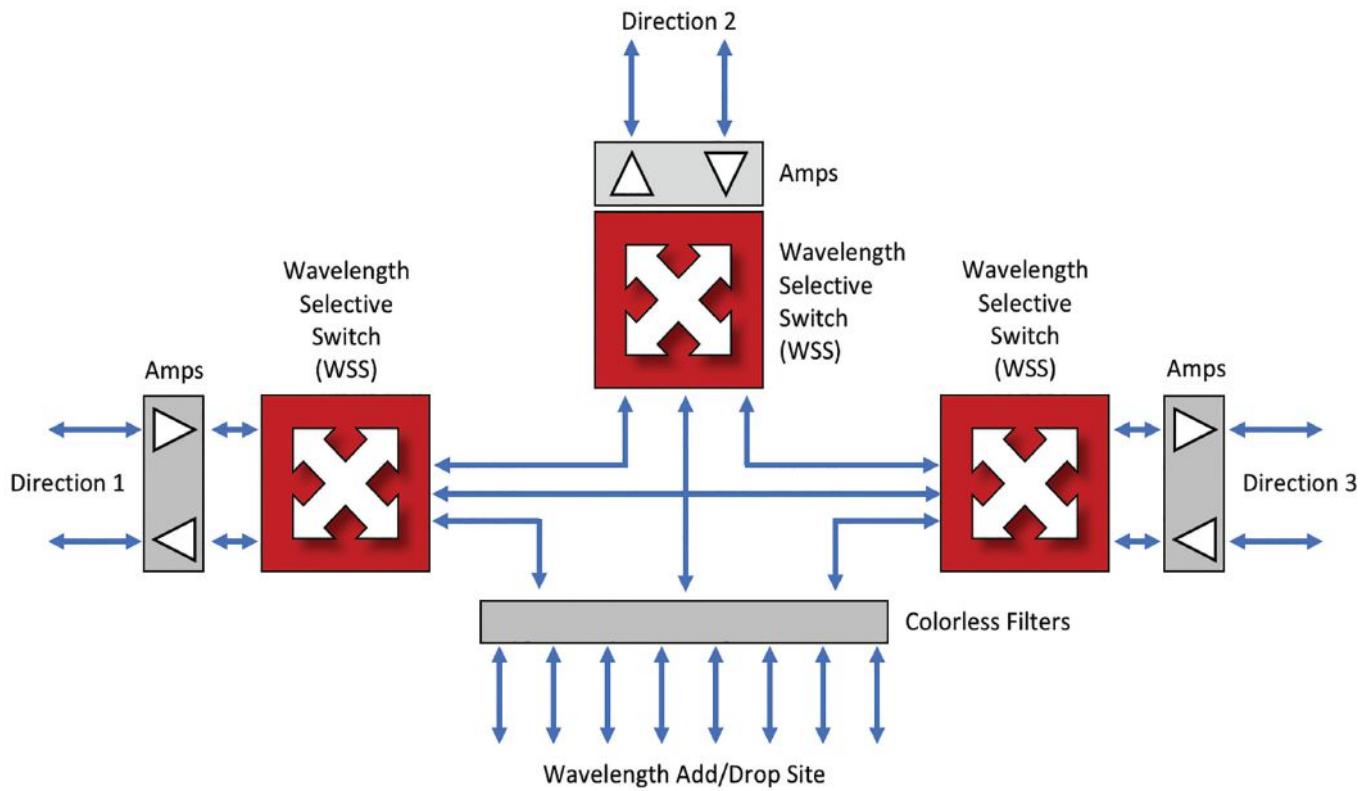
Besides offering highly reliable and protected data center connectivity, Tampnet also offers their customers an alternative for transport to carrier hotels, peering exchanges, and points beyond the Nordics, such as Russia and Central and Eastern Europe. By enabling a northern alternative connecting these markets, Tampnet provides geographic diversity from congested infrastructure found in Belgium, The Netherlands, and Germany. In many cases, Tampnet's alternative routes offer reductions in latency as well, which is always a sought-after benefit.

Tampnet also offers an advantage by combining the latest in CDC optical technology from Ciena across its entire infrastructure, which means a failure in one part of the network does not interrupt traffic in other parts of the Tampnet network and ensuring resiliency and high network availability. In addition, because Tampnet's subsea routes are switched on offshore platforms, Tampnet can shift traffic mid-span in the event of an outage at sea. This capability is particularly helpful in the increasingly congested, yet vital waterways of Europe.

A CDC architecture transforms optical network links into a fully flexible programmable platform that is highly responsive to application needs, allowing network operators to future-proof their assets—submarine assets in this case—such that Tampnet can fully optimize, scale, and flexibly meet constantly evolving optical network service demands. Intelligent software control abstracts any CDC architecture complexities, allowing network operators to focus on offering a broad set of network services that are highly available, which is critical to connecting offshore assets. The key attributes and benefits of a CDC architecture are as follows:

- Directionless provides the ability to route wavelengths across any viable path in the optical network;
- Colorless provides the ability to receive any wavelength on any optical port for improved flexibility; and
- Contentionless eliminates wavelength blocking, allowing for wavelength reuse within the optical network.

Security and reliability-minded end users of optical networks incorporate redundant contingency paths as



General Colorless-Directionless-Contentionless (CDC) architecture. Image by Ciena.

part of their risk analysis since terrestrial and submarine networks are susceptible to faults, regardless of the cause. Network path redundancy is key to improved Business Continuity and Disaster Recovery plans and, as cloud-based content and applications are increasingly migrated into distant data centers, constant network access is critical to corporate viability—making constant uptime within the network component ever more necessary.

Tampnet's large installed base of over 240 interconnected offshore assets is proof of their ongoing commitment to operating high availability services and the entire ecosystem relying on Tampnet to continue to put trust in their services. Tampnet's network was designed from inception with the offshore energy sector's ultra-reliable connectivity needs in mind, which is very similar to the connectivity needs of other sectors in northern Europe, such as large data center operators, carriers, ISPs, cloud, and content providers.

Unique Solutions, Advanced Technology, and Superior Reliability

Since 2001, Tampnet's mission to create industry solutions for the energy sector has brought it to the unique position of operating critical and vital infrastructure, not just for the North Sea but for the Nordic region as a whole. Offering multiple diverse paths to and from the UK and Norway, combined with the latest in Ciena CDC capabilities, it provides customers with a highly unique and superior solution for reaching and transiting the Nordics when compared to most traditional, more conventional routes.

As we enter the next decade, the stage is already set for the introduction of new and exciting technologies, such as 5G, IoT, big data analytics, artificial intelligence, and augmented/virtual reality—all of which will further disrupt the markets and application spaces served by Tampnet's expansive network assets. As this profound and exciting transformation continues to unfold, the global demand for highly secure and scalable data centers interconnected over highly robust and resilient network connectivity will continue to grow. Tampnet and its close partners in the Nordic region have created a distinctive pairing of connectivity, scalability, security, and cost effectiveness that is currently unique in the Data Center Interconnect industry.

ROV, AUV buoyancy and umbilical flotation



1 Umbilical floats

A standard range of floats is available to suit most control umbilicals. Comprising symmetrical half shells Balmoral floats are designed to permit flexing within specified bend radii.

2 Flexlink™ articulated umbilical buoyancy

Designed to ensure umbilical lines remain out of the ROV work zone, Flexlink is installed onto lines of 25-75mm with uplifts of 6-12kg in operating depths to 6000msw.

3 ROV buoyancy

Offering a full in-house service Balmoral Offshore Engineering designs and creates intricate ROV/AUV buoyancy profiles with virtually no size limitation. Balmoral's unique composite and pure foam systems are designed to operate at depths of 1000-10,000msw.

The company's refurbished ROV plant incorporates an end-to-end process that includes temperature controlled curing facilities and a state-of-the-art buoyancy block boring and milling plant.



BALMORAL
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OPT, HAI Announce Agreement Focused on Chemical Injection Systems

Ocean Power Technologies, Inc. (OPT) and HAI Technologies Corp. announced a strategic alliance to pursue mutual opportunities through a joint applications development and marketing agreement with an initial focus on offshore oil and gas subsea chemical injection systems where persistent power and real-time data communications are critical.

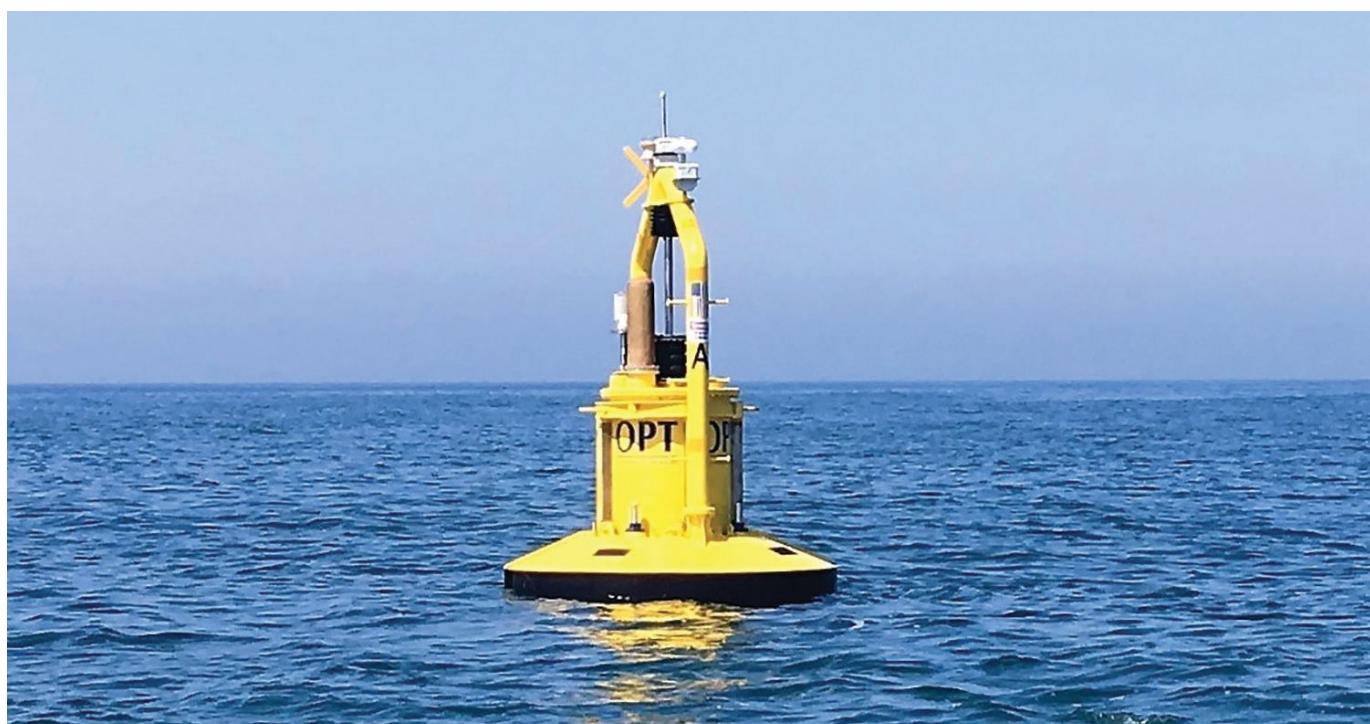
Dan Krohn, HAI Technologies general manager, stated, "HAI has tremendous experience in a variety of technologies and applications in the offshore oil and gas industry, including subsea chemical systems. Chemical injection techniques are used to mitigate the diminishing effects of buildup in piping and pumping systems used in subsea oil production operations. HAI has developed an innovative, compact, and modular approach which moves the chemical injection system closer to the production field."

We believe HAI Technologies' advanced chemical injection solutions, combined with OPT's PB3 PowerBuoy®, creates a unique opportunity to pair two distinctive offshore technologies creating new methods to deal with long distance and remote offshore field developments. We believe combining subsea chemical injection components with a local surface power system such as the PB3 is a new subsea architecture reducing field development cost, and potentially making an impractical field now practical."

