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& TECHNOLOGY

News for the Ocean Industry

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TODAY'S AUVS ARE REVEALING
THE OCEAN'S SECRETS

Feature Story - Page 10





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in this issue

Ocean Industry



Offshore Industry



Feature Story

10 Equipped with More Capability than Ever, Today's AUVs are Revealing the Ocean's Secrets

- | | |
|----------------------------|--------------------------------|
| 15 Ocean Industry Briefs | 33 Offshore Industry Headlines |
| 18 Maritime Transportation | 36 Upstream Oil & Gas |
| 20 Ocean Science | 42 Underwater Intervention |
| 24 Ocean Energy | 48 Maritime Communications |
| 28 Defense | 52 Subsea Cables |

June 2016

6

Departments

- 8 Editorial
- 57 Offshore Stats and Data
- 64 Product News
- 70 People & Company News
- 72 Calendar & Events
- 75 Ocean Industry Directory

Ocean News & Technology

Cover Photo



Hydroid's New Generation REMUS 100 Featuring Cutting Edge Technology.

New Product Profiles

Page 62

OCEAN NEWS & TECHNOLOGY

More News, More Technology, More Data

in the next issue

Editorial Focus

- Ocean Engineering
- Marine Construction
- **Special Focus Section:** Company History Profiles - Then and Now

Product Focus

- Navigation
- Mapping & Signal Processing
- Data Processing Services



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Advancing Autonomous Underwater Vehicle Technology

Autonomous underwater vehicles (AUVs) are a mainstay of the subsea survey industry. With unparalleled speed and accuracy in deep water, they have long been the obvious choice for surveys in inhospitable, deep environments. In light of the current downturn in the oil and gas market and the increasing visibility of autonomous vehicles, such as self-driving cars, AUV technology is poised to break into new markets.

Ironically, it is the downturn in the oil and gas market that now offers the opportunity for technology to penetrate areas that previously were hard to enter. Whether through inertia or reluctance on operators' parts, the acceptance of new technologies for certain tasks in this industry has, at times, proceeded at a much slower pace than in other industries. With this downturn, operators are now willing to revisit and explore technologies that offer a better value proposition than doing things the "old way."

AUV operators are constantly striving to prepare their vehicles to perform new tasks. Meanwhile, our customers are looking for faster, more cost-effective ways to complete slow, labor-intensive tasks. These forces, aligned with the visible state-of-the-art in autonomous vehicles, offer the perfect recipe for the use of autonomous underwater technologies. Improvements in sensing technology, coupled with autonomous advances, make AUVs an attractive platform for inspection tasks. Increasing customer confidence in the state of the art for AUVs is driving the two next big advancements: in-field inspection vehicles with hovering capabilities, along with subsea fieldresident vehicles.

AUVs are carrying more sophisticated sensor suites than ever before. Multibeam echosounder resolutions are increasing, supporting both better quality bathymetry and also water column visualization and analysis. Laser line scanners are being installed on AUVs as standard equipment, allowing subcentimeter resolution imaging and measurement of the subsea environment. High-definition still cameras provide extremely highresolution imagery that can be used both for visualization and metrology. Single images can be stitched together to provide a global view of the inspected area.

Concurrent increases in computing power have made it possible to analyze and act on the rich sensor data collected in real time. Building on the same types of technologies that enable self-driving cars, the next-generation AUV can respond to changes in its environment. For example, if a seep is detected during an inspection, the vehicle can autonomously determine that it should perform a more detailed search pattern in that area. This improves data quality and mission efficiency, which translates directly into cost savings.

Pipeline inspection is another emerging technology for AUVs. In the fourth quarter of 2016, Oceaneering is qualifying a pipeline inspection AUV (PIAUV) for commercial use. This vehicle development program has been driven and funded by industry partners looking to fill a technology gap. The PIAUV autonomously tracks a pipeline, ensuring complete sensor coverage of the pipeline at the lower altitudes that provide the highest resolution imaging and bathymetry available. Additionally, the PIAUV responds dynamically to changes in these environments (such as unexpected obstacles), thus avoiding collisions without needing to abort the mission. This technology is expected to offer substantial cost savings over traditional pipeline inspections performed by ROVs, due to a decrease in field time.

Future development lies in hybridizing ROV and AUV technologies. Merging the two paradigms yields a vehicle that is greater than the sum of its parts. A hovering AUV would be untethered and able to perform lightintervention, upclose inspections, and to safely navigate a cluttered subsea environment. This migrates the pilot's role to one of supervision and monitoring, reducing the potential for human error. In the long term, this vehicle could be imagined in a subsea resident capacity, tremendously reducing the cost of operations. The subsea resident application has substantial opportunities for technology development, such as in-field power and data connections for real-time control and video. Currently, wet-mateable power connectors are limited in the number of connections before failure. Future inductive systems for power and data transfer would improve the feasibility and reliability of subsea resident solutions.

To summarize, in spite of challenging market conditions, it is an exciting time to be working in the AUV arena. New and enabling technologies are constantly springing up. High-profile autonomous land vehicles and cost-saving measures are driving AUV operators and customers to invest in exciting applications that push the state of the art for vehicles, sensors, and vehicle autonomy.



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Equipped with More Capability than Ever, Today's AUVs are Revealing the Ocean's Secrets

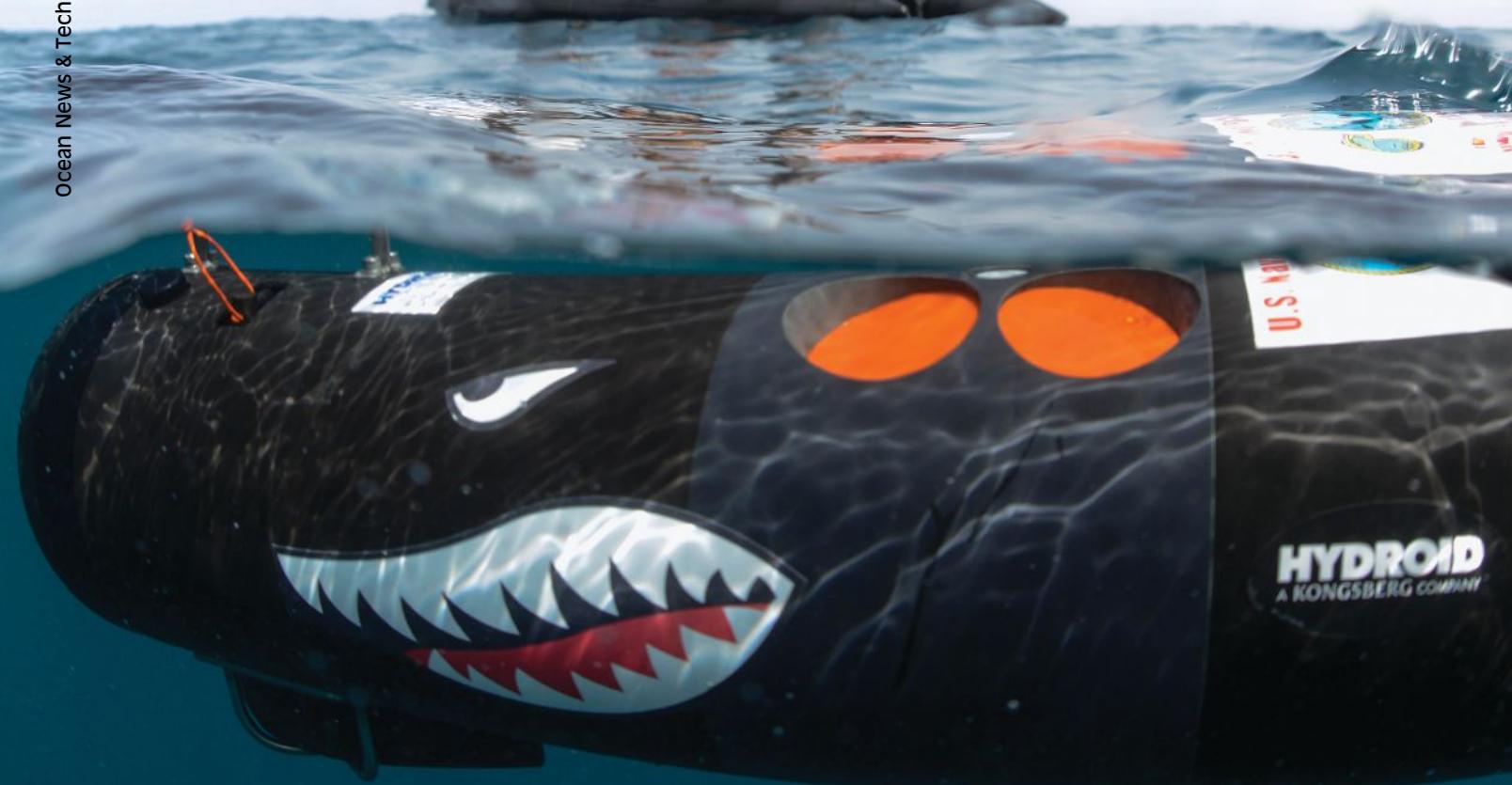
*By: Sandor Becz, Vice President
of Engineering at Hydroid*

June 2016

10

Ocean News & Technology

The military uses AUVs for missions related to intelligence, surveillance, reconnaissance and mine countermeasures.



If I had to pick one word to describe the current state of autonomous underwater vehicle (AUV) development, I'd have to choose "flourishing." The marine robotics market has grown significantly over the past 20 years, from its infancy in the 90s through its adolescence in the 21st century. As it continues to grow and the technology improves, vital data-gathering capabilities expand and innovative new designs become possible thanks to enabling technologies that have been developed for other military, commercial, and even consumer applications.



Developed by a veteran team of engineers, Hydroid's line of AUVs provide safe and reliable answers to the challenges that have hampered ocean exploration in the past.

AUVs: A history of steady progress

Years ago, exploration of the oceans and seafloor depended on manned submersibles. Eventually, however, those manned vessels were replaced by remotely operated vehicles (ROVs) and tethered systems towed by surface ships. By the mid-1990s, semi-autonomous platforms were, in turn, giving way to untethered, truly autonomous underwater vehicles. This shift was accelerated by increasing interest and investment from the military following the successes and acceptance of air and land-based robotics.

However, ocean engineers have had to contend with certain challenges that are ever present and often unique to the subsea marine environment. These challenges include operating without electromagnetic communications in poor visibility, at great pressures, in a changing environment, and with little or no human presence or infrastructure.

FEATURE STORY

Among the hurdles engineers face with untethered systems is vehicle endurance. Like smartphones and laptops, AUVs are limited by their available energy—and while today's most sophisticated models can run for longer than ever before, they need to return to the surface so their batteries can be recharged or exchanged. Of course, endurance is also impacted by payload and overall design; developers of AUVs have grappled for years with the size and lack of energy efficiency of electronics, sensors, and other key components. New devices are now making their way into the market that are changing this landscape.

The challenges, unfortunately, do not stop with just energy. Unlike land and airborne robots that use satellites for communications and navigation, subsea systems require alternative technologies for successful deployment. Additionally, vehicle launch and recovery has its own issues in an environment where tides, currents, waves, and weather all conspire to make each mission different.

Innovation continues to improve AUV capabilities

Today's state-of-the-art AUVs are rising to these challenges with innovative technologies that build on the past decades of research and reliable operations. The increasing availability of multifunctional sensors, better navigation systems, low-cost/low-power electronics, and open architecture middleware tools (such as ROS and MOOS) are enabling more capable and flexible systems that can perform operations and gather data like never before. For example, Hydroid, Inc., a subsidiary of Kongsberg Maritime and a leading manufacturer of marine robotic systems, recently announced its New Generation REMUS 100 AUV—a man portable vehicle that combines the reliability of the well-known REMUS 100 AUV with new features and capabilities. Innovative robotic vehicles like this are tackling the most difficult AUV challenges mentioned above:

- Endurance/Energy. High-capacity battery packs allow today's most modern AUVs to carry significantly more energy than before. The New Generation REMUS 100, for instance, comes equipped with two of Hydroid's latest 18650 Li-Ion based packs. The packs have 50% more energy than the previous version.

- Miniaturization. Advanced low-power electronics significantly reduce payload size and power consumption and are much more capable than their counterparts from just a few years ago. The New Generation REMUS 100 features cutting-edge core electronics (CE) designed to replace not only the previous motherboard, but also the CPU stack, emergency board, and six serial cards. The new CE board is smaller and lighter than the components it replaces, and it uses an ARM +FPGA architecture that makes it both potent and versatile while consuming less than 5W of power—about 25% of the power required by the earlier version.

- Customization. More and more customers require software that is expandable with standardized interfaces. In other words, they want software that is interoperable across platforms so that it appears common among the various systems they're using. Customers also want to easily accommodate new “apps” providing capabilities such as goal-based mission planning and real-time autonomy. For example, the New Generation REMUS 100 expands on the capabilities of previous generations by adding an open architecture platform for advanced autonomy, making the vehicle more versatile. This platform is realized with a publish-subscribe database

based on Robotic Operating System (ROS) middleware operating on a second processor. The new REMUS “front seat” controller performs control functions using well-tested, reliable proprietary control software. The “back seat” controller performs mission tasks, such as side-scan sonar data logging via the ROS publish-subscribe operating environment.

Loaded with advanced computing power and versatile capabilities like these, today's state-of-the-art AUVs are proving invaluable across a wide variety of commercial, military, and scientific applications.

What does the future hold?

When a customer buys an AUV, they're not interested in the vehicle itself, per se. They're interested in the data the AUV can gather. An oil company may need to monitor its deep-sea infrastructure; a marine researcher is interested in studying mammal behavior; and the military is interested in AUVs for missions related to intelligence, surveillance, reconnaissance, mine countermeasures, and the like. Researchers want to gather the data needed to better understand how ocean systems impact marine and coastal ecosystems, climate, and overall global environmental health. Now that AUVs are better equipped and more capable than ever before, many predict that all of these applications are poised for tremendous growth.

For proof, look no further than the 2016 National Academies Keck Futures Initiative (NAKFI) Conference, which is devoted to Discovering the Deep Blue Sea: Research, Innovation, Social Engagement. Billed as a way to enable scientists from different disciplines to explore the frontiers of deep ocean science, this year's conference will focus on one of the least studied regions of our planet—the zone of transition between the ocean's solar energy-rich, productive euphotic zone and the energy-starved abyss. Researchers believe exploring this transition zone can lead to dramatic advances in the fields of climate change, biodiversity, aquaculture, adaptation and resilience, energy, and technology.

How will AUVs be even further refined as they continue to unlock mysteries of the ocean's “twilight zone” and complete other, increasingly complicated missions? In addition to incremental improvements to the areas outlined above, I expect to see a push toward self-learning capabilities that will make AUVs truly autonomous. Guided by perceptual robotics (machine learning) and artificial intelligence, AUVs of the not-too-distant future will be better able to comprehend their surroundings and execute non-programmed behaviors. These behaviors could even include cooperative activities, such as swarming and the transference of capabilities between AUVs. Additionally, we can expect to see vehicles that can harvest energy from the ocean using changes in temperature and pressure. They will traverse entire oceans using completely new navigation methods and power sources or remain as sentinel nodes gathering data and secreting data mules as required. Perhaps AUVs will be sleeping on the seafloor only to awake when needed or when triggered by a specific event. Some vehicles are now articulated and perhaps may evolve with reptilian behaviors to operate in multiple domains and perform interactive tasks.

Taken altogether, it's clear that this is an incredibly exciting time to be working in this field. The AUV industry is indeed “flourishing” and rich with opportunities for new approaches, collaborations, and projects.

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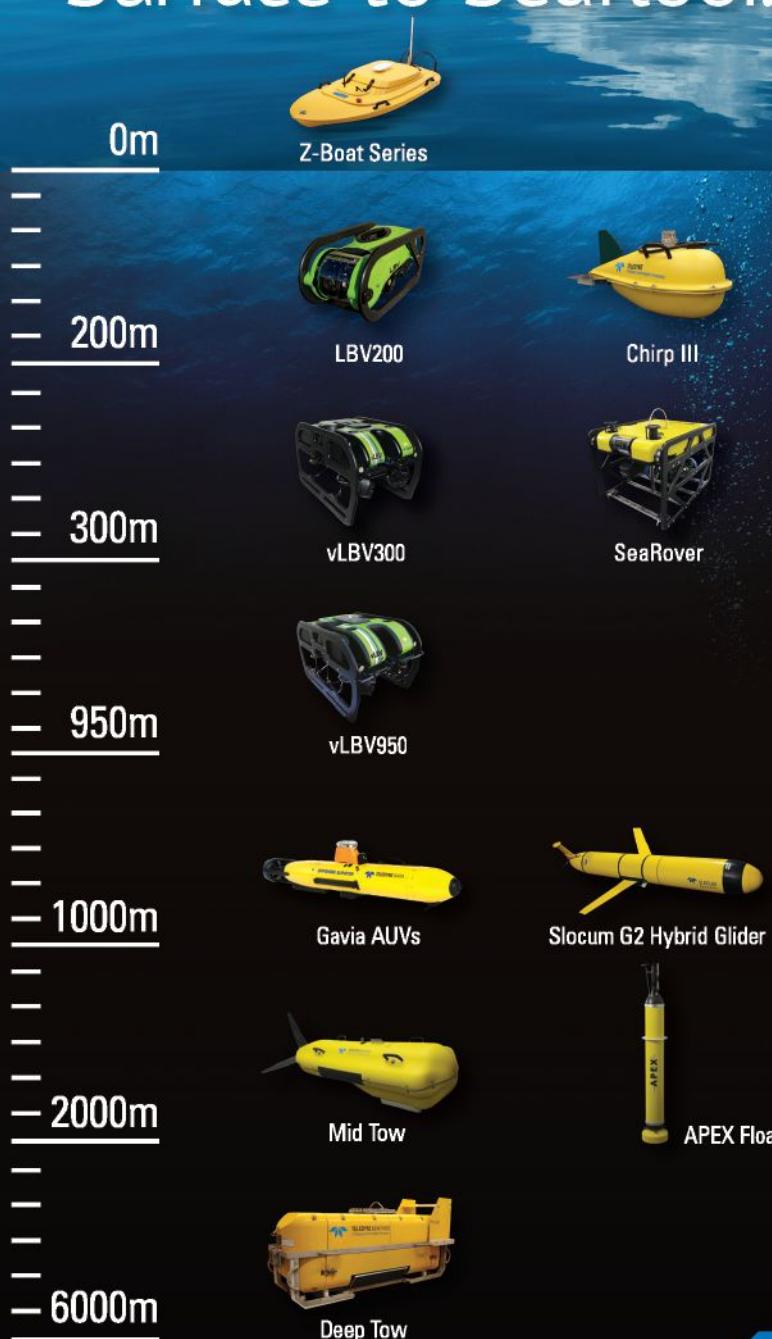
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Navy's Underwater Archaeology Team assists with assessment of historic ship remains



Blair Atcheson, Naval History and Heritage Command (NHHC) historical preservation coordinator, uses multiple rulers to take the length and curvature of a historical timber while Dr. Alexis Catsambis, cultural resource manager, records the information. (U.S. Navy photo by Mass Communication Specialist 1st Class Clifford L. H. Davis/Released).

When archaeologists needed assistance after discovering the remains of an 18th century ship buried in Alexandria, Virginia, they only had to look across the Potomac River for a team of underwater specialists.

The Naval History and Heritage Command's (NHHC's) Underwater Archaeology Branch (UAB) assisted city archaeologists with measuring and recording the excavated timbers at a warehouse in Alexandria.

NHHC archaeologists used tools such as measuring tapes, calipers and plumb bobs to measure the remains. Data collected on the curvature of the frames could reveal the shape of the hull, according to UAB archaeologist George Schwarz, Ph.D.

"We are recording each one of the timbers so that we can learn about the ship construction and see if there are any maker's marks or other indications of specific construction techniques," Schwarz said.

The recovered ship was built with thousands of trunnels to connect the different elements together. Also called treenails, trunnels are wooden pins that swell when exposed to moisture, contributing to watertight integrity.

"It's a very strong, robustly built ship, and the extensive use of the trunnels is an indication of how structurally sound this ship was," Schwarz said. "They put a lot of effort into the construction because the builders had to fabricate each wood pin, drill each hole in the timbers by hand, and then plug both elements to attach the planks to the frame. It represents a lot of work."

UAB was first contacted in December 2015 when the buried ship was found at the construction site of a new hotel. The branch observed the site and provided advice on maritime archaeology and options for preservation.

"While the ship was in position, we used a photo scan program that allowed us to take photographs around the site itself, and then the program basically matched the pictures together and stitched different points to create a photographic 3D model," Schwarz said.

For more information, visit www.navy.mil.

in this section

Ocean Industry Briefs	15
Maritime Transportation	18
Ocean Science	20
Ocean Energy	24
Defense	28

New report shows U.S. fisheries rebuilding

The number of domestic fish stocks listed as overfished or subject to overfishing remain near all-time lows, according to the 2015 Status of U.S. Fisheries report to Congress.

The 2015 report highlights the U.S.' continued progress towards managing fish stocks sustainably. This is a result of the combined efforts of NOAA Fisheries, commercial and recreational fishermen, the regional fishery management councils, states, and other partners.

"It's fitting that this report aligns with the 40th anniversary of the Magnuson-Stevens Act," said Eileen Sobeck, assistant NOAA administrator for fisheries. "Magnuson-Stevens provided the dynamic, science-based management process that is proving successful year after year at keeping U.S. fisheries among the world's most sustainable and resilient. This year's report highlights the act's continued success."

For more information, visit www.noaa.gov.

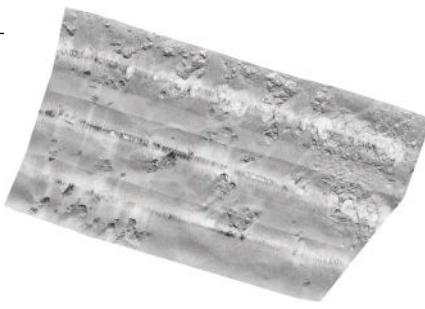
ABS brings industry leaders together in landmark standardization JIP

ABS, the leading provider of classification services to the global offshore industry, convened industry partners at the Offshore Technology Conference on 4 May, to sign a memorandum of understanding (MOU) establishing a unified joint industry project (JIP) for standardization. The goal of the JIP, which includes participants from Korean shipyards, operators, drilling contractors, engineering companies and classification societies, is to develop offshore design standards that will help to improve safety and increase efficiency for offshore projects.

While smaller JIPs have formed to address standardization issues, the number of companies participating in this partnership constitutes an industry "first," bringing together leaders from a broad range of companies with the common goal of improving consistency and reducing construction inefficiencies.

ABS initiated its first standardization JIP in 2015 with the three leading Korean shipyards—HHI, Daewoo Shipbuilding and Marine Engineering (DSME) and Samsung Heavy Industries (SHI)—and oil and gas and engineering companies to establish new global design standardization procedures based on relevant industry standards, international regulations and class requirements across the offshore industry. The unified offshore standardization JIP, which includes these participants among a much broader group, marks the beginning of the second phase of this project.

For more information, visit www.eagle.org.



EdgeTech side-scan sonar instrumental in the discovery of reef at the mouth of the Amazon

EdgeTech, the leader in high resolution sonar imaging systems and underwater technology, provided side scan sonar equipment that was used in support of the recent discovery of a large coral reef at the mouth of the Amazon River. The recently publicized finding is exciting for researchers as they learn more about the area and the unique marine life and characteristics of the distinctive environment.

One of the key researchers on the project is Dr. Michel Michaelovitch de Mahiques, Instituto Oceanográfico of the University of São Paulo. The Institute used their EdgeTech 4200 Side Scan Sonar system operating at 100/400 kHz to find and map this exceptional coral reef. The 4200 Series is a versatile side scan sonar system that can be configured for almost any survey application from shallow to deep water operations. The 4200 utilizes EdgeTech's Full Spectrum® CHIRP technology to provide crisp, high resolution imagery at long ranges allowing customers to cover larger areas and save money spent

on costly surveys. One of the unique features of the 4200 is the optional Multi-Pulse (MP) technology, which places two sound pulses in the water rather than one pulse like conventional side scan sonar systems. This allows the 4200 to be towed at speeds of up to 10 knots while still maintaining 100% bottom coverage. In addition, the MP technology will provide twice the resolution when operating at normal tow speeds, thus allowing for better target detection and classification ability.