George Kirby, OPT chief executive officer, stated, "We are excited to join efforts with such an innovative company as HAI Technologies. Chemical injection systems require persistent and reliable power, and we believe OPT's PB3 PowerBuoy® can provide prime and augmented power and real-time system control communications which may enable the cost reduction and simplification of transporting chemicals over long distances. Our PowerBuoy complements HAI's modular approach to chemical injection systems by providing cost-effective and persistent power and communications. We are seeing a demand for innovative, cost-saving technologies in the offshore oil and gas industry, and we believe that HAI Technologies' innovative chemical injection capabilities, in combination with OPT's PowerBuoy, will enable our customers to overcome technical hurdles and to deliver significant savings to their operations."

OPT's PB3 PowerBuoy® is a reliable and persistent power and communication platform for remote offshore applications such as advanced multi-functional sensors, modular chemical injection systems for subsea oil production operations, and docking stations for subsea drones. End-users can apply the PB3 to a suite of mission critical payloads while extending their range of operation, lowering their operational costs, and enabling real-time data transfer and decision making.

For more information, visit www.oceanpowertechnologies.com.



Bibby Offshore Extends Charter of Bibby Topaz DSV

Bibby Offshore, the leading provider of subsea installation and services to the offshore oil and gas industry, announced the long-term extension to the charter of its dive-support vessel (DSV) Bibby Topaz, owned by Volstad Maritime. The terms and conditions of the extended charter arrangement have been adjusted to reflect the current market environment and are now based on a more mutual sharing of risk and reward.

This charter extension allows Bibby Offshore to maintain and grow the Group's market share in the North Sea DSV market. As one of the premier DSVs in the North Sea, the Bibby Topaz has been a core part of Bibby Offshore's fleet since its delivery in 2008 and has been identified as the best technical and commercial option for the Group.



The new contract sees Bibby Offshore secure exclusive and uninterrupted access to this asset until 31 December 2019, with flexible options to further extend the charter to the end of 2024.

Bibby Topaz has a proven track record in the North Sea and has continued to win and execute major scopes of work with existing and new clients to date, and as a result of this extension, Bibby Offshore's clients will benefit from having continued access to this vessel.

Howard Woodcock, CEO at Bibby Offshore, commented, "The Bibby Topaz has built a strong reputation with clients and is well-established as our premier DSV in the North Sea. We are delighted to have secured an extension to the charter, which will maintain our capacity in the North Sea over the next two and half years, and allow us to continue to deliver comprehensive support for clients in this region."

For more information, visit www.bibbyoffshore.com.

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Shell's LNG Outlook Finds Total Global LNG Demand Increase

Global demand for liquefied natural gas (LNG) reached 265 million tons (MT) in 2016—enough to supply power to around 500 million homes a year. This included an increase in net LNG imports of 17 MT.

Many expected a strong increase in new LNG supplies would outpace demand growth during 2016. Instead, demand growth kept pace with supply as greater than expected demand in Asia and the Middle East absorbed the increase in supply from Australia, according to Shell's first LNG Outlook.

"Global LNG trade demonstrated its flexibility time and again in 2016, responding to shortfalls in national and regional gas supply and to new emerging demand," said Maarten Wetselaar, Integrated Gas and New Energies Director at Shell. "The outlook for LNG demand is set to grow at twice the rate of gas demand, at 4% to 5% a year between 2015 and 2030."

China and India—which are set to continue driving a



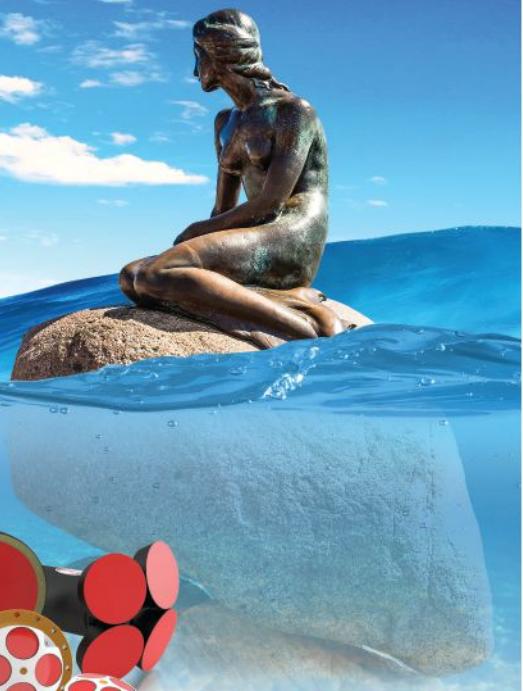
rise in demand—were two of the fastest growing buyers, increasing their imports by a combined 11.9 MT

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Measuring Doppler Profiles to New Depths



Rowe Technologies, Inc.
12655 Danielson Court, Suite 306
Poway, CA 92064 USA
www.rowetechinc.com

of LNG in 2016. This boosted China's LNG imports in 2016 to 27 MT and India's to 20 MT.

Total global LNG demand increased following the addition of six new importing countries since 2015: Colombia, Egypt, Jamaica, Jordan, Pakistan and Poland. They brought the number of LNG importers to 35, up from around 10 at the start of this century.

Egypt, Jordan and Pakistan were among the fastest growing LNG importers in the world in 2016. Due to local shortages in gas supplies, they imported 13.9 MT of LNG in total.

The bulk of growth in LNG exports in 2016 came from Australia, where exports increased by 15 MT to a total of 44.3 MT. It was also a significant year for the USA, after 2.9 MT of LNG was delivered from the Sabine Pass terminal in Louisiana.

LNG prices are expected to continue to be determined by multiple factors, including oil prices, global LNG supply and demand dynamics and the costs of new LNG facilities. In addition, the growth of LNG trade has evolved into helping meet demand when domestic gas markets face supply shortages.

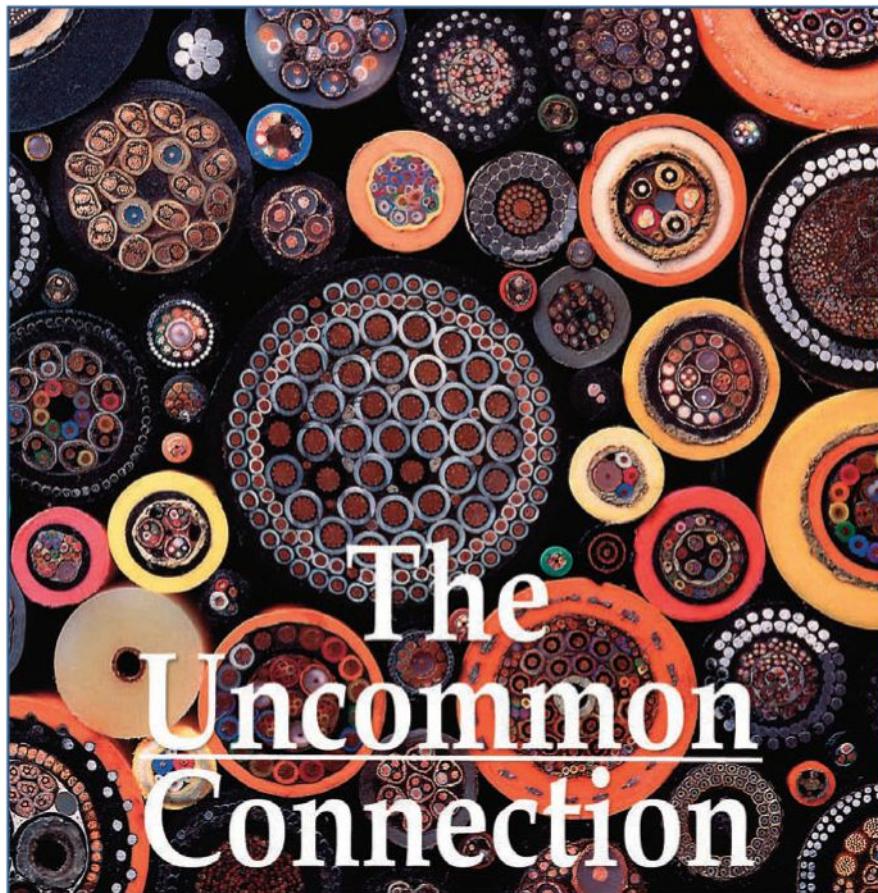
LNG trade also is changing to meet the needs of buyers, including shorter-term and lower-volume contracts with greater degrees of flexibility. Some emerging LNG buyers have more challenging credit ratings than traditional buyers.

While the industry has been flexible in developing new demand, there has been a decrease in final investment decisions for new supply.

Shell believes further investments will need to be made by the industry to meet growing demand, most of which is set to come from Asia, after 2020.

In China, a government target has been set for gas to make up 15% of the country's energy mix by 2030, up from 5% in 2015. Meanwhile, Southeast Asia is projected to become a net importer of LNG by 2035, a significant transformation for a region that includes Malaysia and Indonesia—currently among the major LNG exporters in the world.

For more information, visit www.shell.com.



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Siemens 8-MW Offshore Wind Turbine Up and Running

Siemens Wind Power has installed the latest version of its offshore direct drive wind turbine at the national test center in Østerild, Denmark according to plan. The SWT-8.0-154 is rated at 8 MW and equipped with the proven 154-m rotor. The prototype was certified by DNV GL in January, confirming all relevant safety features for test operation. The new offshore turbine was installed on a steel tower at a hub height of 120 m. The prototype will be used for both mechanical and electrical testing. The final type certificate is expected for 2018.

With the full commissioning of the prototype, Siemens will enter the final development phase for the new turbine that allows for up to 10% higher annual energy production (AEP) under offshore wind conditions than the 7-MW model.

The upgrade to 8 MW enables a rated power increase of more than 14% from 7.0 to 8.0 MW. Similar to the previous upgrade from 6.0 MW to 7.0 MW, the 8-MW turbine will benefit from the established supply chain and proven offshore direct drive technology components. Since the higher rating will be achieved with only a few component upgrades, including a new cooling concept and a new control system, customers will again benefit from key value drivers, including fast time-to-market and low risk.

"The installation of the SWT-8.0-154 prototype in Østerild is an important milestone in the success story of our offshore direct drive wind turbines," states Michael Hannibal, CEO Offshore at Siemens Wind Power. "The evolution based on our platform strategy demonstrates that innovation to lower the cost of wind energy can work without compromising the proven reliability of a technically mature product."

The offshore direct drive is the youngest Siemens wind turbine platform. It has already made an impact.

Recently, 100 years of combined operation were reached with 2.5 terawatt-hours (TWh) of electricity produced. The total energy yield harvested by Siemens offshore direct drive generators installed by the end of 2016 corresponds to the energy demand of all households in the city of Munich for an entire year. This amount of electricity has been produced in less than six years, starting with the first SWT-6.0-120 prototype to large offshore projects now in operation like Westermost Rough in the UK and Gode Wind in German waters. At the same time, Siemens' Offshore Direct Drive platform helped to avoid 1,250,000 metric tons of CO₂ emissions. This corresponds to the emission of all cars in a city the size of Munich over a period of four months. The latest model SWT-8.0-154 is expected to enter serial production in 2019.



Currently, approximately 150 Siemens offshore direct drive wind turbines have been handed over to customers. More than 600 units of Siemens' offshore direct drive wind turbines have been sold since the launch of the large gearless turbine in 2011. The innovative product platform incorporates the unique technical experience from more than 2,300 installed offshore turbines and nearly 1,300 onshore direct-drive wind turbines.

For more information, visit www.siemens.com/wind.

EU SWARMS:

Intelligent Cooperation of Underwater Vehicles with EvoLogics Modems

By: Maria Pleskach, EvoLogics GmbH, Berlin, Germany

EvoLogics GmbH, Berlin, Germany, designs and manufactures underwater information and communication systems as well as smart robotic solutions. The company's core technologies stem from bionic concepts that fuse state-of-the-art engineering with the best ideas found in nature. EvoLogics' "ecosystem" of products includes several series of underwater acoustic modems, underwater positioning systems (USBL, LBL, SBL), and an advanced framework for developers. Development, research, and innovation are the cornerstones of the company—it is an active collaborator of several EU-funded projects, focusing the efforts on communication and positioning for distributed underwater networks.



An exciting example is SWARMS (Smart and Networking Underwater Robots in Cooperation Meshes), an EU project focused on cooperative operation of unmanned underwater vehicles. The SWARMS consortium includes 30 partners from 10 European countries; the collaborators work on unified software and hardware components that will allow heterogeneous AUVs, ROVs, and USVs to link into a smart multimedia sensor network for various automated missions.

The global goal of SWARMS is to make autonomous self-controlled UUV missions more viable for maritime and offshore industries, offering an efficient and versatile solution. Nowadays UUVs are very task specific and hard to operate and their deployment is rather time and cost consuming.

A cooperative swarm of AUVs and ROVs would open new opportunities for industrial operations; instead of a highly specialized vehicle, SWARMS would support several standard vehicle types that combine their functionality to solve most various tasks—from seabed mapping to offshore installations, monitoring, and inspections.

For any cooperative mission, information exchange is crucial. One of the project's objectives is a communication concept that explores new, innovative technologies, whilst ensuring smooth and reliable operation in a high-latency,

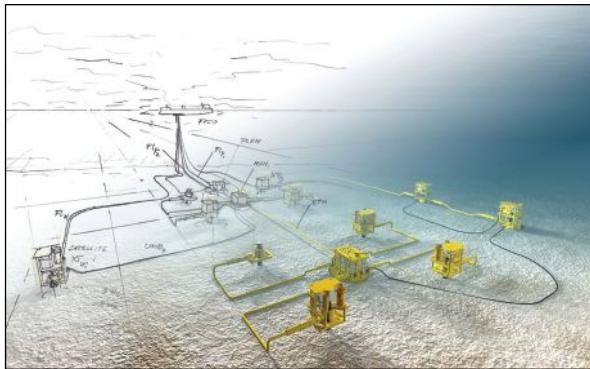
dynamic subsea environment. EvoLogics is proud to collaborate with SWARMS on its hardware and software solutions for underwater communication and networking based on the company's patented S2C technology.

The first stage of the SWARMS field trials took place in September 2016 in the Atlantic (Spain), with 10 days of exhaustive proofs of concepts and validations of the team's technical approach. Seven missions were conducted, including extensive testing of the communication system's performance in real-world operation conditions at sea. Obtained results were encouraging, and a final test demonstrated successful integration of an EvoLogics-powered underwater subnetwork with radio frequency and Wi-Fi. The next project milestones are to be validated in the Black Sea (Romania) in 2017.

Meanwhile, EvoLogics works on further improving its S2C technology: S2C 2.0, enhanced with dynamic carrier arrangement, implements novel modulation and demodulation techniques and aims to set new standards for reliable data transfers in the most challenging environmental conditions. The upgraded S2C 2.0 product line is to be showcased at Ocean Business 2017 in Southampton, UK along with the company's other recent developments.

For more information, visit www.evologics.de.

OFFSHORE ENERGY



A Subsidiary of TechnipFMC has Entered into an Agreement with INPEX

A subsidiary of TechnipFMC has entered into an agreement with INPEX Operations Australia for Riserless Light Well Intervention (RLWI) services in the Ichthys field, approximately 220 km offshore Western Australia, for the Ichthys LNG Project. Under the agreement, TechnipFMC will deploy its deepwater RLWI stack and two Schilling Robotics ROVs, from the Island Performer vessel, to perform riserless well access services on up to 20 subsea wells in the Ichthys field, beginning in 2017.

<http://ont.news/2mwZvOC>

SOC Completes Cable Works on Veja Mate Offshore Wind Farm

Siem Offshore Contractors (SOC) announced that all 73 inner array grid cables of the Veja Mate Offshore Wind Farm have been installed and trenched 10 weeks ahead of schedule. The submarine composite cables were successfully installed since 1 October 2016 using the "Siem Duo" consisting of the Cable Lay Vessel Siem Aimery and the Installation Support Vessel Siem Moxie. The Siem Duo demonstrated its advanced weather operability during the harsh winter season, whereby both the operations of the gangway on the Siem Moxie as well as post-lay trenching by the Siem Aimery were undertaken in significant wave heights of up to 3 m.

<http://ont.news/2lZ6j9C>



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JW FISHERS Save time and money locating subsea cables with a JW Fishers CT-1 Cable Tracker.



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MONTH IN REVIEW

Eni Successfully Appraises Merakes Discovery Offshore Indonesia

Eni successfully drilled and tested Merakes 2, the first appraisal well of the Merakes discovery under the Production Sharing Contract in East Sepinggan.

<http://ont.news/2INatko>

DNV GL Connects Oil and Gas with New Industry Data Platform

The oil and gas industry is recognizing the need to overcome data quality issues and manage the ownership, control, sharing and use of data.

<http://ont.news/2INkkqn>

DONG Energy Invests in Taiwan's Formosa 1

DONG Energy has signed an agreement to acquire a 35% ownership interest in the Taiwanese offshore wind project from local developer Swancor Renewable.

<http://ont.news/2I86aBy>

TOFCO Completes Fabrication of Historic Juniper Topsides

TOFCO recently completed work for the Juniper offshore gas platform topsides at its facility in Trinidad.

<http://ont.news/2mn89SE>

FAR Limited's Prospective Resource Offshore Senegal Increases

FAR Limited of Australia has identified over 1.5 billion barrels of undrilled oil prospectivity in its offshore Senegal acreage.

<http://ont.news/2I5LA51>

SOUL Jack-Up Vessel: the Next Step Up for Offshore Wind

Ulstein and SeaOwls have launched a pioneering heavy-lift jack-up vessel design with a cruciform structural lay-out that is 10% lighter.

<http://ont.news/2lhqR9u>

More Efficient O&G Sector to Widen Portfolio

Research by DNV GL, technical advisor to the oil and gas industry, shows oil and gas companies seeking to rebalance business portfolios and reorganizing for a new era.

<http://ont.news/2lhqNqb>

Farstad Shipping Restructuring Plan Agreed On

Farstad Shipping, Aker Capital, Hemen Holding Limited, and F-Shiplease have agreed on a fully funded financial restructuring of Farstad Shipping.

<http://ont.news/2mneFsL>

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**SHARK
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BARRACUDA

The Barracuda is a new breed of ROV, designed to work in high current. Small, Streamlined, Extremely Powerful and loaded with Advanced Capabilities.

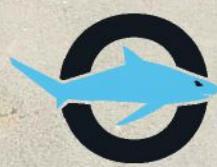
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Shark Marine Technologies Inc. www.sharkmarine.com sales@sharkmarine.com Ph: (905) 687 6672

REACHING THE DEPTHS

A crew in the Gulf of Mexico engages in sediment sampling utilizing an array of scientific rental equipment from Okeanus, including this twelve-position sediment corer being deployed to 2000 meters. Other equipment on the vessel includes our A-frame (pictured), 50HP DT Marine Winch, Sonardyne Ranger 2 GyroUSBL system, and over-the-side pole. **Okeanus provides the latest oceanographic and scientific marine rental equipment for offshore and nearshore projects around the world.**



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Bert Instruments Adds Nexus USBL to Equipment Pool

Since 1993, Florida-based Bert Instruments' team of highly qualified consultants has been providing marine geophysical and environmental studies in the U.S., Caribbean, and Latin America for prestigious major petroleum companies, the U.S. Department of Defense, major universities, and private companies. The company's expertise covers both hydrographic and oceanographic surveys and is headed up by electronic engineer Humberto Guarin Ph.D., skilled in digital image processing and underwater acoustics and with some 30 years' experience the field.

For each project, specialist engineers and equipment, from its own extensive stock, are assembled for the operation and to address any specific challenges to be encountered. One such project recently undertaken by the company and its sister company, Bert Instruments Colombia S.A.S, was a pre- and post-drilling environmental and geophysical study in the deep waters (up to 700 m) off Colombia at the Orca-1 exploratory well, 40 km north of the coast of La Guajira. Surveys, geophysical, and environmental studies were commissioned to comply with government regulations prior to any production phase.

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Survey equipment selection Orca 1.

For the operation, Bert Instruments first selected its side-scan sonar deployed at high resolution linked to a marine magnetometer with positioning of the field and its anomalies provided by its Nexus USBL. In the next phase, the newly acquired Nexus USBL was used to track the Bert Instruments' inspection-class ROV that was investigating the anomalies found in the initial magneto-acoustic survey and to do some transect lines crisscrossing the well position.

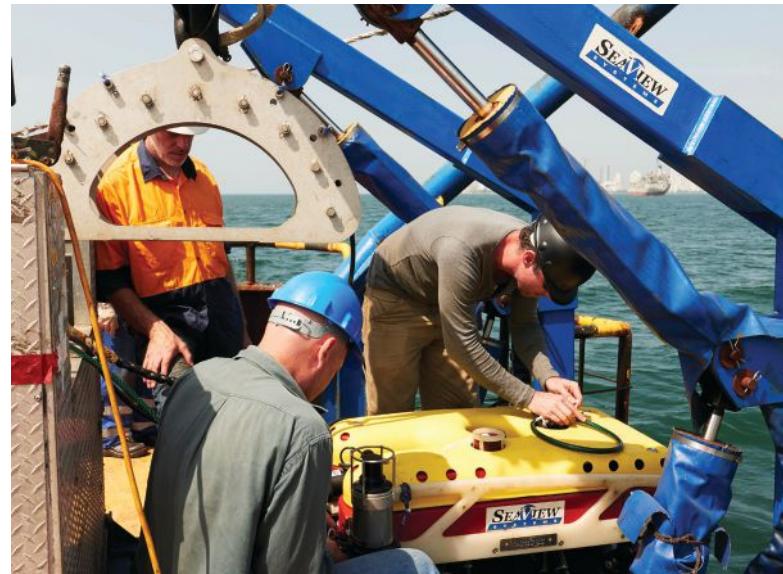
Humberto found the use of this particular selection of advanced equipment for the ORCA 1 survey proved to

be highly satisfactory. "Our Nexus USBL was integrated with a GNSS aided inertial navigation system POS-MV WaveMaster to provide accurate geo-referenced positioning of the seabed anomalies and proved to be a great addition to our system arrangement. We found the Nexus system very easy to use, and it greatly increased our efficiency and overall operational effectiveness."



Seaway with USBL tracking beacon.

"At the end of November 2016, we followed up our original work and surveyed the planned well ORCA 2, close to ORCA 1 using our side scan-sonar, magnetometer and our Nexus USBL for accurate, reliable positioning once again."

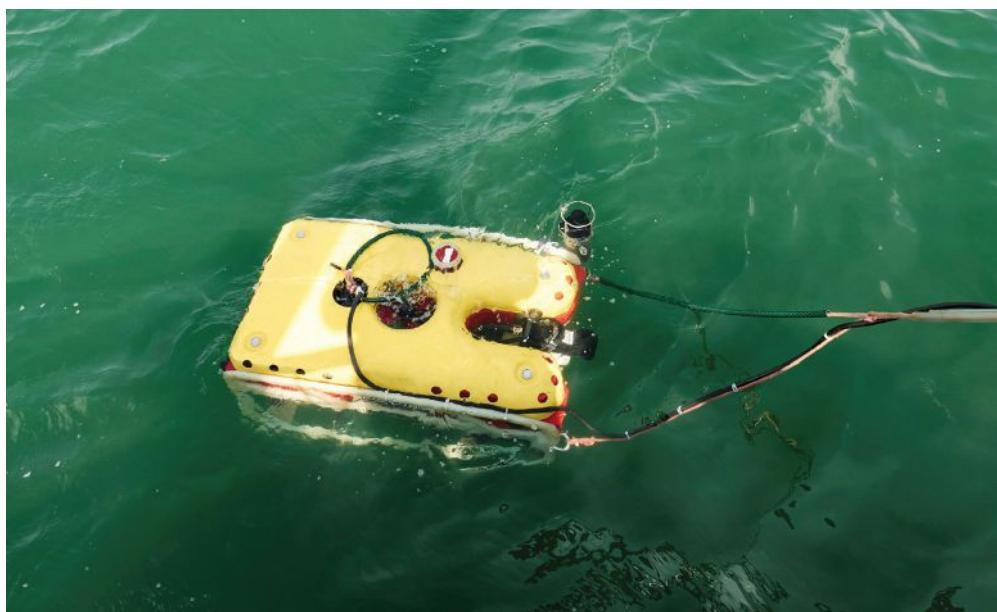


Survey crew preparation.