For more information, visit www.edgetech.com.

World Bank warns about deep sea mining

A new World Bank report recommends that Pacific Island countries supporting or considering deep sea mining activities proceed with a high degree of

caution to avoid irreversible damage to the ecosystem and ensure that appropriate social and environmental safeguards are in place as part of strong governance arrangements for this emerging industry.

Deep sea exploration of minerals and resources is increasing across the globe, but its short and long-term impacts on the environment, economy and society in general remain largely unknown, according to the report, *Pacific Possible: Precautionary Management of Deep Sea Mining Potential in Pacific Island Countries*.

"Given the immense uncertainty, deep sea mining in Pacific Island countries should be approached with the highest degree of caution and transparency," said Tijen Arin, Senior Environmental Economist and co-author of the paper. "Work in this space is already progressing in many countries, and progress has been made in legislation, but strengthening and increasing institutional capacity still remains a significant challenge and therefore we recommend stronger regional cooperation in this area."

For more information, visit www.worldbank.org.

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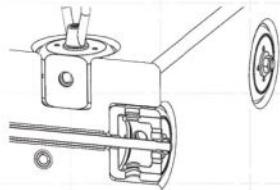
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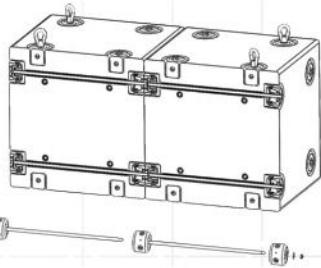
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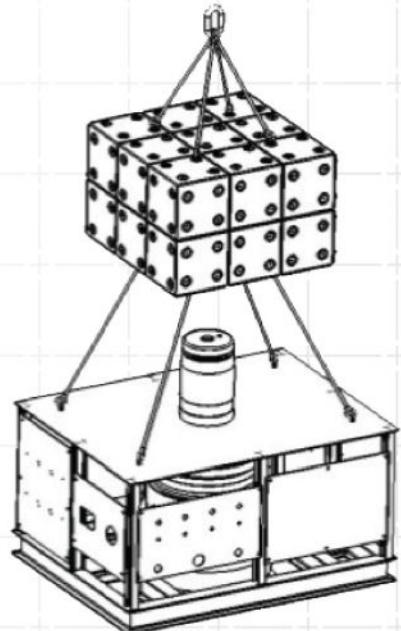


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Wärtsilä to participate in LNG-powered dry bulk carrier project

Wärtsilä is to team up with an international group of shipping industry companies and organizations in a project to develop a concept for equipping future dry bulk carrier vessels with LNG propulsion.

Project Forward is led by Athens-based Arista Shipping. It began officially in May 2015 with the aim of developing a commercially feasible LNG-powered dry bulk carrier design capable of complying with the International Maritime Organization's (IMO) Energy Efficiency Design Index 2025 standards as well as with all relevant emission reduction regulations. In addition to Arista Shipping, the other parties involved in the project are Finnish ship designer Deltamarin, the Houston-based classification society American Bureau of Shipping (ABS) and GTT, the French LNG membrane containment system designer.

The Wärtsilä 31DF dual-fuel engine is likely to form the basis of the concept's propulsion system. Introduced in June 2015, the Wärtsilä 31 has been recognized by Guinness World Records as being the world's most efficient 4-stroke diesel engine. The DF version allows the use of either LNG or conventional marine fuel oils. While 2-stroke engines are the conventional choice for vessels of this type, the supreme efficiency of the Wärtsilä 31 engine makes it a competitive and viable alternative option.

The project is to be presented as a topic at the Posidonia 2016 conference and exhibition to be held in Athens, Greece from June 6 to 10.

Oregon State University to issue RFI on ship project after design completion

The design phase for a project to construct a new regional class research vessel to replenish the U.S. academic fleet is complete and Oregon State University has issued a request for information (RFI) to shipyards that may be interested in the vessel construction phase.

In January 2013, the National Science Foundation selected Oregon State as the lead institution to finalize the design and coordinate the construction of the vessel—and possibly up to two more—a project considered crucial to maintaining the country's marine science research capabilities.

The design phase has been completed by The Glosten Associates, a naval architecture firm based in Seattle, and the RFI is a chance to generate market interest and to get feedback from industry on the design and other project documents. OSU plans to issue a Request for Proposals (RFP) in two phases beginning this summer—a technical phase to establish a competitive pool of qualified shipyards and a cost phase to elicit vessel cost proposals.

For more information, visit <http://ceoas.oregonstate.edu/ships/rdrv/>.

Passenger ship sewage discharges into the Baltic Sea will be banned

The International Maritime Organization (IMO) agreed that the Baltic Sea special area for sewage discharges from passenger ships under Annex IV of the MARPOL Convention will take effect by latest 2021 for IMO-registered passenger vessels. However, in certain cases of direct passages between St. Petersburg area and the North Sea there is a 2-year extension to the deadline, until 2023.

The decision means that by 2021 all IMO-registered passenger vessels sailing in the Baltic Sea, as the first region in the world, must discharge all sewage at port reception facilities (PRFs), or treat it with an on-board treatment plant certified to meet stringent special area requirements. For new ships built on or later than 2019, these requirements will apply earlier.

The significant outcome concludes the long HELCOM process aiming to limit sewage discharges in the Baltic Sea from passenger vessels, as the emissions have negative impact on the marine environment.

The proposal to designate the Baltic Sea as a special area for sewage within MARPOL Annex IV was developed by the HELCOM Maritime Working Group, which is made up of maritime administrations of the Baltic Sea coastal countries and the EU.

GE enters the container ship industry



GE's Marine Solutions announces the expansion of its offering with the signing of a key contract to provide the latest in auxiliary electric systems to Maersk Line, the world's leading container ship operator. GE's Power Take Off/Power Take In (PTO/PTI) technology consists of two drives, two induction motors and a power management system. It is a smart solution that provides excess power on demand while reducing fuel consumption. When not being used to propel the vessel, the PTO/PTI technology uses the surplus energy to power onboard systems and equipment.

GE's Marine Solutions' entry into the container ship industry also marks its intention of contributing to the technological advancement of the industry at large. The global container ship industry continues to grow at a steady rate, as around 90% of the world's trade is carried across the sea.

The PTO/PTI solution provided to Maersk Line for 11, 2nd generation Triple-E container vessels with a capacity of 19,630 TEU, is composed of a shaft generator motor installed between the main engine and the propeller. It acts as either a generator or a booster to generate electricity from slow streaming speeds all the way up to the design speed of the vessel. The PTO/PTI technology will be installed onboard vessels built by the DSME shipyard in Korea, with which GE has had a long-standing relationship.

The PTO/PTI technology harnesses the mechanical energy of the vessel's drive shaft to convert it into electrical energy. This excess energy is then directed to onboard systems when it is required, which diminishes the need to burn fuel to power these systems. The result in fuel savings is significant, especially when coupled with improved operational flexibility. Unlike its competitors, the electric machine is equipped with induction motors instead of synchronous motors. By removing transformers, it offers a simpler design and therefore reduces the complexity of the system, making it more reliable and requiring less CAPEX. The arrangement of induction motors reduces the frequency and extent of maintenance and, combined with the system's fuel saving characteristics, brings down the operational expenses for customers.

GE's Marine Solutions is dedicated to power and propulsion systems for customers in the workboat, merchant, offshore and naval industries. Smart engineering coupled with software analytics, provide customers with data-driven efficiency.

For more information, visit www.gemarinesolutions.com.

Trelleborg report reveals fender maintenance lacking

The fifth annual Barometer Report from Trelleborg's marine systems operation, which discusses the issues impacting ports and terminals around the globe, has revealed that over 60% of the port owners, operators, consultants and contractors surveyed have experienced unscheduled downtime due to fender damage. This is a huge increase compared to the last report in 2014, when only 20% cited it as a contributing factor.

At the same time, 25% of those surveyed expect fender systems to have a life expectancy of at least 10 years. This is a reasonable expectation, but not when taking in to consideration that respondents are not placing enough importance on regular inspections and maintenance, which only 36% carry out annually.

Richard Hepworth, president of Trelleborg's marine systems operation, says: "Fender systems can have very low failure rates and minimal inspection requirements. However, to do so they need to be specified correctly and manufactured using the right materials. For example, the modulus of the rubber

compound—the relationship between stress and strain in a cured rubber sample—is one of the determining factor of a fender's performance, and highly impacted by the dispersion of carbon black filler in the rubber. The level of dispersion, in turn, is dependent on the mixing process, the quality of which is determined by the machinery used in the production of the rubber compound."

After manufacture, fenders must be subjected to rigorous materials and full-scale testing. To ensure they consistently meet working demands and environmental conditions over their lifetime, they need to be maintained correctly. Given the lack of regular inspections and maintenance, it's unsurprising that 50% of port owners are saying they have had to upgrade their fender systems within the last 10 years.

Over 60% of those surveyed said that they or their clients only carried out inspections and maintenance every 2 to 10 years, far below the recommended frequency of every 12 months.

To download the Barometer Report visit: <http://ow.ly/VmYR3>.

Korea and Japan welcome the first methanol-fueled, ocean-going vessels

Waterfront Shipping Company Ltd. (WFS), Marinvest/Skagerack Invest (Marinvest), Westfal-Larsen Management (WL), and Mitsui O.S.K. Lines, Ltd. (MOL) were proud to attend the traditional ship naming ceremonies and take delivery of the first Korean and Japanese built methanol-fueled ocean tankers, the Lindanger, Mari Jone and Taranaki Sun.

Hyundai Mipo Dockyard hosted the Korean ship naming ceremony, while Minaminippon Shipbuilding Co., Ltd. hosted the Japanese ceremony, where all three of these 50,000 dead weight tonne vessels were built. The vessels are built with the first-of-its-kind MAN B&W ME-LGI 2-stroke dual-fuel engines that can run on methanol, fuel oil, marine diesel oil, or gas oil. The engine was developed by MAN Diesel & Turbo and is based on the company's proven ME-series, with its approximately 5,000 engines in service.

For more information, visit www.wfs-cl.com.

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Liquid Robotics supports Fishackathon to help fight illegal fishing

Liquid Robotics®, the leader in long-duration USVs, is proud to announce support for the U.S. State Department's 3rd annual Fishackathon 2016. Fishackathon started in 2014 in response to Secretary Kerry's Our Oceans conference. Opening on Earth Day, this event brings together volunteer coders, technologists, and scientists around the globe to help create new applications and tools to thwart the global epidemic of illegal and unregulated fishing.

In support of this event, Liquid Robotics is providing historical and real-time ocean data collected by the Wave Glider®, an unmanned surface vehicle. The Wave Glider collects and communicates ocean data without the need for fuel. Wave Gliders perform long-duration missions that fundamentally change ocean research and monitoring, including patrolling vast marine sanctuaries for illegal fishing.

The global problem of overfishing impacts one of the world's primary food sources, economies, and the overall health of our ocean. With over 800 million people making a living through fisheries, this critical issue is demanding creative new approaches and technologies. Using unmanned, self-sustaining ocean robots to patrol the world's oceans and communicate violations in real time is one of the innovations that will enable breakthroughs in the detection and capture of illegal fishing.

On Earth Day weekend, 43 host sites in 27 countries on 6 continents participated to find a technological solution to their selected fisheries challenge.

The U.S. IOOS QARTOD project publishes manual update for real-time quality control of water level data

The U.S. Integrated Ocean Observing System® (IOOS) Quality Assurance/Quality Control of Real-Time Oceanographic Data (QARTOD) project has released the Manual for Real-Time Quality Control of Water Level Data Version 2.0, which helps data providers and operators to ensure the most accurate real-time data possible.

The U.S. IOOS QARTOD project has published nine data quality-control manuals since 2012, five of which have been revised. The manuals are based on U.S. IOOS-selected parameters (or core variables) that are of high importance to ocean observations. The purpose of the manuals is to establish data quality control (QC) procedures for data collection for core variables, such as water levels, currents, waves, and dissolved nutrients. These QC procedures meet the requirements outlined in the Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009 and provide guidance to 11 U.S. IOOS Regional Associations, as well as other ocean observing entities.

Version 2.0 incorporates general content from QC manuals developed since 2014, updates links to related documents, and provides access to several related documents on the U.S. IOOS website.

Water level observations covered by procedures outlined in the manual are collected in oceans and lakes in real time. Scientists use sensors that employ various technologies, including microwave radar, pressure, acoustic, global positioning system (GPS), and laser. Most water level sensors operate from fixed platforms, for example, at tide stations that have bench marks to ensure a stable reference point from which measurements are made.

Water level data are used for numerous critical applications, including those that contribute to safe navigation, recreational activities, and input for modeling studies.

During the manual preparation, U.S. IOOS received extensive input from experts from the Center for Operational Oceanographic Products and Services, the National Hurricane Center, the National Data Buoy Center, the U.S. Army Corps of Engineers, and others. U.S. IOOS also actively solicits feedback from data providers and operators who have used the manual as guidance for conducting real-time quality control for not only water levels but other core variables as well. This feedback is pertinent for preparation of manuals and updates, which is done as technologies expand and resources permit.

For more information about the U.S. IOOS QARTOD project, please visit www.ioos.noaa.gov/qartod.

Daily up and down of the plankton in the sea



A unique series of measurements taken over several years in the Antarctic Ocean provide new findings about the daily vertical migration of zooplankton communities. Scientists of the Thünen Institute of Sea Fisheries in Hamburg and the Alfred Wegener Institute in Bremerhaven observed changes during the year and between years. The Antarctic zooplankton is the main source of food for many fish and whale species, including the largest mammal in the world, the blue whale.

For the first time, researchers were able to document the annual cycle of zooplankton communities in the Southern Ocean. Using data from anchored acoustic Doppler current profilers (ADCP), Dr. Boris Cisewski of the Thünen Institute of Sea Fisheries, and Dr. Volker Strass of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) continuously recorded the daily vertical migration of the zooplankton for 3 years. They also investigated how individual environmental parameters such as light, sea ice cover, food availability, circulation and temperature as well as salinity influence their migration behaviour.

The daily vertical migration of zooplankton—often crustaceans with body lengths ranging from millimetres to centimetres—is mainly triggered by the day-night cycle. In order to escape potential predators, they dive into the dark depths at sunrise and stay there during the day. After sunset, they once again rise to the upper layers to feed where the sunlight has allowed planktonic algae to grow. Until now, only short time snippets of the migration pattern of the zooplankton in the Southern Ocean existed. Because of its seasonal sea ice cover, many areas are not accessible by ship during the southern winter. At this time of year, biological network samples can only be taken intermittently.

The current study is based on data that was collected during three Polarstern expeditions and with deep-sea moorings deployed in the Southern Ocean between 2005 and 2008 within the framework of the LAKRIS project (Lazarev Sea Krill Study). As part of this study, ADCPs were moored at three different geographical locations along the Greenwich meridian; the ADCPs send out sound waves at fixed intervals and cover an up to 500 m deep water layer under the surface. While the strength of the echo provides information about the concentration of the zooplankton, the migration velocity can be calculated based on the Doppler shift of the sound frequency.

For more information, visit www.awi.de.

Deep-sea biodiversity impacted by climate change's triple threat

A new study found that vulnerability of deep-sea biodiversity to climate change's triple threat—rising water temperatures and decreased oxygen and pH levels—is not uniform across the world's oceans.

The analysis by researchers at Scripps Institution of Oceanography at University of California San Diego used responses to natural variation in temperature, oxygen, and pH to reveal that deep-sea biodiversity from Baja California to San Francisco may be highly susceptible to projected climate changes in the future.

Climate change is often thought of as a single environmental threat from increases in atmospheric CO₂. However, multiple climate stressors, from ocean warming and acidification to low oxygen levels, are expected to result in cumulative impacts on marine life. The deep ocean, which covers more than 60% of Earth's surface, is a biodiversity hotspot at increased risk from climate change.

The National Science Foundation-

funded study, published in the 27 April issue of the journal Proceedings of the Royal Society B, looked at how marine communities change across natural gradients to better understand the influence of the three climate stressors.

"These stressors are often underappreciated threats to diversity and ecosystem health," said Scripps biological oceanographer Lisa Levin, the senior author of the study. "Yet, they raise questions about whether, and how, populations will adapt and which stressors are the primary drivers."

To untangle the impacts that these three climate stressors will have on seafloor diversity in the future, the researchers examined existing published data and collected new data on organisms living in deep-sea sediments in upwelling regions along continental margins, where the ocean and continental crusts meet along the seafloor. The researchers found that organisms from each ocean basin had its own unique threshold for the level and type of stressor it could tolerate.

The researchers found that diversity of marine life in the eastern Pacific Ocean is highly sensitive to declining

oxygen levels, while CO₂ levels were of importance to biodiversity in the Indian Ocean. Oxygen levels are falling throughout the world's oceans, and the decline is expected to have the greatest impact to biodiversity in the eastern Pacific Ocean.

"Global change affects so many different environmental aspects, and across such a range of conditions, that it can be difficult to study in the laboratory," said Erik Sperling, assistant professor of geological sciences at Stanford's School of Earth, Energy & Environmental Sciences, lead author of the study, which was conducted while he was a postdoctoral researcher at Scripps. "In some sense nature has already run these experiments on continental margins, where sharp natural environmental gradients exist."

Continental margins cover over 11% of the world's oceans. They are considered biodiversity hotspots and play a major role in supporting commercially important fisheries. They are also considered the largest "carbon sink" of atmospheric carbon dioxide on Earth.

For more information, visit www.ucsdnews.ucsd.edu.

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UCI sleuths search the seas for soot

Earth system scientists from the University of California, Irvine have taken water samples from the north Pacific, north and south Atlantic, and Arctic oceans in search of repositories of black carbon, soot from burning biomass and diesel engines, among other sources. They've found considerably less of the material than expected, and they've discovered that it exists in at least two varieties: a younger pool closer to the ocean's surface that is absorbed into the environment in a roughly 100-year cycle and an ancient reserve that remains stable for millennia.

"We find that, indeed, black carbon resides in the oceans for tens of thousands of years, yet it's not as abundant as you'd expect given its relatively inert structure and the sheer quantity of it being produced on land," said Alysha Coppola, Ph.D. '15, lead author on a study published in *Geophysical Research Letters*. "It seems that all of the black carbon emitted into the environment every year may not persist as a 'locked' chemical structure in the carbon cycle; some of it likely gets degraded back to CO₂ by other loss processes."

Ellen Druffel, UCI professor of Earth system science and senior author on the study added, "As we're changing the planet, burning more material and producing more black carbon, we need to understand where it is going; we just don't, and that's a huge red



Alysha Coppola on the deck of the National Oceanographic and Atmospheric Administration research vessel Ronald Brown collecting seawater samples in search of black carbon in the North Atlantic Ocean. Credit: Samuel Billheimer

flag. Given what we know about how much black carbon is generated and our understanding of the rates at which we think it breaks down, we should be knee-deep in this stuff. There apparently are some big sink mechanisms that we don't yet understand."

Climate scientists expect even more of this material to be ejected into the environment as the planet heats up and forest fires become more prevalent. Up to 27% of it is retained as char or soot instead of returning to the atmosphere as CO₂, researchers said. Black carbon is a particularly strong agent of climate change, itself, as it absorbs sunlight, trapping heat on Earth. Particles thrown into the atmosphere through fossil fuel or biomass burning can land on ice and snow in the Arctic, reducing reflectivity.

For more information, visit <http://news.uci.edu>.

Biological insights to help protect coastlines

The first project to investigate the role of biological processes on the future evolution of the UK coastline is expected to produce valuable insights that will shape coastal protection policy. This project, called BLUE-coast, is led by the National Oceanography Centre (NOC) alongside nine partner organizations.

The research will improve our ability to accurately predict regional sediment budgets on time scales of years to decades. Professor Alejandro Souza from the NOC who is leading the project said, "BLUE-coast will help create a step-change in coastal management strategies."

This will be achieved by improving our understanding of the origin, flux and characteristics of the sediment, including biological or ecological mediation, and how to build that knowledge into complex models. The project will also assess how sensitive this sediment system is to external factors such as human intervention and climate change.

Professor Souza continued, "NOC has world-class expertise in coastal ocean observations and modelling. It is the only research organization in the UK that is able to provide the field and sea-going capability to measure and model coastal sediment processes. In combination with the world leading team on coastal erosion, coastal ecology and coastal eco-morphology, this will allow us to better forecast the future of key areas of the UK coast where policy decisions need to be made."

BLUE-coast starts on the first of May, and is led by the NOC alongside: Birkbeck College, British Geological Survey (BGS), Cardiff University, HR

Wallingford Ltd, University of St Andrews, University of Cambridge, University of Liverpool, University of Plymouth and University of Southampton. BLUE-coast has received funding from the Natural Environmental Research Council (NERC) and complements NOC's long term strategic research into coastal processes.

For more information, visit www.noc.ac.uk.

Study offers clues to better rainfall predictions

The saltiness, or salinity, of seawater depends largely on how much moisture is pulled into the air as evaporative winds sweep over the ocean. But pinpointing where the moisture rains back down is a complicated question scientists have long contended with.

Now, scientists at the Woods Hole Oceanographic Institution (WHOI) have found a potential path to better seasonal rainfall predictions. Their study, which is published in the 6 May issue of *Science Advances*, shows a clear link between higher sea surface salinity levels in the North Atlantic Ocean and increased rainfall on land in the African Sahel, the area between the Sahara Desert and the savannah across Central Africa.

"We know that higher salinity is a likely signature of increased moisture export from the ocean," said Laifang Li, a postdoctoral scholar in physical oceanography at WHOI and lead author of the study. "So, we were motivated to look at whether salinity, which is typically used to understand ocean dynamics and variations in the water cycle, could be utilized as a predictor of precipitation on land. Our study, for the first time, provides evidence that high springtime salinity levels in the northeastern portion of the subtropical Atlantic correlate significantly with increased monsoon-season rainfall in the African Sahel. This discovery has important predictive value for this region, where even slight variations in rainfall can be a matter of life or death for millions of people."

The original idea behind the study traces back to 1993 during the Mississippi and Missouri River floods, when Li's advisor, WHOI senior scientist Ray Schmitt, noticed reports of abnormally low salinity in the Gulf of Mexico following the 7-month dousing of the region. "A lot of freshwater had to leave the ocean during that time to supply the extra rainfall on land, so some part of the ocean had to get saltier," said Schmitt.

For more information, visit www.whoi.edu.

Acidification and low oxygen put fish in double jeopardy

Severe oxygen drops in the water can leave trails of fish kills in their wakes, but scientists thought adult fish would be more resilient to the second major threat in coastal waters: acidification. A new study published from the Smithsonian Environmental Research Center (SERC) shows that is not entirely true—where fish are concerned, acidification can make low oxygen even more deadly.

Low oxygen and high acidity almost always go hand in hand. In coastal waters, nutrient pollution fuels the growth of algae and other organisms. As microbes, plants and animals take up oxygen through respiration, oxygen levels plummet to low levels or even zero. At the same time, acidity spikes as those same organisms release carbon dioxide. Worldwide, both low oxygen and acidity are expected to worsen as ocean temperatures rise. But until now, most research on how well fish cope has focused on either oxygen or acidification alone. This new study shows the consequences of the double threat: fish exposed to low oxygen and high acidity can die at higher oxygen levels, suggesting the low-oxygen thresholds considered “safe” might not be as safe as once thought.

“Those dissolved oxygen limits actually might not be as protective as we thought they were,” said Seth Miller, postdoctoral fellow and lead author of the study published in *Marine Ecology Progress Series*.

Even more surprising was the discovery that acidity hurt adult fish. While past research had uncovered dangers for juvenile fish and larvae, adults were thought to be more resilient to increases in acidity by virtue of the fact that their growth has slowed and they have stopped developing.

For more information, visit <http://newsdesk.si.edu/>.

Influence of sea-ice loss on Arctic warming is shaped by temperatures in the Pacific Ocean

The crucial role that sea-ice loss plays in rapid Arctic warming is regulated by variable climate patterns taking place in the Pacific Ocean, a pioneering new study has found.