The side-scan sonar selected by Bert Instruments is the Edgetech 4200 with its Multi-Pulse technology for crisp, high-resolution imagery, and the magnetometer is the Geometrics 882 with its easy portability and high sensitivity features. The Nexus USBL is manufactured by UK-based Applied Acoustics and is the most advanced of the range available with bi-directional spread spectrum technology for increased accuracy.

In order to obtain real-time video images of the seabed, Bert Instruments has configured an entirely new deep water sensor platform, the BerTow, for use on its projects in 2017. This includes a high-definition video and still camera, measuring lasers and depth sensors along with accurate positioning from the Nexus USBL. This newly developed sophisticated system will be used once the trade winds in the ORCA location subside over the winter months.

For more information, visit www.appliedacoustics.com.



Seaeye with tracking beacon in the Columbian Caribbean.



Ocean Sensor Systems

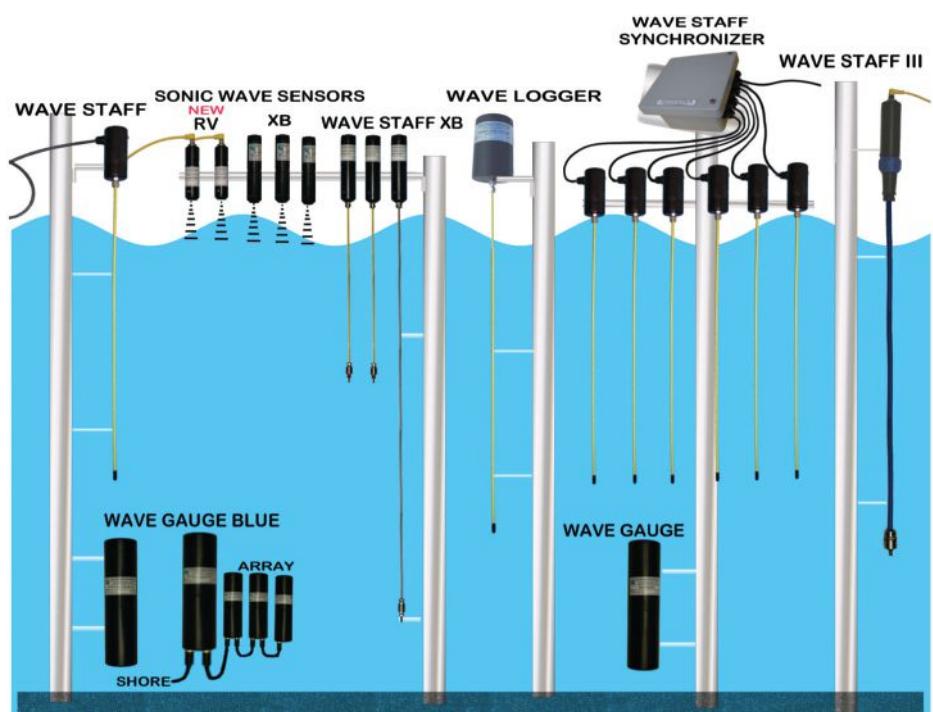
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Wärtsilä to Maximize Availability of PGS's Seismic Vessel Fleet

Wärtsilä and PGS Geophysical AS have signed a service agreement that makes Wärtsilä the preferred service supplier for engines and other Wärtsilä equipment. According to the agreement, Wärtsilä will take care of the maintenance of engines and propulsion systems on board PGS's fleet of eight seismic vessels, securing maximum uptime as well as safe and economic operations. PGS's seismic vessels are used for mapping and analyzing the subsurface beneath the ocean floor for oil and gas exploration around the world.

The three-year agreement was signed in December 2016 and it includes an option for two extra years. In the first phase of the contract, Wärtsilä will optimize the operations and maintenance of the Wärtsilä engines and propulsion systems installed on board PGS's vessels. This allows PGS to optimize its operational costs over the lifecycle of the vessels.

Four of the PGS vessels are also connected to Wärtsilä's Condition Based Maintenance (CBM) solution. The CBM balances safe operations with optimum engine performance and extended times between overhauls. Automatic transfer of data from the installations to the CBM center enables online monitoring and troubleshooting of the engines on board. Wärtsilä analyses the data and provides advice on the optimization of operating parameters as well as preventive maintenance recommendations.

In the second phase of the contract, Wärtsilä and PGS

will identify how PGS can utilize Wärtsilä's digital solutions to further secure maritime uptime and minimize risk and costs.

"We are very proud to announce this new cooperation that makes Wärtsilä the preferred partner for PGS. Ensuring the availability and reliability of a large, globally operating fleet requires a wide service network, which we are able to offer. With Wärtsilä's advisory service and support, PGS is able to concentrate on what they specialize in—offering seismic services for their customers," says Hans Petter Nesse, director, Service Unit Norway, Wärtsilä Services.

PGS operates globally from the company headquarters in Oslo, Norway. The company provides 3D images of the subsurface that oil companies use to find oil and gas reserves. The company provides a broad range of seismic, electromagnetic, and reservoir services, including acquisition, imaging, interpretation, and field evaluation.

"Marine geophysics is a highly specialized and technology-driven area, and the reliability and safety of our fleet is essential as it ensures that we can deliver these services, as promised, to our customers. We are confident that we in turn can rely on the maritime solutions and expertise of Wärtsilä. We are looking forward to the coming years of fruitful cooperation," says Håkon Matheson, global sourcing manager, PGS Geophysical AS.

For more information, visit www.wartsila.com.



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Saab Seaeye Makes Falcon Even Smarter with iCON Control Architecture

The winning formula of the Falcon—the most successful underwater electric robotic vehicle of its class in the world—has received a considerable boost. Saab Seaeye has enhanced the Falcon's already smart intelligent control system with their advanced iCON behavior-based intelligent control architecture. It means the Falcon can now host many new features, making it an advanced platform for further automation and behavior-based software development.

<http://ont.news/2mxrKMP>

Teledyne RESON Announces SeaBat and Teledyne PDS Open Courses

This year, Teledyne Marine again offers a number of courses set at different global locations. The open courses cover Teledyne PDS for Dredge or Multibeam operations and SeaBat training. Teledyne PDS and Teledyne SeaBat Multibeam Sonars are widely used for many seabed mapping and dredging operations. Due to the popularity of the SeaBat and Teledyne PDS, the company also offers a combined training session, giving you everything needed to know from SeaBat installation to producing a deliverable in Teledyne PDS.

<http://ont.news/2I5OWVi>



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Sonardyne Sentinel:

Closing the Gap in Underwater Situational Awareness

Due to their strategic and economic importance, critical national infrastructure (CNI) such as nuclear power plants, dams, LNG terminals, and offshore oil platforms represent attractive targets for sabotage. While these CNI installations have stringent above-the-water security measures, including physical barriers, access control, radar, and long-range opto-electrical sensors, they are not generally equipped to detect intrusions from below the water. That's why constant, real-time underwater monitoring using a diver detection sonar (DDS) can help ensure a facility is fully protected.

However, the reliable detection of underwater threats and the discrimination from marine flora and fauna is a notoriously difficult challenge to overcome. Any intruder detection system must work—and work reliably—in the most

challenging acoustic environments where large vessels come and go, where depth sounders may be continually active, and where relatively still water creates a complex thermal structure. In addition to the environmental factors that increase the difficulty of detection, once a target has been detected, it must also be classified.

Few commercially available DDS systems can lay claim to overcoming these hurdles, but one that can is Sentinel from subsea technology company Sonardyne Inc., Houston. It's now 10 years since the company, perhaps best known for its acoustic positioning and inertial navigation systems, entered the maritime security market with Sentinel—a DDS designed from the outset to be quick to deploy, easy to use, and outperform all other, mainly military-derived technologies.



Sentinel is small and lightweight so is quick to deploy from a boat, install in a port or fix along a coastline—providing users with an instant underwater security shield.

Performance, Coverage, and Protection

Sentinel detects, tracks, and classifies divers and autonomous underwater vehicles (AUVs) approaching a protected asset from any direction and alerts security personnel to the threat. With the ability to identify underwater vehicles at ranges of up to 1,200 m and divers up to 900 m, Sentinel takes reliable, long-range underwater intruder detection to a new level and, since its introduction, has established itself as the most widely deployed system of its type on the market.

An ongoing development program has ensured that Sentinel has kept pace with users' needs and, today, three variants are available. The base system is configured to meet the needs of commercial and infrastructure facility protection projects. It can be used as a standalone security sensor or integrated with third-party C2 (Command and Control) security systems. Support for networked sonars is also offered, meaning that entire waterfronts can be protected from a single operator station.

Sentinel RD (Rapid Deployment) is the expeditionary variant configured for Portable Diver Detection Sonar (PDDS) duties. Its small topside footprint means it is

perfect for short-term operations using offshore patrol vessels (OPVs) and temporary sites on shore. Sentinel XF (Extended Features) is a military-only variant not available to private or commercial users.

Sentinel's compact size and lightweight design make it a practical solution for force protection in support of military ships visiting overseas ports as well as homeland expeditionary roles securing naval bases and ports of embarkation/ debarkation. It was recognized early on that security personnel using Sentinel would not be sonar experts, so all the complexity was engineered into software that remains easy-to-use. In fact, once it's set up, the system can be left to run autonomously.

It's essential that any alarm system does not cause unnecessary workload by falsely reporting the presence of an intruder. Continuous false alarms can also lead to operator fatigue, whereby alarms are mostly ignored knowing that each time it will probably be false. Sentinel's advanced algorithms can intelligently and reliably discriminate a real threat from fauna and flora, eliminating false alarms. This means security personnel are free to monitor other critical systems, safe in the knowledge that Sentinel is keeping watch.



Sentinel detects, tracks and classifies divers and autonomous underwater vehicles (AUVs) approaching a protected asset from any direction and alerts security personnel to the threat.

Four Ships Commission Popular Cable Laying Software

In the last few months, the submarine cable industry's No.1 cable installation software, MakaiLay, has been commissioned on four cable laying vessels around the world. KT Submarine (KTS, Korea) recently completed a challenging installation with one of their cable laying vessels, Segero.

They also commissioned the software on their other vessel, the Responder, and are currently using it to manage a cable installation in the Pacific. "To provide more accurate cable installation services to our client, we started using MakaiLay in our most recent cable lays, and we are impressed with its capabilities," said Mr. Moon, engineer-in-charge, KT Submarine. "Especially useful is the look-ahead feature that allows us to keep the cable on the desired route and to maintain the correct bottom slack by issuing appropriate instructions to the cable engine and the DP operators."

"We have been relying on MakaiLay to safely and efficiently complete installations for the past 18 years on our existing cable laying vessel Subaru."

- Mr. Takayuki Tanaka,
technical senior manager, NTTWEM.

MakaiLay is currently being commissioned on NTT World Engineering Marine Corporation's (NTTWEM, Japan) newly constructed cable laying vessel Kizuna. "This is why we decided to include the software on our newly built cable laying vessel Kizuna as well," says Tanaka.



"We are glad to see that our earliest customers, like NTTWEM, continue to trust our product. By now, the cables they installed while first using MakaiLay are graduating from their teenage years!" said Dr. Venkata Jasti, manager-Submarine cable systems, Makai Ocean Engineering, Inc. "At the same time, we are encouraged to see that newer clients are adopting MakaiLay as they get into more challenging installations. Our recently initiated lease-to-own option has also made it easier for new clients to try the software on a lay for a low-cost, as was the case with PT. Bina Nusantara Perkasa's (BNP, Indonesia) cable ship Nusantara Explorer."

MakaiLay is advanced sub-sea cable installation software that enables users to lay submarine cables with



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the highest level of accuracy, speed, safety, and reliability possible today, dramatically reducing the risk of cable failures. The software has been rigorously tested and validated and is used by over 80% of the global fleet of cable ships on countless commercial lays and military installations to successfully install well over 400,000 km of cable worldwide.

For more information, visit <https://www.makai.com>.

Cable Maintenance: Keeping the Lifeline Operating

Submarine cable system owners must face the realities of cable maintenance but are sometimes unprepared. In times of urgent need—such as during an unplanned network outage—clear channels of responsibility, troubleshooting procedures, problem escalation and even awareness of spares availability and locations are just some of the datapoints that could be needed to expedite a network's return to service and revenue generation. And the information and procedures had better be up to date, accessible by decision makers and have a well-trained and practiced team backing it all up.