The Arctic amplification phenomenon refers to the faster rate of warming in the Arctic compared to places farther south. Arctic amplification has been linked to a spike in the number of persistent cold spells experienced in recent years over Europe and North America.

New research led by University of Exeter expert Dr. James Screen and

published in leading scientific journal *Nature Climate Change* has shown that the influence of sea-ice loss on warming in the far north during winter is dependent on a recurring ocean temperature pattern in the North Pacific.

In the study, Dr. Screen identified the role that the Pacific Decadal Oscillation (PDO)—a cyclical pattern of warm and cool ocean temperatures in the Pacific—plays on the impact of sea-ice loss on Arctic warming.

The study used observations and new climate model experiments to show that the warming effect of sea-ice loss is dependent on the PDO’s phase: the same amount of sea-ice loss leads to greater Arctic warming in the “negative” phase of the PDO compared the “positive” phase.

During the ‘negative’ phase of PDO, there are colder-than-normal ocean temperatures along the west coast of North America and warmer temperatures in the western Pacific. The pattern is opposite for the “positive” phase.

This pattern is known to also affect coastal sea and continental surface air temperatures from Alaska to California. However, that it also regulates the contribution of sea-ice loss to Arctic amplification had not been previously known.

For more information, visit www.exeter.ac.uk.

Tsunami risk: World's shallowest slow-motion earthquakes detected offshore of New Zealand

Research published in the 6 May edition of *Science* indicates that slow-motion earthquakes or “slow-slip events” can rupture the shallow portion of a fault that also moves in large, tsunami-generating earthquakes. The finding has important implications for assessing tsunami hazards. The discovery was made by conducting the first-ever detailed investigation of centimeter-level

seafloor movement at an offshore subduction zone.

“These data have revealed the true extent of slow-motion earthquakes at an offshore subduction zone for the first time,” said Laura Wallace, a research scientist at The University of Texas at Austin’s Institute for Geophysics who led the study.

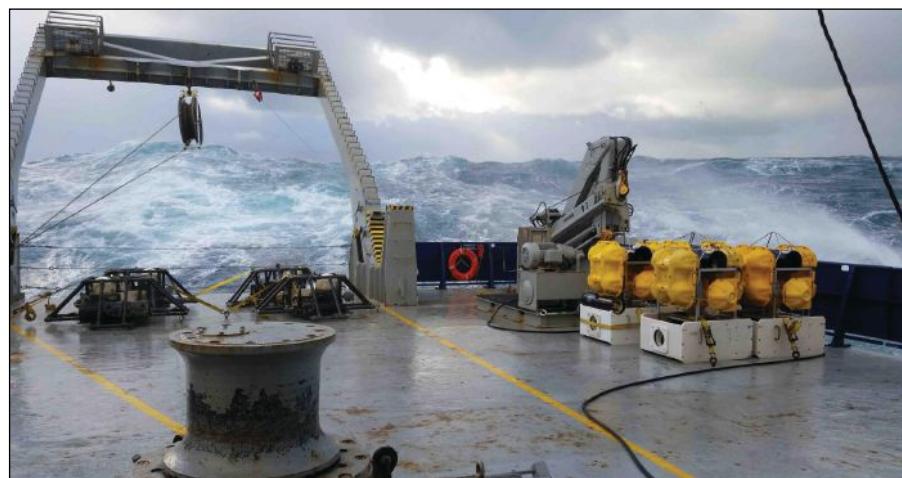
An international team of researchers from the U.S., Japan and New Zealand collaborated on the research. The Institute for Geophysics is a research unit of The University of Texas Jackson School of Geosciences.

The world’s most devastating tsunamis are generated by earthquakes that occur near the trenches of subduction zones, places where one tectonic plate begins to dive or “subduct” beneath another. Using a network of highly sensitive seafloor pressure recorders, the team detected a slow-slip event in September 2014 off the east coast of New Zealand. The study was undertaken at the Hikurangi subduction zone, where the Pacific Plate subducts beneath New Zealand’s North Island.

The slow-slip event lasted 2 weeks, resulting in 15 to 20 cm (about 6 to 8 in.) of movement along the fault that lies between New Zealand and the Pacific Plate, a distance equivalent to 3 to 4 years of background plate motion. If the movement had occurred suddenly, rather than slowly, it would have resulted in a magnitude 6.8 earthquake. The seafloor sensors recorded up to 5.5 cm (about 2 in.) of upward movement of the seafloor during the event.

Slow-slip events are similar to earthquakes, but instead of releasing strain between two tectonic plates in seconds, they do it over days to weeks, creating quiet, centimeter-sized shifts in the landscape.

For more information, visit <http://news.utexas.edu/>.



Seafloor absolute pressure gauges lashed to the deck of the R/V Roger Revelle. The devices monitor slow-slip events on the ocean floor. Credit: Justin Ball, University of Colorado.

Carnegie/EMC transaction completed

Carnegie Wave Energy announced that its investment and alliance agreement with Western Australian-based EMC Solar Construction and EMC Engineering (EMC) has now been executed, with Carnegie chief executive officer, Dr. Michael Ottaviano, appointed to the EMC board. This follows the approval of the agreement by Energy Made Clean Limited shareholders at an extraordinary general meeting.

The completion of the agreement means that Carnegie and EMC have now begun working to deliver microgrid initiatives, the first of which is Carnegie's mauritius wave and microgrid design project.

The agreement—which saw Carnegie invest \$1.5 million in Carnegie shares and \$3 million in cash to take a 35% stake in EMC—will see the companies share a joint focus on the delivery of a combination of renewable energies.

The mauritian project, which was awarded to Carnegie in 2015, will combine EMC's microgrid expertise with the CETO technology and Carnegie's finance, governance and technical capabilities.

For more information, visit www.carnegiewave.com.

UK tidal power project gains approval

A state-of-the-art tidal energy generation project to be constructed off the Isle of Wight has been given approval. The Marine Management Organisation has given the go-ahead to the offshore elements of the Perpetuus Tidal Energy Centre (PTEC). With the onshore part given local planning consent in September 2015, the project at 30 MW is now the largest consented tidal stream energy project in England and Wales. It has also secured its future connection to the UK's electricity grid.

PTEC is now set to become a world leader in large-scale tidal power production, using the motion of the changing tides to generate clean and reliable electricity for the UK.

PTEC will commercially operate a range of different world-leading turbine technologies in a 5 sq. km area off St. Catherine's Point, the southernmost tip of the Isle of Wight. The project will bring international companies to the UK and accelerate the country's adoption and understanding of tidal energy.

A number of tidal turbine manufacturers have already expressed interest in partnering with PTEC to install their turbines. Once operational, PTEC will generate sufficient clean electricity to power more than 15,000 homes.

Evidence from other tidal energy projects suggests that PTEC could also create or safeguard hundreds of jobs and attract significant investment into the local economy. Opportunities for businesses on the Isle of Wight and around the Solent area will be generated both in the construction and operational stages of the project.

PTEC is operated as a joint venture between private company, Perpetuus Energy Ltd, and the Isle of Wight Council. It is hoped that the construction of the project will start in 2017, with potential to be generating electricity from late 2018.

For more information, visit www.perpetuustidal.com.

France states ocean energy objectives

Over the next 7 years, the French government intends to push 100 MW of installed tidal, wave and floating wind capacity and to have awarded tenders for an additional 200 MW to 2,000 MW. These ambitions were stated by Government decree on 24 April 2016. The strategy is part of the French "energy transition" plan, which has been under development since 2009.

Welcoming the publication of the objectives by the French authorities, Jacopo Moccia, Ocean Energy Europe Policy Director, said, "The French have now fully quantified their ambitions for ocean energy. With the first tidal demonstration projects at the Raz Blanchard expected to kick-off in the next couple of years, the ocean energy industry and investors, now, have some visibility on where the French ocean energy market is going in the short and medium-term."

In addition, the French government has set targets for fixed offshore wind energy generation at 500 MW by the end of 2018 and 3,000 MW by 2023. The government may add up to 500 MW more to the 2018 target and up to 6,000 MW for 2023 based on consultations on suitable areas and feedback from the implementation of the first projects.

For more information, visit www.legifrance.gouv.fr.

Installation of foundations for Nordsee One completed



In April, an installation team successfully installed the last foundation for the Nordsee One offshore wind farm, located approximately 40 km north of the island of Juist, Germany. All 54 monopole foundations have also been fitted with the associated transition pieces for the installation of the tower segments. This fully completes all of the 54 foundations 6 weeks ahead of schedule.

Each monopile foundation is up to 70 m tall and weighs approximately 900 tons; the weight of about 750 small cars. Throughout the installation process, four foundations and four transition pieces at a time were loaded on to the installation vessel "Innovation" at Cuxhaven for transportation to the offshore construction site. The foundations were erected at water depths of 26 to 29 m. The Belgian company GeoSea was contracted to install the foundations, which were produced by Ambau in Bremen and Cuxhaven.

"Thanks to strong cooperation between our team and partners, we have installed 54 foundations and the associated transition pieces in only 4 months. During installation we have fulfilled at all times the high German environmental standards," Tim Kittelhake, managing director (COO) of Nordsee One GmbH emphasized. "In the days ahead, we will begin installation of the inter-array cables, and this summer we will install the substation. We expect wind turbine installation to begin early in 2017."

Once complete, the Nordsee One wind farm will consist of 54 wind turbines with an overall installed capacity of 332 MW. Once commissioned in 2017, the wind farm is expected to produce an annual output of more than 1,300 GW-hours of electrical energy, enough to supply the equivalent of some 400,000 German households. Nordsee One is owned by Northland Power Inc. (85%) and RWE International SE (15%).

For more information, visit www.northlandpower.ca.

Siemens receives order for turbines

Siemens has received a major order for its offshore wind power business: the company is to supply, install and commission 102 wind turbines, each with a capacity of 7 MW and a rotor diameter of 154 m, for the East Anglia ONE project. The customer is ScottishPower Renewables, a subsidiary of Iberdrola S.A. The 714-MW wind power plant will be the largest project in terms of capacity for Siemens so far.

Once operational in 2020, the ecofriendly electricity generated by the project is expected to be sufficient for around 500,000 British households. Siemens will additionally be responsible for servicing the wind farm for an initial period of 5 years.

The East Anglia ONE offshore wind power plant is to be erected around 45 km off the British east coast over an area of 300 sq. km. The 102 Siemens direct-drive wind turbines of type SWT-7.0-154 will be installed on jacket foundations. The nacelles shall be manufactured in Cuxhaven, Germany. Siemens plans to produce the corresponding wind turbine blades for East Anglia ONE at its Hull facility. The port of Great Yarmouth will serve as pre-assembly harbor for the project. The first wind turbines are scheduled to be installed in the summer of 2019, with the start of commercial operation scheduled for 2020.

Siemens has also been awarded a long-term service agreement that includes remote monitoring and diagnostics services to help ensure the long-term reliability, performance and availability of the wind turbines. The logistics approach will feature the availabilili-

ty of a helicopter that will be based near Lowestoft port and used mainly in winter when the use of crew transfer vessels (CTVs) is not feasible due to high wave conditions and rough seas.

This marks the second offshore wind project between Siemens and ScottishPower Renewables. Siemens previously supplied this partner with wind turbines with a total capacity of 389 MW for the West of Duddon Sands project in the Irish Sea.

Having installed nearly 2,100 wind turbines to date, with a total capacity of more than 7 GW, Siemens is the leading provider for offshore wind turbines worldwide. The company also has 6.7 GW of offshore wind capacity under service contracts and is a leader in offshore grid connections.

For more information, visit www.siemens.com.

First turbine at Shetland Tidal Array connected to grid

The first turbine in the Shetland Tidal Array has successfully exported power to the grid. The 100 kW Nova M100 device has passed an extensive series of commissioning tests and is now fully operational. Nova Innovation

and Belgian green energy company ELSA installed the device in February. It is now connected to SSE's NINES grid management system, which enables increased renewable energy capacity on a congested grid.

The Shetland Tidal Array, in the Bluemull Sound, will be one of the world's first in-sea tidal arrays when the first three devices are fully installed.

Simon Forrest, managing director of Nova Innovation, said, "Completing this first phase of commissioning is an important milestone for the project and our company. It shows that, through collaboration, a pan-European partnership between a Scottish manufacturing company and a Belgian developer can deliver a world-leading project."

The Shetland Tidal Array is a joint enterprise between Nova Innovation (Scotland) and ELSA (Belgium). Phase 1 of the array consists of three 100-kW Nova M100 turbines, with more turbines planned in following phases.

With the help of Scottish Enterprise, Nova Innovation has delivered a project with over 80% Scottish supply chain content, and over 25% of the spend in Shetland alone.

This offshore tidal array project has

June 2016

25

Ocean News & Technology



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already achieved a number of significant firsts:

- First offshore tidal array project to achieve financial close; and
- First to proceed with a significant share of debt funding.

For more information, visit www.novainnovation.com.

OMM unveils fast response vessel for offshore wind market

Experienced marine services provider Offshore Marine Management (OMM) is launching a fleet of fast response vessels as a new solution for handling emergency or fast response situations at offshore wind projects for personnel, equipment and stores.

The total number of offshore incidents in European markets is projected to continue growing as a result of higher volumes of construction with year-long project programs, which is also taking place further offshore.

The proven vessels, which have maximum rated speeds of 48 knots and excellent maneuverability in rough conditions, will be available as call-out to offshore windfarms that are in the construction and operating phase. OMM is utilizing Innovation with modifications to a proven vessel to improve the response times to emergency offshore and to improve QHSE standards, where there is a current gap in the market place.

OMM is providing the new fast response vessel solution to meet the growing demand for safety for projects to offer faster, safer and more cost-effective alternatives to current practices, such as one-off helicopters call-outs and the use of slower traditional crew transfer vessels in emergencies. This is a dedicated response vessel that works outside of daily operations that doesn't hit the project budgets.

The fast response vessels will be operated by two ex-military qualified and experienced crew members with one boat handling and one medical staff/boat handler with relevant professional backgrounds. High levels of experience and training will ensure that these crew members handle critical offshore situations in a rapid and controlled manner.

The vessels can also be used for less critical situations, such as the rapid delivery of up to 500 kg of critical components and/or up to six passengers. The design of the vessel also fulfills the need for reliable, low-maintenance standby and operation.

OMM currently expects to have around four FRSVs (Fast Response Service Vessels) to be built in the UK and modified to meet the certification of the MCA. They will be in the UK and German market by 2017. Short build times mean OMM is able to respond rapidly to market requirements.

For more information, visit www.offshoremm.com.

E.ON, Statoil to build Arkona offshore wind farm

E.ON is to build another offshore wind farm in German waters. The company announced in April that it has decided to move forward with the Arkona project in the Baltic Sea. The wind farm is expected to be fully operational in 2019. Norwegian energy company Statoil will have a 50% stake and will be involved in the project from the start. E.ON will have responsibility for building and operating the wind farm. Investments in the project will be in excess of € 1.2 billion. This will make E.ON the first company to operate wind farms in both the German North Sea and the Baltic Sea.

Arkona is located in the Baltic Sea, 35 km northeast of Rügen Island. With an installed capacity of 385 MW, the wind farm will be able to provide 400,000 homes with renewable energy and displace approximately 1.2 million metric tons of carbon dioxide annually. It will consist of 60, 6-MW Siemens turbines. The turbine towers will be mounted on monopile foundations installed at depths of 23 to 37 m.

For at least the next 25 years, the logistics base for the construction and subsequent operation of Arkona offshore wind farm will be the Port of Sassnitz in Mecklenburg-Vorpommern. Up to 400 people will help build the wind farm during the construction phase. Once in service, the wind farm will create up to 50 permanent jobs for highly skilled staff in operations, administration, and maintenance as well as, indirectly, another 100 jobs for external service providers.

E.ON's core businesses are energy networks, customer solutions and renewables. The company has invested more than €10 billion in renewables in Europe and the United States since 2007. E.ON operates wind and solar farms with an aggregate capacity of 5.2 GW and is the world's second-largest

offshore wind company. It is currently building Rampion, a 400-MW wind farm located off the coast of Brighton in the English Channel.

Statoil is an international energy company with operations in 37 countries. Building on more than 40 years of experience from oil and gas production on the Norwegian continental shelf, Statoil is committed to accommodating the world's energy needs in a responsible manner, applying technology and creating innovative business solutions. The company is headquartered in Stavanger, Norway with approximately 22,000 employees worldwide and listed on the New York and Oslo stock exchanges.

For more information, visit www.eon.com.

ORE Catapult, Tecnalia to collaborate on R&D

The UK's Offshore Renewable Energy (ORE) Catapult and Spain's Tecnalia have committed to work together to take forward offshore renewable energy research and development.

The two organizations have signed a Collaboration Agreement with the aim of developing R&D projects to tackle some of the key technology challenges facing the sector. They will collaborate on EU frameworks and share testing and demonstration experience in offshore wind energy technologies, with a view to improving existing testing capabilities and facilitating access to each other's testing infrastructure.

They will also exchange knowledge on HVDC technologies, rain erosion test methodologies, erosion coating technologies and measurement techniques.

Representatives from both organizations will sit on each other's respective advisory groups, helping to identify and prioritize critical areas where innovative approaches and technological development can accelerate cost reduction in the delivery of offshore renewable energy.

For more information, visit www.ore.catapult.org.uk.

Seacat supports construction of Race Bank

DONG Energy and offshore energy support vessel operator, Seacat Services, confirmed a 2 year, four-workboat crew transfer deal to support construction operations at the 580-MW Race Bank Offshore Wind Farm.

As offshore wind developers begin construction on current projects in the UK, there is a strong demand for experienced and highly capable supporting contractors equipped to facilitate the installation of new, increasingly sophisticated sites.

With all 91 turbines at Race Bank to be fully commissioned by 2018, construction of the project will demand the highest possible level of workboat availability—something that can present significant challenges for developers when undertaking large-scale installations far out to sea.

Since the early days of offshore wind development in UK waters, the domestic service vessel industry has risen to this challenge, and the versatility, expertise and number of operational hours provided by UK fleets and crews continues to grow with the expansion of the industry.

Seacat Services is committed to providing the market with first-class workboats capable of delivering technicians safely and comfortably to site in the toughest of environments. The operator's fleet of DNV-GL 1A1 HSLC R1 Service 1 classified vessels, all built locally on the Isle of Wight by South Boats, is able to deliver large cargo payloads at high speed.

Under the terms of the agreement with DONG Energy, the first charter day took place on 1 April 2016.

For more information, visit www.seacatservices.co.uk.

Rentel announces turbine supply and maintenance agreement

Rentel NV announced it has signed a Turbine Supply Agreement (TSA) with Siemens for the supply and installation of 42 Siemens offshore wind turbines of the D7 platform and a 17-year Service and Maintenance Agreement (SMA).

After a competitive process that started at the end of 2013, Rentel has chosen for Siemens' offshore wind turbine of the D7 platform. Siemens' D7 type turbines will have a hub height of 106 m LAT and a rotor diameter of 154 m; the wind turbine will be the largest ever in the Belgian North Sea and Rentel will be the first wind farm with a "direct drive" (without gearbox), connecting its rotor directly to the generator.

After having awarded the contracts for the 40 km long export cable (to Swedish ABB AB) and the offshore substation (to STX France-Offshore Energy), the signing of the TSA and SMA contract with Siemens is another important step toward the realization of the fourth complete offshore windfarm in the Belgian North Sea, located between the existing Northwind and C-power projects, about 35 km off the coast of Zeebrugge.

RENTEL aims to complete its project financing by the summer of 2016 in order to immediately start the construction works. The total investment cost is

estimated at €1,250 million. The European Investment Bank (EIB) already provisionally approved financing of the Rentel project through the European Fund for Strategic Investments (EFSI).

This new offshore wind farm will supply renewable energy as from mid-2018. With a total installed capacity of 309 MW, the project is expected to have an annual production of more than 1,100 GWh which is equivalent to the annual electricity consumption of 285,000 Belgian households.

For more information, visit www.rentel.be.

N-Sea awarded renewables unexploded ordnance contract

Subsea IMR provider, N-Sea, has been awarded a new contract with Galloper Offshore Wind Farm Ltd (GWFL).

The contract for pre-construction unexploded ordnance (UXO) clearance works commenced in April 2016 and includes UXO risk management, target investigations and clearance on the Galloper Wind Farm, off the coast of Suffolk.

Expected to run for between 3 to 6 months, the project sees the Siem N-Sea multi-support vessel utilize a WROV to investigate potential UXO targets within the array areas and export cable corridor. N-Sea's dive support vessel, Neptunus, will also undertake similar tasks in shallow water areas.

To complete the clearance works, N-Sea has sub-contracted Ordtek Ltd (provider of unexploded ordnance risk management for land and marine developments), Modus Seabed Intervention (work class ROV and crew hire) and Ramora UK (Explosive Ordnance Disposal services).

Chief operating officer at N-Sea, Roddy James, said: "We are delighted to have the opportunity to contribute to the development of the Galloper project, which is a key part of the UK's renewable energy portfolio.

"N-Sea has an impressive track record of unexploded ordnance campaigns in harsh conditions, which was key to our success in securing this contract. Our personnel and equipment resources are at the leading edge of UXO services, and our efficient, robust systems ensure we complete every project safely, on-time and within budget. This is a clear reflection of our ability to always provide safe, sound and swift solutions for our clients."

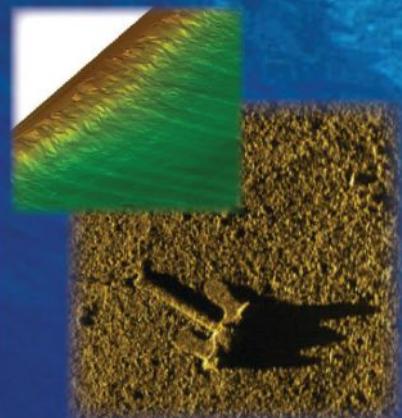
For more information, visit www.n-sea.com.

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Kongsberg active sonar suite and bottom navigation package for next generation submarines

The Swedish Navy together with SAAB Kockums AB has selected an active sonar suite and bottom navigation technology from Kongsberg Maritime for installation on two next generation A26 submarines, which are due for delivery no later than 2022. The contract was awarded through a competitive international tender process and follows a 2015 contract win covering similar systems for two Swedish Navy A19 submarines.

The Kongsberg technology package for the Swedish A26 submarines will consist of SA9510S Mine Avoidance and Navigation Sonars specially designed for submarine applications and a bottom navigation package containing EM2040 multibeam echo sounders, side scan sonars, sub bottom profilers and hydrographic echo sounders.

The SA9510S sonar detects mines, obstacles and the sea floor in a wide swath ahead of the submarine, generating target warnings or alarms within sufficient time to perform avoidance maneuvers. It is a vital tool providing information to crew for bottom navigation purposes and submerged navigation. The SA9510S sonar has the ability to detect and display the bottom profile in several selected horizontal directions in front of the submarine. Mine-seeking and submerged navigation can be performed simultaneously.

For more information, visit www.km.kongsberg.com.

Dassault Systèmes congratulates DCNS and Australian Government on historic naval defense collaboration

France-based DCNS has been selected by the Commonwealth of Australia as its preferred partner for the design of the 12 future submarines. DCNS, whose naval systems are recognized worldwide for their operational, innovative multi-mission capabilities, has chosen Dassault Systèmes' 3DEXPERIENCE platform to manage the entire lifecycle of its products, from concept through engineering, to build, maintain and operations services.

DCNS must manage extreme complexity and high-level integration to provide its clients, industrial systems and equipment partners, and supply chain with the most modern cooperation tools and digital interface. Adopting marine and offshore industry solution experiences based on the 3DEXPERIENCE platform provides the major catalyst to increase capacity and flexibility as well as the most competitive and efficient solutions.

This is a historic international achievement for DCNS. Dassault Systèmes is the technology partner of choice to accompany global industrial innovators on large-scale, long-term international projects and will closely collaborate with Australian subcontractors on this program. The 3DEXPERIENCE platform enables pioneers in their respective marine and offshore segments to virtually experience next generation concepts for the open seas before a structure reaches the water, from one of the world's major cruise ship builders, to the leading international classification society, to high performance competitive sailing teams.