Cable Maintenance Authority services are, therefore, a necessity, yet the expertise required is often not available in-house or not available yet in-house. Sometimes the stakeholder interfaces required for a successful subsea cable maintenance authority function aren't shared with other network functions. In addition, the expertise required can become stale if not utilized regularly, yet regular utilization within a single network group usually isn't possible.

Given this reality, Ocean Specialists Inc. (OSI) has for the past two years been providing customers with a Cable Maintenance Authority service where we can take responsibility for the complete Maintenance Authority scope or can work to develop a scope specific to a cable operator's needs.

Although it is still in its early years, the 21st century is clearly becoming the Century of the Internet. In an incredibly short time, the Internet has seemingly changed everything. It has become the world's critically important medium for conducting government and business activities, enabling education and health care services, and providing entertainment for billions of people.

Submarine fiber optic cables make the Internet possible. It took a period of about 15 years at the end of the 20th Century to build out a submarine cable network linking the world's major business, political and communications centers. But that was not enough to keep up with the growing impact of the Internet on people's lives. In the last decade, the web of cables has extended its reach globally, linking vast areas of the developing world as well as some of the most remote and isolated communities on earth. They represent for many, quite simply, a lifeline.

The importance of high-speed Internet access can't be understated. It is now considered a basic human right—a necessity for economic development and social engagement. Without the Internet, communities will be left behind, missing out on the opportunities to improve quality of life.

Just as important as having access to the Internet is keeping that access at all times. The danger of being served by a single submarine cable has been demonstrated again

and again as outages cause the loss of Internet access and result in devastating economic losses. Even diversity through multiple cables does not guarantee undisrupted access. Multiple, simultaneous cable cuts still happen, while single cable outages sometimes eliminate enough capacity that the service on the remaining cables can be unreliable.

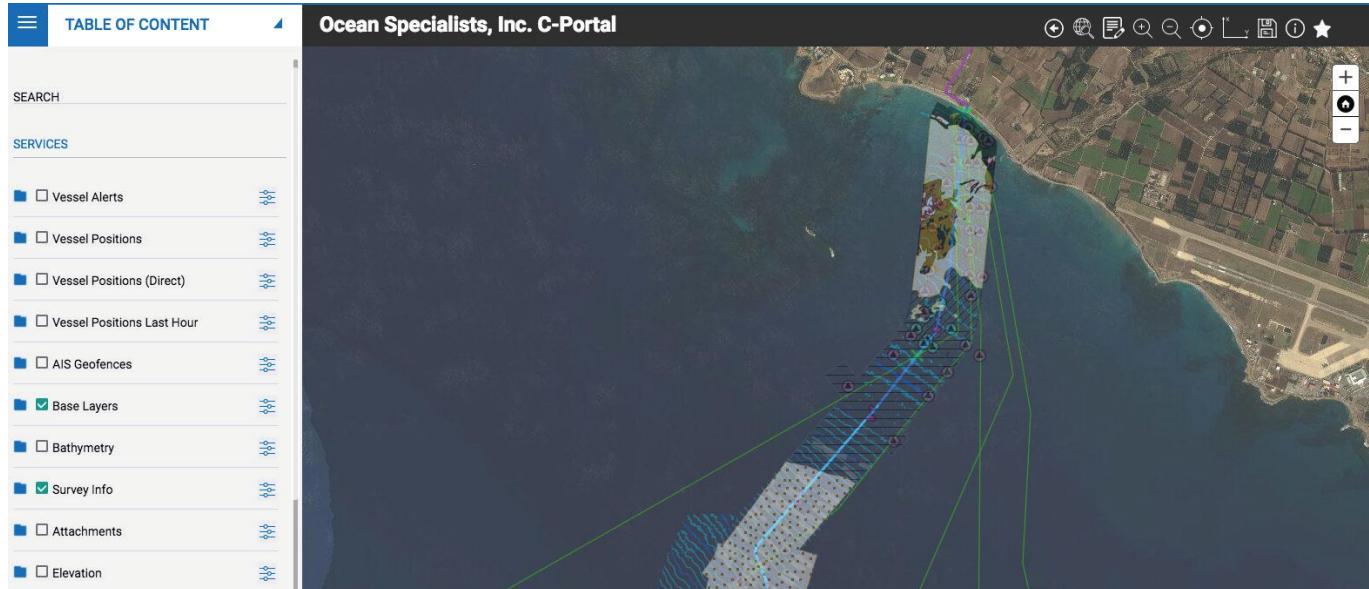
As the Internet and the submarine cables that give it global access grow in importance, the issue of cable maintenance has taken on a growing importance as well. Cable maintenance and cable protection have always been a part of the submarine cable picture, but as Internet traffic grows, its impact on government, business and society grows as well. Outages are not just annoying for residential users who can't check their emails; they have caused airline services to stop, emergency communications to shut down, important events to be cancelled, and other problems that can have an impact on national economies.

Any approach to cable maintenance must be comprehensive in scope—dealing with the myriad of issues individually is not an effective approach. There are five key points in OSI's Cable Maintenance Authority service:

- System Maintenance Administration Services;
- Preventive Maintenance and Risk Mitigation;
- Wet & Dry Spares Inventory Management;
- Network Outage Response, Repair & Return-to-Service; and
- Document Management and Control.

System Maintenance Administration Services include Procedures (establishing and documenting procedures and processes for all maintenance and repair processes), Financial Controls (budgeting and O&M disbursement management), Document Management (the establishment of a document access and control system for all relevant system documentation), Supplier Management (periodic performance reviews and re-bidding as well as system warranty and support liaison), System Performance (annual review and response drill coordination and execution), Cable Crossings (evaluation and approval of crossing requests), and Permit Management (compliance, modifications and applications).

Preventative Maintenance and Risk Mitigation are vital components of any cable maintenance plan. Cable Awareness—seabed user outreach, system information distribution and navigational publication updates—are critically important for the protection of any submarine cable. Geo-fencing is a relatively recent defense strategy for cables that utilizes Automatic Identification System (AIS) technology. This allows OSI to monitor and identify ship traffic in early warning alert zones near the cable, with real-time smart phone alerts to NOC engineers and other key staff.



Representative OSI C-Portal image showing an In-Service Submarine Cable System as-laid route, cable crossings, bathymetry data and satellite imagery. AIS local antenna and satellite data are streamed live and are programmed to interact with early warning Geo-Fence boundaries.

As part of Inventory Management, cable depot audits monitor quality of services and ensure safety and security. Inventory control tracks valuable assets such as wet and dry plant spares.

All of the above-described services and documentation are managed and delivered via OSI's C-Portal™, an AWS Cloud-based platform that combines the power of an ESRI ArcGIS database with the ease of a web browser. The portal allows key OSI and system owner staff to access all system documentation, real-time AIS, and other relevant data feeds, all through a web browser interface that allows geospatially accurate display of the system cable, other cables and pipelines in the region, all crossings and wet plant elements. One of the key advantages of C-Portal is the ability to access all relevant documentation, charts, seabed and other information from anywhere in the world with secure login access, thus allowing both the system owners and OSI staff to be fully informed and take action as quickly as possible.

In spite of all the precautions that can be taken to prevent a cable outage, the reality is that outages can still happen, especially in a turbulent ocean environment. When a fault occurs, cable operators must be ready to respond quickly to assess the nature and severity of the fault, initiate a testing plan, determine the required response and initiate the marine maintenance provider.

Under OSI's Cable Maintenance Authority service, all aspects of the repair response are actively managed, including contractual oversight, establishing baseline repair data and document control. If the fault occurs in shallow water, an ad-hoc repair solution design may be appropriate and OSI can provide budgeting and project management, local asset provider sourcing and permit processing. Once the repair is completed, spares must be replenished and system documentation updated and distributed.

Limiting the downtime of a submarine cable is a necessity in today's world. It is essential to have a well thought-out plan to reduce the likelihood of outages and to

minimize their impact when they do happen. Cable Maintenance Authority services should start early in the development process of any cable system. As the System Owner, having a qualified and experienced Maintenance Authority Service Team is critical to protecting your submarine infrastructure investment.

For more information, visit www.oceanspecialists.com.



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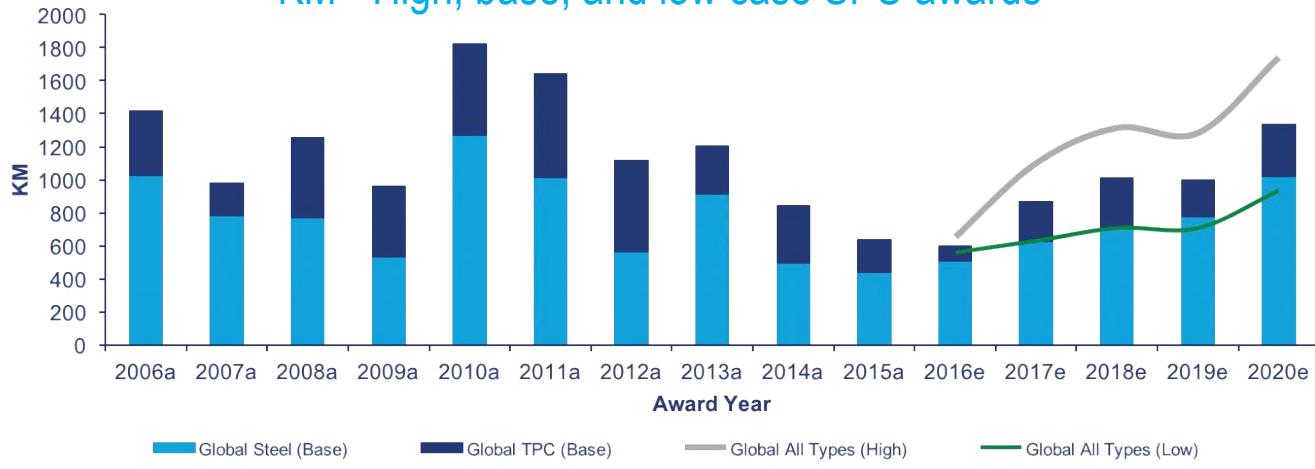
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COMMUNICATION & SUBSEA CABLES

Wood Mackenzie launched its Upstream Supply Chain research in 2016 upon the acquisition of In-field Systems and the data and subscriptions business of Quest Offshore. Together, the upstream supply chain team is working to provide an integrated view of project economics, demand drivers, and supply dynamics to illustrate strategic capacity and cost trends for the oil and gas market.

Global SPU KM demand trends

KM • High, base, and low case SPU awards



Source: Wood Mackenzie

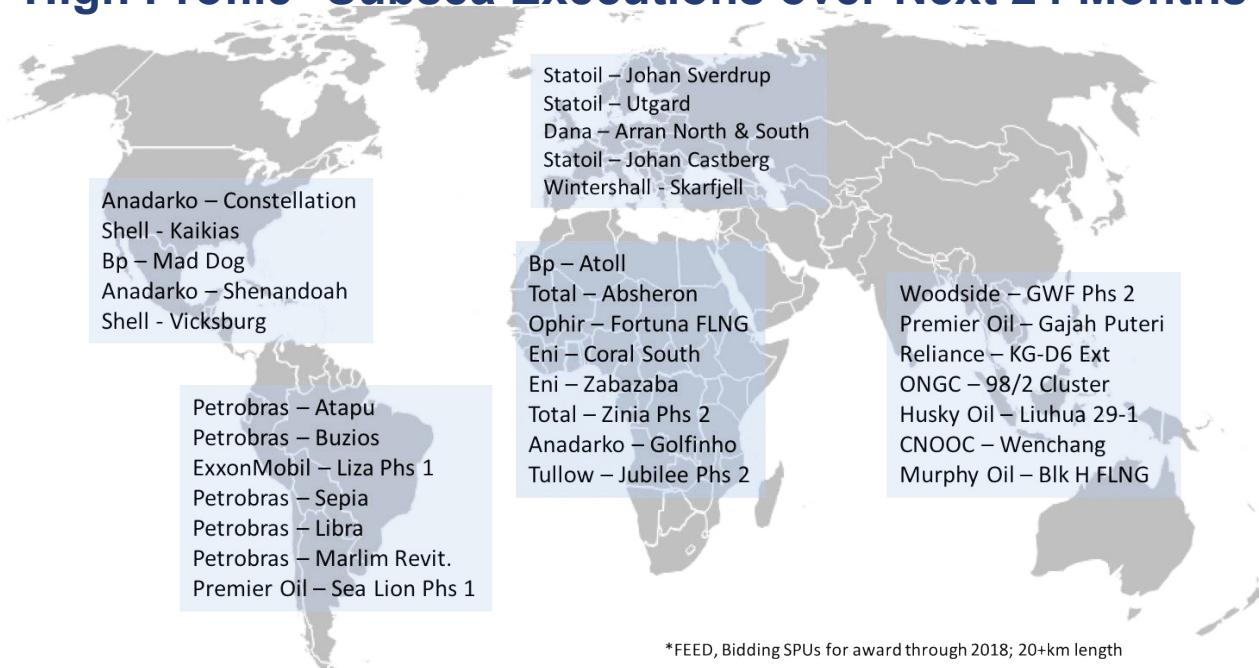
According to Wood Mackenzie's global subsea production umbilical demand forecast, future award expectations through 2020 are down over 25% compared to 2011-2015. This anticipated trend closely follows that of the overall subsea market. Wood Mackenzie's upstream supply chain team expects 2017 to be a transition year towards a recovery trend.