For more information, visit www.3ds.com.

Bollinger wins phase II contract for fast response cutters

Bollinger Shipyards has been awarded a new contract to build Phase II of the Sentinel Class Fast Response Cutters (FRCs) for the United States Coast Guard (USCG). The FRC, the newest generation of USCG patrol cutters, is a replacement for the Coast Guard Island Class cutters that Bollinger built over three decades ago.

Bollinger's CEO and president Ben Bordelon said, "We are pleased with this award to build 26 FRC Coast Guard cutters. Our relationship with the Coast Guard began over 30 years ago and we are proud to continue building on that legacy. This is a testament to the skilled Louisiana based team of Bollinger employees."

For more information, visit www.bollingershipyards.com.

HII's UUV proves reliable during endurance testing

Huntington Ingalls Industries (HII) announced that Proteus, the dual-mode undersea vehicle developed by the company's Undersea Solutions Group (USG) subsidiary and Battelle, successfully completed endurance testing earlier this month.

Proteus successfully completed a 30-day simulated unmanned mission earlier this month. The endurance testing was performed in a test tank at Undersea Solution Group's Panama City, Florida, facility to demonstrate the vehicle's reliability and ability to perform long-duration missions contemplated for the U.S. Navy's future unmanned undersea vehicles.

Computers in a van beside the test tank fed navigational and depth data to Proteus' autonomy and vehicle control systems to simulate the vehicle running a mission in open water. All systems necessary for an autonomous mission were operational and responded to commands. During the test, Proteus simulated traveling 2,412 nmi and ran submerged for 720 hrs while executing a full range of simulated mission behaviors.

For more information, visit www.huntingtingalls.com.

Truman continues strikes against ISIS

Continuing the coalition fight against ISIS, Harry S. Truman Carrier Strike Group has surpassed an operational milestone, delivering the most carrier-based ordnance throughout the conflict, substantially degrading ISIS resources and leadership.

After returning from strike missions 15 April, Carrier Air Wing (CVW) 7 embarked aboard aircraft carrier USS Harry S. Truman (CVN 75), completed 1,407 combat sorties, delivering 1,118 pieces, over 580 tons, of ordnance. Both the weight and number exceed the total dropped by aircraft carrier USS Theodore Roosevelt (CVN 71) during its record-setting 2015 deployment.

"Since our arrival in the Arabian Gulf, the Truman Strike Group has been conducting operations around the clock," said Capt. Ryan B. Scholl, Truman's commanding officer. "This deployment is busier than any other I've seen. Every sailor is doing great work individually and executing as a combat team to reach this milestone. It is due to this dedication as a combined force that Truman is making a significant difference fighting for our country."

Truman, in partnership with 64 nations, has taken the fight to ISIS. Now in its fifth month of deployment, the strike group has played a tremendous role in Operation Inherent Resolve.

"I want you to know the impact you are having," said Lt. Gen. Sean MacFarland, commanding general, Combined Joint Task Force Operation Inherent Resolve. "You've seen

the [OIR] strike videos; but holistically, what I'm seeing is an enemy who doesn't have gas left in the tank."

Truman did not intend to set a Navy record, it was simply a result of the ship's productivity and efficiency while working toward completing its mission.

"Completing the ship's mission is something I always look forward to," said Capt. David "Chicken" Little, commander, Carrier Air Wing 7. "Today marks and signifies the progress we've made and how hard we've worked as a strike group. Everyone did their part. It's the dedication of the whole team that makes completing our mission out here possible."

Deploying during times of conflict is a challenge that requires all hands to achieve mission success.

"We figured based on [Roosevelt's] deployment that we would be utilized more than our previous deployment," Cmdr. Jim McDonald, Truman's weapon's officer. "We had no idea we would be used to this extent and magnitude. We started dropping bombs 29 December and here we are in mid-April still going strong."

Truman sailors responsible for

assembling, handling and transporting the ordnance throughout the ship played a crucial role in reaching the amount of bombs dropped.

Harry S. Truman Carrier Strike Group is deployed in support of Operation Inherent Resolve, maritime security operations and theater security cooperation efforts in the U.S. 5th Fleet area of operations.

For more information, visit www.navy.mil.

Austal awarded Australia patrol boat project

Austal Limited has been awarded preferred tenderer status by the Commonwealth of Australia for the Pacific Patrol Boats Replacement (PPBR) Project.

The PPBR project involves the construction of up to 21 steel-hulled patrol vessels and through life sustainment over 30 years in a total Government expenditure of up to \$900 million. Austal's share of the PPBR program will include the construction of the vessels and short- to medium-term maintenance components of the project.

Austal will now work with the

Commonwealth of Australia to complete documentation and finalize the contract over the coming weeks. Full details will be provided to the market when the contract is finalized.

Austal plans to construct the Pacific Patrol Boats in its shipyard in Henderson, Washington, with through-life support to be performed at Austal's existing facility in Cairns, Queensland. The vessels will replace the existing Pacific Patrol Boat fleet, which is approaching the end of its service life, and will assist Pacific Island countries to continue to take an active part in securing their own extensive Exclusive Economic Zones.

Austal chief executive officer David Singleton said, "Austal has delivered Australia's entire border patrol capability—comprising 30 vessels delivered over the past 17 years—and we look forward to extending this by constructing and servicing vessels that will be used by many of our neighbors in the South Pacific. Construction of the Pacific Patrol Boats also extends Austal's shipbuilding capability into steel-hulled vessels, which will be important for the future construction of Offshore Patrol

June 2016

29

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-Jack Fisher,
Founder

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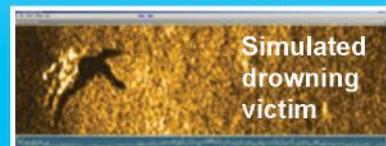


DDW-1

\$1,395



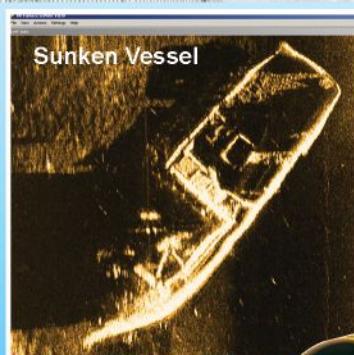
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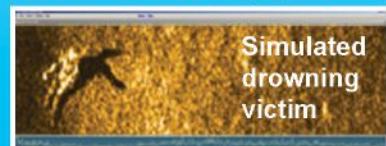
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Vessels. This project will add to our existing work at our Henderson shipyard, where two High Speed Support Vessels are being constructed for the Royal Navy of Oman this year as well as two additional Cape Class Patrol Boats."

For more information, visit www.austal.com.

LPD 26 successfully completes acceptance trials

Huntington Ingalls Industries (HII) announced the successful completion of acceptance sea trials for the company's 10th San Antonio-class amphibious transport dock, John P. Murtha (LPD 26). The ship, built at HII's Ingalls Shipbuilding division, spent 6 days with the test and trials team performing more than 200 trial events that included both an in-port and underway portion.

"This was a significant test at sea for LPD 26, and the ship performed well," said Kari Wilkinson, Ingalls' LPD 26 program manager. "The logistical performance it takes for our test and trials team to execute all of these events while underway is nothing short of phenomenal. Once again the Navy will be receiving a quality Ingalls-built ship that will be mission-ready and able to achieve whatever tasks the sailors and Marines require."

The U.S. Navy's Board of Inspection and Survey (INSURV) spent time onboard evaluating the ship's performance. Now shipbuilders will put the final fit-and-finish touches on the ship in preparation for delivery in May.

Major evolutions during acceptance trials include the anchor-handling demonstration, ballast/deballast demonstration, detect-to-engage exercise, run-

ning the ship at full power and steering.

LPD 26 is named in honor of the late John P. Murtha, who represented Pennsylvania's 12th Congressional District from 1974 to 2010. In addition to his tenured history in the House of Representatives, Murtha was also a veteran of the U.S. Marine Corps and Reserves. He served for 37 years and received the Bronze Star with Combat "V," two Purple Hearts and the Vietnamese Cross of Gallantry for his service in the Vietnam War. He retired as a colonel in 1990.

Ingalls has built and delivered nine ships in the San Antonio class. In addition to John P. Murtha, Ingalls has the 11th LPD, Portland (LPD 27), under construction. Portland launched on Feb. 13 February and will be christened on 21 May. Ingalls has received advance procurement funding for long-lead-time material for the 12th ship in the class, LPD 28.

The San Antonio class is the latest addition to the Navy's 21st century amphibious assault force. The 684-ft-long, 105-ft-wide ships are used to embark and land marines, their equipment and supplies ashore via air cushion or conventional landing craft and amphibious assault vehicles, augmented by helicopters or vertical takeoff and landing aircraft such as the MV-22 Osprey. The ships support a Marine Air Ground Task Force across the spectrum of operations, conducting amphibious and expeditionary missions of sea control and power projection to humanitarian assistance and disaster relief missions throughout the first half of the 21st century.

For more information, visit www.huntingtingalls.com.



UVU aids mine hunting during IMCMEX

Sailors aboard USS Sentry (MCM 3) successfully piloted an unmanned underwater vehicle (UUV) mounted with live explosives to destroy a training mine as part of International Mine Countermeasures Exercise (IMCMEX) on 14 April.

Mapping the seafloor with the SQQ-32(v4) mine hunting sonar, sailors aboard Sentry can identify anomalies and classify objects as "mine-like" based on observed characteristics. Mine-like objects are then investigated and, if necessary, neutralized by deploying the SLQ-60 SeaFox UUV.

SeaFox is a remote-controlled mini submarine drone that can be piloted to a mine while the ship remains at a safe distance. Using sonar, cameras, fiber optics and searchlights, SeaFox allows MCMs to gain valuable visual information of the ocean floor and identify mines with certainty without deploying divers into a minefield. SeaFox has different variants that allow it to be used for investigations, training or mine neutralization. The SeaFox used for mine neutralization is an explosive variant called a combat round or "C-round" and is rarely used for training.

"You can't recover a C-round once it's been deployed; you have to send another C-round after it and blow it up if it malfunctions," said Mineman 3rd Class Matthew Drees, of Lee, Massachusetts, who piloted a C-round into the inert MK36 training mine. "The 3 years I've been in the Navy I've never heard of a C-round being used, so it was pretty cool putting all the training to practice."

The explosion of the C-round shook the ship slightly upon detonation.

To assess the effectiveness of the C-round, Drees piloted a SeaFox investigative round to the training mine. Carefully re-approaching the training mine, Drees was able to visually confirm that the C-round's directional charge collapsed the sensory data collection chamber that the MK36 influence mine would use to arm itself. The C-round placed and detonated by Drees would have rendered a live mine inert.

USS Sentry is an Avenger class Mine-Countermeasures ship homeported in Manama, Bahrain. IMCMEX is focused on maritime security from the port of origin to the port of arrival and includes scenarios that range from mine countermeasures, infrastructure protection and maritime security operations in support of civilian shipping. The exercise, which includes international naval and civilian maritime



forces from more than 30 nations spanning six continents training together across the Middle East, showcases the use of technology to protect freedom of navigation and free flow of maritime commerce.

For more information, visit www.navy.mil.

First UAV command center installed on CVN

USS Carl Vinson (CVN 70) marked a historical milestone 13 April after installing the first unmanned aerial vehicle (UAV) command center aboard an aircraft carrier.

Capt. Beau Duarte, program manager of Unmanned Carrier Aviation program office (PMA-268), inspected the site and recognized Carl Vinson Sailors instrumental in the security, logistics and installation of the UAV suite.

"This marks the start of a phased implementation of the MQ-XX system on an aircraft carrier," said Duarte. "The lessons learned and ground-breaking work done here will go on to inform

and influence future installations on other aircraft carriers."

The work was performed during USS Carl Vinson's recent Chief of Naval Operations Planned Incremental Availability (PIA). The completion of all phases of installation is scheduled for 2022.

"We are carving out precious real estate on board the carrier, knowing that the carrier of the future will have manned and unmanned systems on it," said Capt. Karl Thomas, Carl Vinson's commanding officer. "This suite is an incremental step necessary to extend performance, efficiency and enhance safety of aerial refueling and reconnaissance missions that are expending valuable flight hours on our strike-fighter aircraft, the F/A-18 Echoes and Foxtrots."