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High Profile* Subsea Executions over Next 24 Months

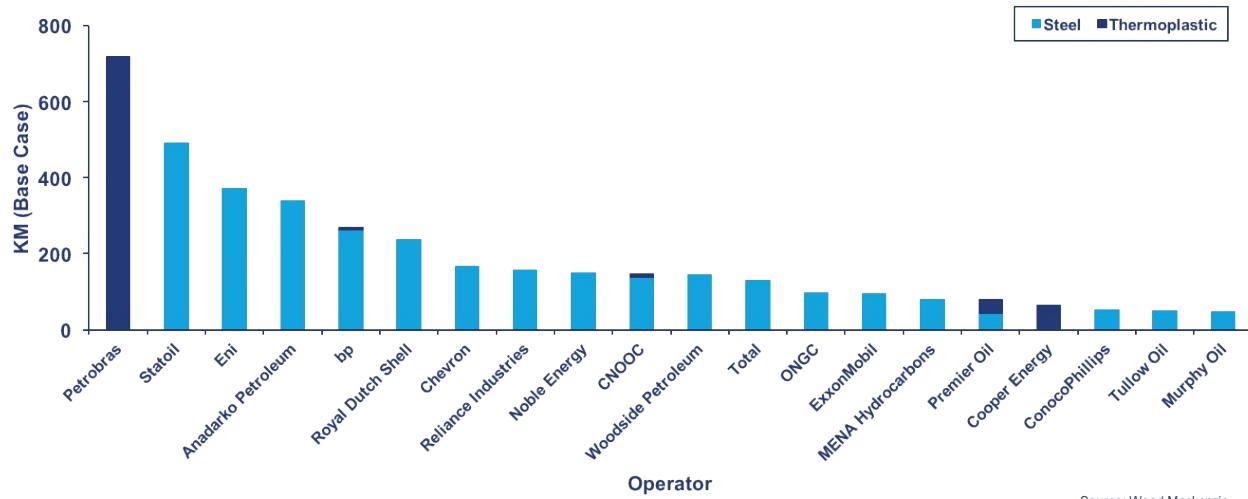


*FEED, Bidding SPUs for award through 2018; 20+km length

According to the Wood Mackenzie's upstream supply chain research, the next few years' worth of subsea production umbilical demand will be driven by projects delayed through the downturn that have emerged more efficient with better project economics in the face of a lower for longer oil price outlook. A diverse mix of project type and operators in most major deepwater basins provides a strong foundation for optimistic expectations compared to recent history.



2016e - 2020e SPU Total Forecast Awards



Source: Wood Mackenzie

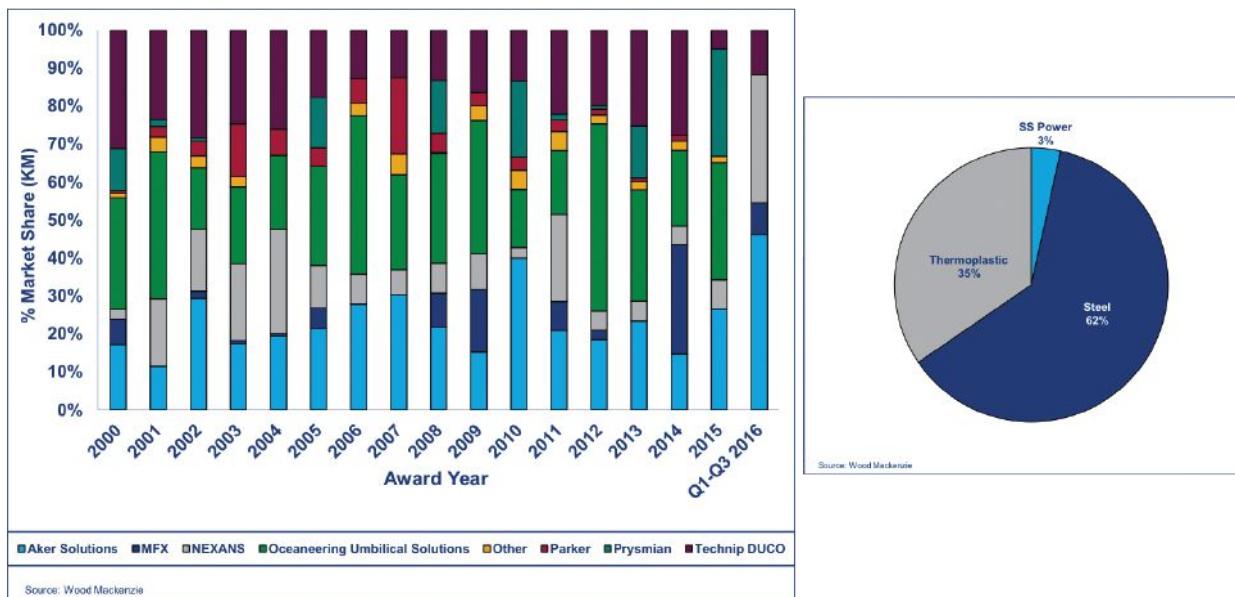
Speaking of oil company activity, Wood Mackenzie's analysis illustrates the top 20 operators driving over 80% of future demand globally. Over 35% of the top operator activity comes from national oil companies, including Statoil, Petrobras, CNOOC and ONGC. Closely reflecting the overall trend, almost 80 percent of demand from the top 20 oil companies is steel-tubed product. Petrobras is the global leader in thermoplastic-tubed umbilical demand and has deployed the product in both their tradition fields as well as their new pre-salt developments.

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Global SPU Manufacturer Market Share



Source: Wood Mackenzie

Through the upstream supply chain team's coverage of the supply side of the market, we see that Aker Solutions, TechnipFMC and Oceaneering have been dominant in long-term market share. This success has to do with their long established capabilities within the market, aligning themselves with the operators strongly committed to ongoing subsea development and for TechnipFMC and Oceaneering, being able to manufacture both thermoplastic-hosed and steel-tube umbilical product. The historical break-out among umbilical type strongly mirrors those trends expected in the future with steel-tubed product contributing the most to demand.

COMMUNICATION & SUBSEA CABLES



Global Marine Renews Contract for Atlantic Cable Maintenance Agreement

The SEA-ME-WE 5 Consortium announced that Global Marine Systems Limited has been awarded the renewal of the Atlantic Cable Maintenance Agreement (ACMA), alongside its Atlantic partner for maintenance services, Orange Marine. The new contract began on January 1, 2017, and runs for five years, through to December 2021. ACMA is a non-profit cooperative subsea maintenance agreement consisting of 60+ members. ACMA members are companies responsible for the operations and maintenance of undersea communications and power cables, as well as Oil & Gas Platform operators, in the Atlantic, North Sea, and South Eastern Pacific Ocean.

<http://ont.news/2my6mY7>

Pharos Offshore Adds New Trenching ROV (TROV) to Fleet

Pharos Offshore have recently completed the development and enhancement of a 2,500-m rated SMD-built tracked (or free-flying) jet trencher, which has subsequently been named the UTV400. The 400-hp Trenching ROV (TROV) set the benchmark for cable maintenance scopes when it was first introduced into the offshore market. Pharos Offshore has now brought the system back in-line with current working practices by modernizing the equipment and doubling the burial capabilities.

<http://ont.news/2IO3KH0>



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A photograph of a large offshore oil platform at night. The platform is illuminated by its own lights, creating a bright glow against the dark sky. In the background, a bright moon is visible, casting a reflection on the water. The overall atmosphere is industrial and dramatic.

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MONTH IN REVIEW

Hawaiki Survey Completed, Manufacturing & Permitting Progress Swiftly

Hawaiki Submarine Cable LP and TE SubCom announced the completion of the route survey for Hawaiki, scheduled for completion in mid-2018.

<http://ont.news/2lsP2CK>

NEC Supplies New Cable System Connecting Hong Kong and Guam

NEC Corporation announced the signing of a contract with RTI Connectivity to supply a new system connecting Hong Kong and Guam.

<http://ont.news/2lOc2Pf>

Hawaiian Telcom Announces SEA-US Cable has Secured FCC License

Hawaiian Telcom announced that the FCC has approved the landing license for the state-of-the-art Southeast Asia – U.S. (SEA-US) fiber cable system.

<http://ont.news/2my0iyJ>

SES and Satcom Global Sign Agreement for Global Ku-band Network

Satcom Global, a leading provider of global satellite communications services to the maritime and land sectors, will become a key partner for SES.

<http://ont.news/2IPKyZD>

Groundbreaking Held for Samoa Cable Landing Station

The groundbreaking ceremony for the Samoa Submarine Cable Company's (SSCC) landing station for the Tui Samoa Submarine Cable took place in Vaivase.

<http://ont.news/2mEDVXH>

IFCS, Tiger Infrastructure to Build Ireland-France Cable

Ireland-France Subsea Cable Limited (IFSC) announced a partnership with Tiger Infrastructure Partners to finance and construct IFC-1.

<http://ont.news/2lsUwgT>

VBMS Awarded Inter-Array Cabling Contract for East Anglia ONE

VBMS, a subsidiary of Royal Boskalis Westminster N.V., has been awarded a cabling contract for the East Anglia ONE offshore wind farm.

<http://ont.news/2mAPr70>

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Bollinger Delivers Fast Response Cutter to U.S. Coast Guard

Bollinger Shipyards has delivered the USCGC Bailey Barco, the 22nd Fast Response Cutter (FRC) to the U.S. Coast Guard. The Coast Guard took delivery on February 7, 2017, in Key West, Florida and is scheduled to commission the vessel in Ketchikan, Alaska in June 2017.

"We are pleased to announce the delivery of the latest FRC, the USCGC Bailey Barco," said Ben Bordelon, Bollinger president & C.E.O. "This FRC built by Bollinger Shipyards will join the USCGC John McCormick stationed in the 17th Coast Guard District in Ketchikan, Alaska and will defend our Nation's interests in the Alaskan maritime region. FRCs already in commission stationed in the mid-Atlantic and the South Eastern U.S. have seized multiple tons of narcotics, interdicted thousands of illegal aliens and saved many lives. The FRC program is a model program for government acquisition and has surpassed all historical quality benchmarks for vessels of this type and complexity. The results are the delivery of truly extraordinary Coast

Guard cutters that will serve our Nation for decades to come. We at Bollinger Shipyards are looking forward to hearing of the heroic exploits of the Bailey Barco as it joins the Coast Guard's operational fleet."

The 154-ft patrol craft USCGC Bailey Barco is the 22nd vessel in the Coast Guard's Sentinel-class FRC program. The FRC has been described as an operational "game changer" by senior Coast Guard officials. Two FRC's will now be stationed at the 17th Coast Guard District in Ketchikan, Alaska. Previous cutters have been stationed in the 7th Coast Guard District in Florida or San Juan, PR, and two have been stationed in the 5th Coast Guard District in Cape May, New Jersey. To build the FRC, Bollinger used a proven, in-service parent craft design based on the Damen Stan Patrol Boat 4708. It has a flank speed of 28 knots, state-of-the-art command, control, communications and computer technology, and a stern launch system for the vessel's 26-ft cutter boat.

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Each FRC is named for an enlisted Coast Guard hero who distinguished him or herself in the line of duty. This vessel is named after Coast Guard Hero Bailey Barco, who was awarded the Gold Lifesaving Medal on October 7, 1901, for his heroic and selfless action

to rescue the crew of the Jennie Hall, a schooner that had been grounded during a severe winter storm off the coast of Virginia Beach, Virginia.

For more information, visit www.bollingershipyards.com.

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Sonardyne
SOUND IN DEPTH
SUBSEA TECHNOLOGY

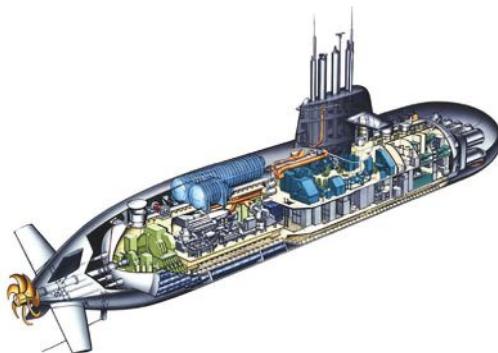
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Thyssenkrupp Named Strategic Partner to the Norwegian Navy

Following an extensive selection process by the Norwegian Defense Ministry, Thyssenkrupp Marine Systems—a leading global system provider for submarines and naval surface vessels—has been chosen as a strategic partner to the Norwegian Navy. The new German-Norwegian partnership is based on the joint purchase and lifetime management of identical submarines, which are to be delivered in the second half of the period 2020-30. In the selection process to find the best submarine partner, Norway pursued an evolutionary approach.

<http://ont.news/2l6Jmq>

Kelvin Hughes to Supply Radar Systems for the Royal Navy

Kelvin Hughes announced in April 2015 that it had been selected to supply its SharpEye™ systems for the new Batch 2 River-class offshore patrol vessels (OPVs): HMS Forth, HMS Medway, and HMS Trent. Now, the company is delighted to announce that it will also be supplying the same industry-leading radar equipment for the two latest Batch 2 ships: HMS Tamar and HMS Spey. Each ship will be equipped with a SharpEye™ I-Band radar for helicopter control and navigation as well as an E/F-Band SharpEye™ radar for navigation and collision avoidance. In addition, Kelvin Hughes will be supplying its ARPA widescreen radar display for all of the Batch 2 OPVs.

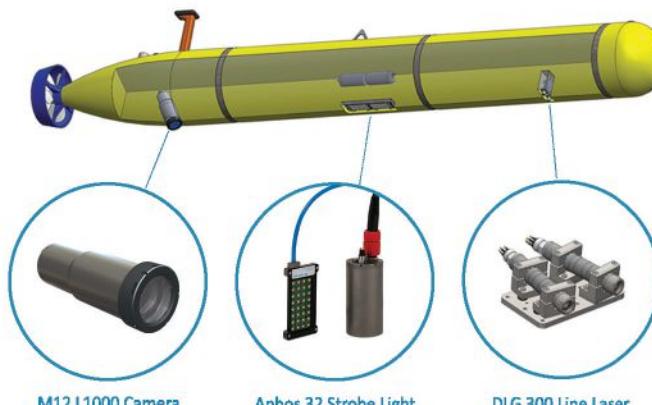
<http://ont.news/2mEGJnH>



March 2017

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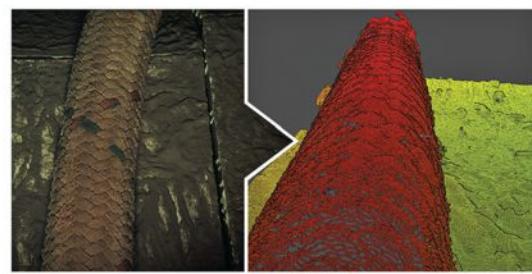
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MONTH IN REVIEW

Future USS Rafael Peralta (DDG 115) Delivered to the Navy

The U.S. Navy accepted delivery of future guided-missile destroyer USS Rafael Peralta (DDG 115) during a ceremony on February 3.

<http://ont.news/2m5aZvf>

US Coast Guard Awards Navigation System Contract to FLIR Maritime

The Coast Guard's Command, Control and Communications Engineering Center (C3CEN) awarded a contract to FLIR Maritime US, Inc. for the (SINS-2).

<http://ont.news/2lsFkjO>

USNS Yuma Completes Acceptance Trials in Gulf of Mexico

Future expeditionary fast transport USNS Yuma (EPF 8) successfully completed acceptance trials after underway evaluation in the Gulf of Mexico.

<http://ont.news/2mEAxMq>

U.S. Navy Christens Future USS Tulsa (LCS 16)

Future USS Tulsa (LCS 16) was christened February 11, in Mobile, Alabama, with VCNO Adm. Bill Moran delivered the keynote address.

<http://ont.news/2lOercz>

BAE Systems to Modernize USS Roosevelt under New Contract

The U.S. Navy has awarded BAE Systems a \$51.3 million contract for the maintenance and modernization of the USS Roosevelt (DDG 80).

<http://ont.news/2mEJ9CN>



Huntington Ingalls Receives Contract for Aircraft Carrier Enterprise

HII was awarded a \$25.5 million modification to an existing advance planning contract in support of advance fabrication of the Enterprise.

<http://ont.news/2lO1dNc>

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OFFSHORE STATS & DATA

Crude & Natural Gas Spot Prices

Prices in USD as of February 24th, 2017

March 2017

56

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\$54.03

\$53.22 previous week



TRENDING UP



Cushing, OK
WTI Spot Price

\$2.62

\$2.87 previous week



TRENDING DOWN

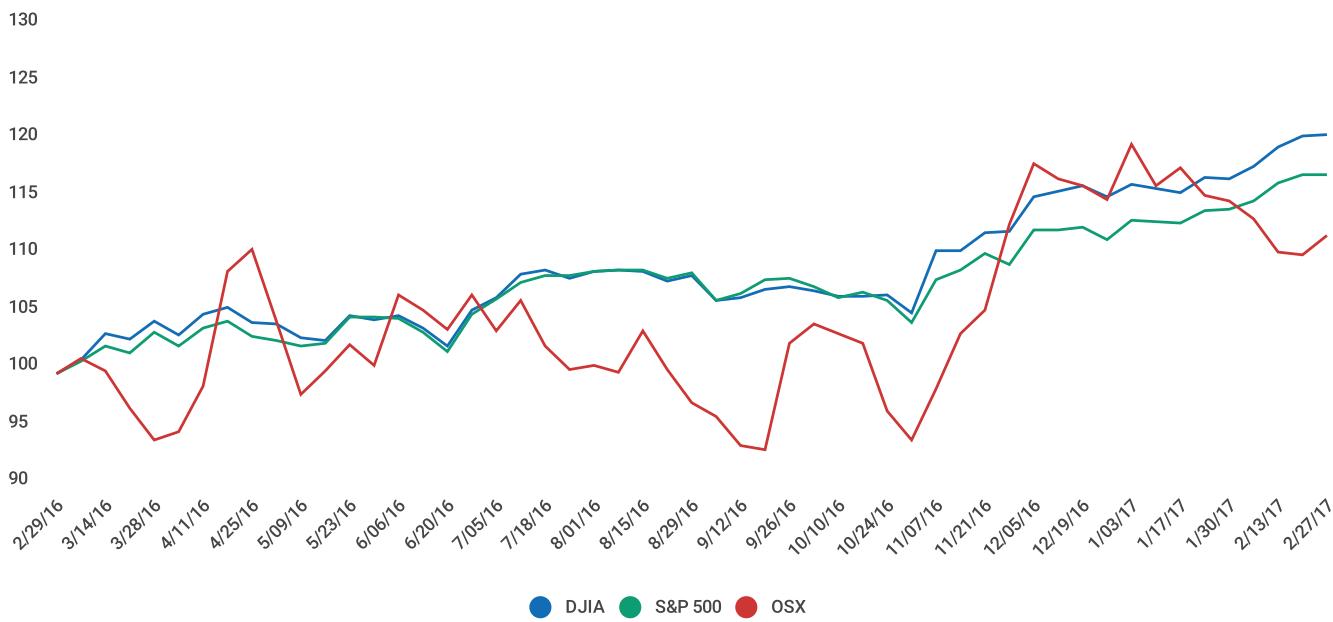


Henry Hub
Spot Price

Oil & Gas Industry Trends

Key Equity Indexes

Cumulative Percentage Change - as of 2/27/17



March 2017

57

Ocean News & Technology

120.81

120.74 previous week



TRENDING UP

DJIA

117.40

117.30 previous week



TRENDING DOWN

S&P 500

112.04

110.36 previous week



TRENDING UP

OSX

OFFSHORE STATS & DATA

Waiting For The Offshore Recovery

The offshore drilling sector has been one of the most devastated in the 2.5 year oil price downturn. To appreciate how much harm has been done, the chart shows the monthly international offshore drilling rig count in the green shaded area and the United States offshore drilling rig count as the blue line. Both the U.S. and international offshore drilling rig count movements mirror each other since 2014, a time when crude oil prices were north of \$100 a barrel.

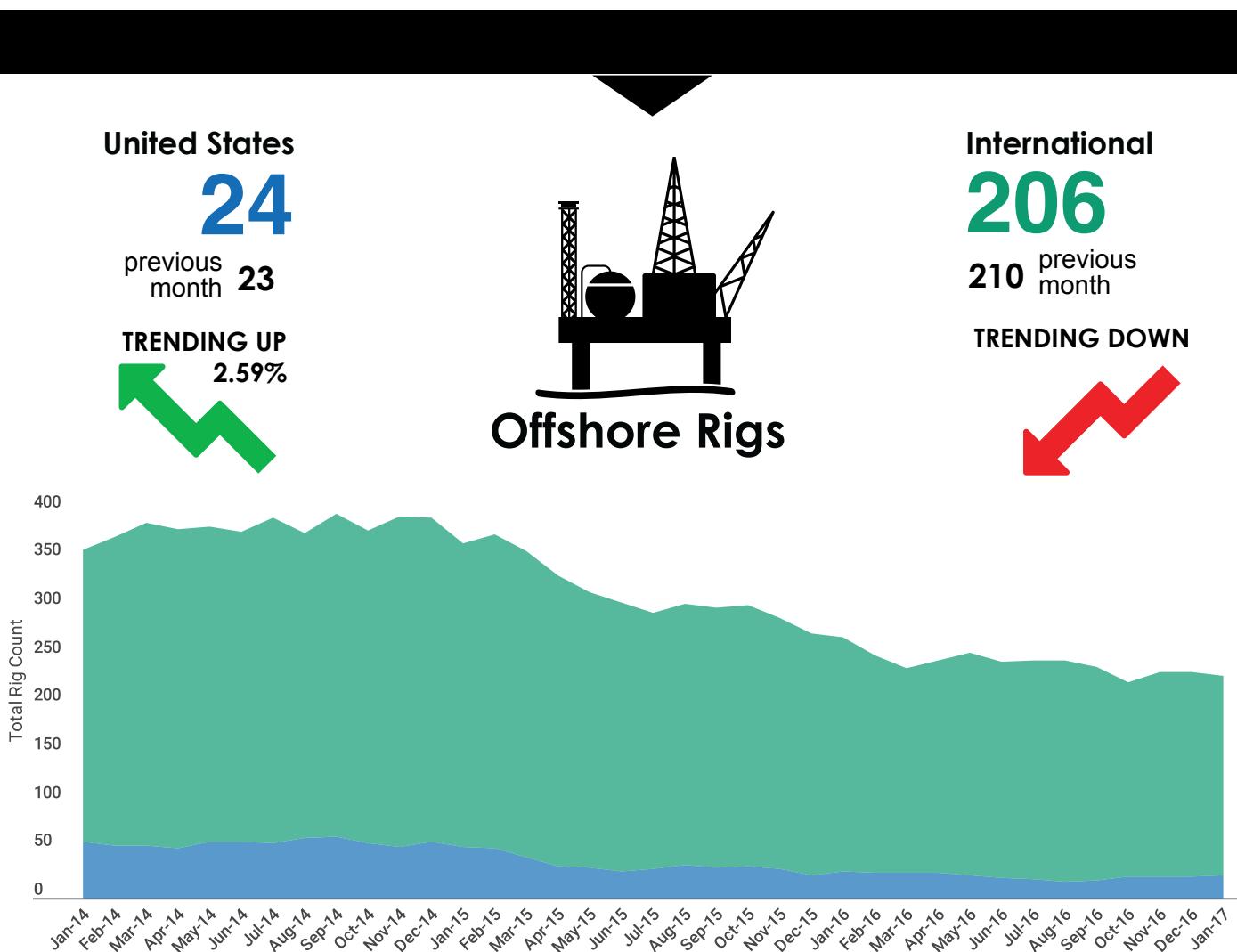
As the U.S. rig count shows, it has been cut by more than half—58 to 24 active rigs between January 2014 and January

2017. The international offshore drilling rig count has fallen by not quite one-third over the time period—302 to 206 active rigs. These data come from Baker Hughes, which means they do not reflect offshore drilling rigs that are working doing tasks other than drilling. We converted the weekly U.S. offshore rig count data to monthly averages to match the international rig count Baker reports. What the time lag in reporting international data provides is an opportunity for us to see what has happened in the Gulf of Mexico in the intervening month. There, in February, the rig count dropped by four from January's total, meaning that the

“With 94 offshore drilling rigs scheduled to be delivered this year...rig supply will suppress any recovery in day rates”

March 2017

Ocean News & Technology



By: G. Allen Brooks

decline in activity from January 2014 is nearly 66% compared to the prior month's decline of only 61%.

Todd Hornbeck, CEO of Hornbeck Offshore, a leading Gulf of Mexico supply vessel operator, told investors and analysts on his company's earnings conference call in mid-February that, "Earlier in this cycle, the industry mantra was lower for longer. The message we have recently been hearing from our customers, almost uniformly, is that they now see oil prices as lower forever. They no longer view this as a U-shape recovery, but an L-shaped recovery, or so we're told." If this view is true, a recovery in offshore drilling is many quarters away, and not months as many industry participants had been hoping.

The pain and suffering in the offshore sector will continue through much of 2017 at a minimum, even with a stabilization of rig count activity. The problem is that another analysis of 2017 market demand by an offshore consulting company suggests that there will be almost as many contracts terminating as in 2016. With 94 new offshore drilling rigs scheduled to be delivered this year, the weight of rig supply will suppress any recovery in day rates, a needed relief for contractors who are desperate for increased revenues in order to retain staff and maintain equipment. There may not be enough cash to pay interest and bond maturities meaning offshore companies are facing a bleak near-term outlook that may force increased merger, acquisition and liquidation. Ultimately 2017 may reflect the darkness before the dawn.

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www.oceanbusiness.com

Deep Sea Mining Summit
London, UK
May 22-23
www.deepsea-mining-summit.com

Offshore Wind Energy
London, UK
June 6-8
<http://offshorewind2017.com>

Seawork Int'l
Southampton, UK
June 13-15
www.seawork.com

Oceans Aberdeen
Aberdeen, UK
June 19-22
www.oceans17mtsieeaberdeen.org

UTC
Bergen, Norway
June 20-22
www.utc.no/conference

MCEDD
Amsterdam
April 3-5
<http://mcedd.com>

Offshore Energy
Amsterdam
October 9-11
<http://offshore-energy.biz>

Wind Europe
Amsterdam
November 28-30
<https://windeurope.org/confex2017>

MAST
Tokyo, Japan
June 12-14
<https://mastconfex.com>

UASUV
Marathon Bay, Greece
May 17-19
www.unmanned-v.com

International Cables
Dubai, UAE
April 25-26
<https://cablesevent.iqpc.ae>

UDT
Bremen, Germany
May 30 - June 1
www.udt-global.com

ADIPEC
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November, 13-16
www.adipec.com

World Congress of Ocean
Shenzhen, China
November 3-5
www.bitcongress.com/WCo2017/default.asp

Philippines Marine
Manila, Philippines
July 12-14
<http://philmarine.com>

Submarine Networks World
Singapore
September 25-27
www.terrapinn.com/conference/submarine-networks-world/index.stm

Asia Pacific Deep Sea Mining
Singapore
November 9-10
www.asia.deepsea-mining-summit.com

2017 EDITORIAL CALENDAR

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CALENDAR

JANUARY

Editorial: Underwater Navigation; Manned Submersibles Research & Development Services
Product & Services Focus: Multibeam & Side Scan Sonar; Research & Development Services

FEBRUARY

Editorial: Oceanology & Meteorology; Decom & Abandonment
Product & Services Focus: Buoys & Monitoring Instrumentation; Environmental Monitoring/Testing Services

MARCH

Editorial: Subsea Fiber Optic Networks; Maritime Security
Product & Services Focus: Connectors; Cables & Umbilicals; Diver Detection Systems

APRIL

Editorial: Offshore Technology; Ocean Mapping & Survey
Product & Services Focus: Subsea Tools & Manipulators; Batteries; Training/Safety

MAY

Editorial: Autonomous Unmanned Vehicles; Defense & Naval Systems
Product & Services Focus: Tracking & Positioning Systems; Seismic Monitoring; Equipment Leasing/Rental Services

JUNE

Editorial: UW Imaging & Processing; Marine Salvage/UW Archaeology
Product & Services Focus: Magnetometers; Water Dredges & Airlifts; Diving Services

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JULY – Digital Distribution Only

Editorial: Ocean Engineering; Marine Construction
Product & Services Focus: Navigation, Mapping & Signal Processing; Data Processing Services

AUGUST

Editorial: Workclass ROVs; Deepwater; Pipeline/Repair/Maintenance
Product & Services Focus: Cameras, Lights & Imaging Sonars; Oil Spill Clean-Up Services

SEPTEMBER

Editorial: Ocean Observing Systems; Subsea Telecom; Offshore Wind Installation & Maintenance
Product & Services Focus: Water Sampling Equipment; Cable Installation Services

OCTOBER

Editorial: Offshore Communications; Subsea Inspection, Monitoring, Repair & Maintenance
Product & Services Focus: Acoustic Modems, Releases & Transponders; Marine Communications; Survey & Exploration Services

NOVEMBER – Digital Distribution Only

Editorial: Offshore Support, Supply & Emergency Vessels; Deep Sea Mining
Product & Services Focus: Ship Protection Systems; Cranes, Winches & Control Systems; Vessel Charter/Leasing Services

DECEMBER

Editorial: Light Workclass ROVs; Commercial Diving; Year in Review
Product & Services Focus: Diving Equipment & Services; Buoyancy Materials; Construction & Repair Services

March 2017

Ocean News & Technology

SHOW DISTRIBUTION

JANUARY

UDT Asia – January 17-18*
Marine Data Infrastructure GCC – January 30-31*
Euromaritime January 31– February 2
GoM Oil Spill & Ecosystems – February 1-9
Oil North America – February 14-16

FEBRUARY

Underwater Intervention – February 21-23
US Hydro – March 20-23*

MARCH

Canadian Underwater Conf & Expo – March 26-28
Ballast Water Management – March 29-30
MCE Deepwater Development – April 3-5
Ocean Business – April 4-6
Telecom Exchange – June 20-21*

APRIL

Int'l Offshore Wind Forum – April 19-21*
OTC – May 1-4
AUVSI XPONENTIAL – May 8-11
IOSC – May 15-18
Deepwater Decomm Workshop – May 23-24♦

MAY

UDT – May 30 – June 1
Offshore Wind Energy Europe – June 6-8♦
Seawork Int'l – June 13-15

JUNE

TBD

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Philippines Marine – July 12-14 *♦

AUGUST

TBD

SEPTEMBER
Oceans 17 – September 17-21
AWEA Offshore Wind – October 24-25♦
WindEurope November 28-30♦

OCTOBER

Oilcomm – October 3-5♦
MTS Dynamic Positioning – October 9-11♦
Offshore Energy – October 9-11
Offshore Well Intervention GoM – TBD*♦
Clean Gulf – December 5-7

NOVEMBER – Digital Distribution Only

World's Congress of Ocean – November 3 – 5*
International Workboat – November 29 – December 1*♦

DECEMBER

TBD

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♦ Pending



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MILESTONES



Hydro Group Named Company of the Year at Subsea UK Awards

Aberdeen-headquartered Hydro Group plc is delighted to have secured the Company of the Year title at Subsea UK Awards. The cable and connector specialist was recognized for its performance in the subsea sector and its significant development to date as well as its plans for future success and growth, both in the UK and internationally. The annual awards, held at the Aberdeen Exhibition and Conference Centre, highlight the achievements of individuals and companies throughout the subsea industry and are the most prestigious awards in the subsea sector.

<http://ont.news/2ITDucD>

TDI-Brooks International Acquires Engineering Firm Certification

Effective 20 January 2017, TDI-Brooks International, Inc. acquired Engineering Firm certification with the State of Texas due to extensive experience in the area of offshore environmental, geotechnical, and geological site investigations, and expands offerings to include seafloor and subsurface soil engineering services.

<http://ont.news/2l8Rbr5>



March 2017

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URI's Coastal Resources Center Wins 2017 Peter Benchley Ocean Award

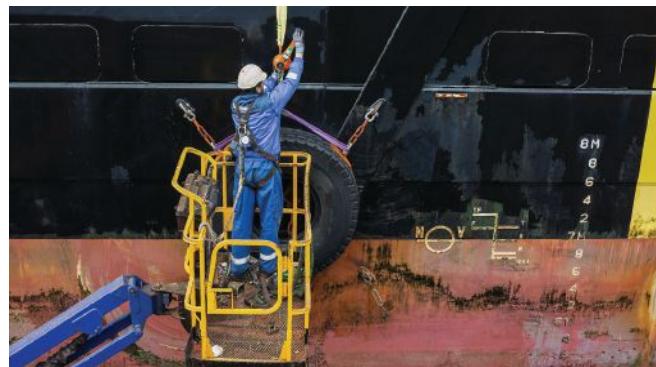
Jennifer McCann, director of U.S. coastal programs for the Coastal Resources Center at the University of Rhode Island and extension director of Rhode Island Sea Grant, has received an international award for her work in coastal and ocean planning. McCann is the recipient of the 2017 Peter Benchley Ocean Award for her Rhode Island Ocean Special Area Management Plan, or Ocean SAMP, which provides regulations for the management and protection of Rhode Island's ocean resources and activities.

<http://ont.news/2mBljYe>

Damen Shiprepair & Conversion Yards Achieve More ISO Certifications

A number of Damen Shiprepair & Conversion yards have recently or will soon achieve new ISO certifications as part of an ongoing initiative to standardize operating procedures across the group. This demonstrates a commitment to excellence to both current and prospective clients. Damen Shiprepair Amsterdam (DSAm) and Damen Shiprepair Vlissingen (DSVi) have passed ISO 3834-2 certificate audits.

<http://ont.news/2IQow96>



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Introducing the New 2017 Ocean Industry Directory

Scheduled for release in January 2017, the updated Ocean Industry Directory provides a dedicated solution for finding product and service providers. Avoid searching multiple, incomplete directories that fail to consolidate ocean industry companies in one place. The comprehensive, easy-to-use Ocean Industry Directory takes the mystery out of corporate listings by distinguishing between manufacturers, sellers, rental agents, and service providers.

Get Listed!

The Ocean Industry Directory is featured in every issue of Ocean News & Technology's print and digital magazines, providing exposure across multiple media channels that is important in a competitive marketplace. In addition, the Ocean Industry Directory is a key component of www.oceannews.com and updated on a monthly basis.

Key Features

If you're interested in becoming a part of the Ocean Industry Directory, consider the benefits of adding your own corporate listing. Key features include:



Company Listing

Offers companies the opportunity to list their company name, address, phone number, and website. All listings submitted through the website will be screened by a moderator to ensure that they align with the mission of the Ocean Industry Directory.



Search by Product or Service

Each listing will be categorized according to the product and or service offered by the company. The directory lists over 200 different oceanographic categories. Users will be able to search the categories listed within the directory to easily find information regarding companies associated with the products and services they are researching.



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Contact: Gary Brown, Sales Manager



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- Provor and Arvor profiling subsurface floats (ARGO project): CTD, dissolved oxygen, BGC, deep; Argos and Iridium transmission.
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