The MQ-XX program will deliver a high-endurance unmanned aircraft that will replace today's F/A-18E/F aircraft in its role as the aerial tanker for the Navy's carrier air wing (CVW), thus preserving the strike fighter's flight hours for its primary mission. It will also leverage the range and payload capacity of high-endurance unmanned aircraft to provide critically needed, persistent, sea-based ISR capability in support of the CSG and the Joint Forces Commander. The MQ-XX is scheduled to be operational in the mid-2020s.

"Having a UAV asset that provides persistent, potentially 24/7, surveillance coverage for the strike group is a game changer," said Commander, Carrier Strike Group (CSG) 1, Rear Adm. James Loeblein. "Putting additional ISR capacity into the warfare commander's hands increases the flexibility and warfare capability of the entire strike group."

For more information, visit www.navy.mil.



C&I Leasing Plc, Nigeria, takes delivery of four Damen Stan Patrol 1605 vessels

Following successful sea trials, C&I Leasing Plc, a leading player in the Nigerian offshore support vessel market, has taken delivery of four Damen SPA 1605 ballistic protected security patrol vessels. The patrol boats will be used to provide security patrol and escort services for LNG tankers calling in and out of the Nigerian LNG Bonny terminal.

The 16-m craft have aluminium hulls and GRP composite superstructures. The accommodation has been additionally clad with bullet-proof materials to protect the personnel inside. All four vessels also feature upgraded water jets and engines for maximum performance.

After, sales support is provided by a Damen Service Hub that was opened in Port Harcourt in early 2015. The hub also delivers on-site training and clears and delivers spare parts for the vessels. Martin Verstraeten, Damen regional service manager Africa, says: "The establishment of the Service Hub ensures a local presence with quick response times with Field Service Engineers and a local Site Manager on the ground. This dynamic team maintains close contact with local repair facilities, cooperation with local suppliers and reinforces the strong relationship with our customers."

While receiving the boats in Lagos, Mr. Wisdom Nwagwu (General Manager of C&I Leasing), disclosed that the NLNG contract, which was signed in late 2014, was for a 5-year firm period with an option of a 1-year extension and a cumulative option to a maximum of 3 years.

While commenting on the partnership with Damen, Mr. Nwagwu mentioned that this set of boats will bring the number of Damen-built boats in their fleet up to seven. "We strongly believe that our partnership with Damen will continually place us in a position to play a key role in the Nigerian marine sector," he said.

Damen is providing additional support to C&I Leasing Plc. In November 2015, C&I Leasing sponsored 12 candidates to travel to Damen Shipyards Galati, in Romania, for a period of 6 weeks to study various aspects of ship building.

The four patrol boats were fitted out at Damen Shipyards Gorinchem and delivered to Nigeria as a single batch at the beginning of April 2016. An 8-m RHIB for up to 10 passengers was also delivered as part of the package.

For more information, visit www.damen.com.



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OFFSHORE INDUSTRY

Maersk Oil awards four year contract for culzean development



Maersk Oil has awarded leading information management specialist—Datum360—with a 4-year contract to implement Software as a Service (SaaS) solutions for the Culzean development in the UK North Sea.

The key component of the solution—PIM360—will be at the center of Culzean's engineering data management. Datum360 software has been used for the issuing, maintenance and creation of a tagging and numbering specification together with the matching of these to specific documents, which will capture work completed on all the platforms and vessel.

Using an integrated solution is the smartest and most economically advantageous way that owner operators should work. Not only does it enhance the consistency of data, but it also increases overall productivity and creates a more structured approach to managing vast amounts of project information.

As well as implementing Datum360's Data Management as a Service (DMaaS), Maersk has also used the company to advise its data control center on processes and software and currently to train staff on engineering information systems.

Speaking about the contract win, Steve Wilson, CEO and co-founder of Datum360 said: "We are delighted to have been awarded this contract and to work with a progressive company that is very reactive to pressures faced in the oil and gas industry. As such, Maersk is really driving to increase its efficiencies and implement improvements to their engineering information management, which will play a significant role in reducing costs and saving the company time. "It is estimated that up to 60% of an engineer's time can be spent moving and organizing data on major assets like offshore oil platforms and vessels. If the systems they use are cobbled together, ineffective and or simply don't interlink then this time is completely wasted.

"We pride ourselves on the speedy deployment of off-the-shelf SaaS solutions that can be operational within days and cost as much as 10 times less than the fees for which owner operators have previously had to budget. In the current oil and gas climate we are acutely aware of the need to add value, build trust and ultimately do more for less and at Datum360 we are very proud that this has always been at the heart of our business—delivering efficiencies, experience and first class SaaS technology that delivers every time."

For more information, visit www.maerskoil.com.

in this section

Offshore Industry Headlines	33
Upstream Oil & Gas	36
Underwater Intervention	42
Maritime Communications	48
Subsea Cables	52

2016 OTC attendance ranks in top 15

Offshore energy industry experts and leaders gathered from across the world at NRG Park in Houston 2-5 May for the 2016 Offshore Technology Conference (OTC).

More than 68,000 attendees from 120 countries gathered at the annual conference, placing 2016's OTC among the top 15 highest attended in its 48-year history.

The exhibition floor was sold out before the conference and was the third largest in show history at 672,300 sq. ft., including outdoor exhibits. This year's conference had more than 2,600 companies exhibiting. These exhibitors represented 47 countries, up from last year's 37. Additionally, nearly 300 were new exhibitors, and international companies made up 51% of exhibitors.

"As it has since 1969, the world came to OTC to make critical decisions, share ideas and develop business partnerships to meet global energy demands," said Joe Fowler, OTC 2016 chairman. "The commitment from OTC's volunteers and staff ensured, regardless of the price of oil per barrel, that OTC upheld its unwavering commitment to delivering attendees unparalleled information on new technologies and global developments. Also, revenue from OTC directly benefits the member programs of its 13 nonprofit sponsoring organizations."

OTC 2016 featured 11 panel sessions, 24 executive keynote presentations at luncheons and breakfasts, and more than 325 technical paper presentations. Speakers—including international and national oil companies; federal and regional government officials; and academics—presented their views on a wide variety of topics, including future industry directions, operational integrity and risk management.

OTC's Spotlight on New Technology Awards recognized 13 technologies for their innovation in allowing the industry to produce offshore resources, including one company in the category of Small Business Awards.

Increasing efficiencies while ensuring safe operations was a key theme at this year's conference. Sessions covered new technologies that not only reduce costs to the operator but enhance the overall safety of the operations; cost-effective advances in well cementing technologies; and use of RFID to precisely track drill pipe for enhanced safety and efficiency.

For more information, visit www.otcnet.org.

OFFSHORE INDUSTRY HEADLINES

Research & Development • Environmental Assessment • Discovery

Halliburton and Baker Hughes announce termination of merger agreement

Halliburton Company and Baker Hughes Incorporated announced that the companies have terminated the merger agreement they entered into in November 2014, effective 30 April 2016.

"While both companies expected the proposed merger to result in compelling benefits to shareholders, customers and other stakeholders, challenges in obtaining remaining regulatory approvals and general industry conditions that severely damaged deal economics led to the conclusion that termination is the best course of action," said Dave Lesar, chairman and chief executive officer of Halliburton. "I sincerely thank both our employees as well as the Baker Hughes employees for their tireless efforts throughout the regulatory review process. While disappointing, Halliburton remains strong. We are the execution company—our strategy, technologies and service quality are focused on helping customers maximize production at the lowest cost and driving industry leading growth, margins and returns."

"Today's outcome is disappointing because of our strong belief in the vast potential of the business combination to deliver benefits for shareholders, customers and both companies' employees," said Martin Craighead, chairman and chief executive officer of Baker Hughes. "This was an extremely complex, global transaction and, ultimately, a solution could not be found to satisfy the antitrust concerns of regulators, both in the United States and abroad. As we turn the page on this chapter, I want to thank our customers for their patience and continued loyalty over the past 18 months. I also want to thank the entire Baker Hughes team for their unwavering dedication and commitment during this process. Baker Hughes is strongly positioned to build on its foundation and heritage as a technology innovator that differentiates for our customers and delivers compelling value to shareholders."

In connection with the termination of the merger agreement, Halliburton will pay Baker Hughes the termination fee of \$3.5 billion.

For more information, visit www.halliburton.com.

ABS releases MODU lay-up, reactivation guide

ABS, the leading provider of classification services to the offshore industry, has published a guide to help drilling asset owners carry out rig layups. The new ABS Guide for Lay-Up and Reactivation of Mobile Offshore Drilling Units provides requirements for stacking units based on the type of lay-up to be carried out and provides valuable information for moving rigs back into active operation.

"With global drilling fleet utilization down to nearly 70%, asset owners are laying up rigs, and they are looking to ABS for guidance," says ABS executive vice president of Global Offshore Ken Richardson. "Our Lay-Up Guide provides information for maintaining assets while in lay-up status and outlines a process for laying up rigs and moving them back into service in a way that is streamlined and straightforward."

The Guide includes information on cold-stacked and warm-stacked assets and introduces "Enhanced" status for laid-up units, a designation that notes the lay-up location and procedures for the

June 2016

34

Ocean News & Technology

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unit have been reviewed and verified by ABS in accordance with this guide.

The ABS Guide provides requirements that cover the location, mooring arrangements, a risk assessment and the level of emergency response capability needed and includes requirements for reactivation that verify the unit is in a safe condition to move onsite and begin operations.

The ABS Guide for Lay-Up and Reactivation of Mobile Offshore Drilling Units is available for free at www.eagle.org.

Schlumberger cuts another 2,000 jobs

Seeing the industry in a full-scale crisis, Schlumberger announced that it has cut another 2,000 jobs in the first quarter. The world's largest provider of oil field services saw its global employment down to approximately 93,000.

"The decline in global activity and the rate of activity disruption reached unprecedented levels as the industry displayed clear signs of operating in a full-scale cash crisis," said Paal Kibsgaard, chairman and chief executive officer of Schlumberger.

First-quarter profit declined to \$501 million, or 40 cents per share, from \$975 million, or 76 cents per share a year earlier.

Bibby Offshore awarded multiple contracts

Bibby Offshore, a leading subsea services provider to the oil and gas industry, has announced a multimillion pound contract with a global energy player to provide first gas and construction support on its assets in the Southern North Sea.

The contract, due to be executed between Q3 and Q4 2016, will see Bibby Offshore's construction support vessel Olympic Ares and its diving support vessel Bibby Polaris perform subsea engineering work 150 km off the coast of Lincolnshire in water depths of 21 and 48 m.

The workscope, which includes pre-commissioning and commissioning support, involves Bibby Offshore carrying out a range of construction services comprising valve operations, spool installation, umbilical pull in and lay, trenching and stabilization through installation of concrete mattresses. Supported by Bibby's dedicated onshore engineering team, the company will have access to offshore construc-

tion and pull in/lay teams, ensuring efficiency and productivity is maximized.

The contract is Bibby Offshore's second construction project with the client, following a previous successful campaign in 2015.

Howard Woodcock, chief executive at Bibby Offshore, said: "This is a significant win for Bibby Offshore—not only is it a strong representation of our technical engineering capabilities, but it further underlines our commitment to the North Sea market."

In addition, a further two contracts with major operators have been awarded.

One contract win is a comprehensive DSV IRM campaign at two fields in the UKCS, Northern North Sea. The scope of work includes performing barrier testing, reconfiguring flexible pipelines, installing a new production spool and commissioning.

Another contract win is a construction project approximately 22 mi off the coast of Trinidad. The project will utilize the Bibby Sapphire and include riser clamp installation, spool installation work, flexible jumper tie-ins and pre-commissioning activities.

For more information, visit www.bibbyoffshore.com.

Global life of field opportunities grow across the global landscape

The global subsea market has grown significantly over the past decade leading to a growing install base now exceeding 4,400 flowing subsea wells. Tremendous opportunities exist for life of field services including subsea well intervention and other maintenance activities. While operators navigate these tumultuous times and practice high levels of spending and discipline, IMR and workover activities can be economically advantageous and pay a return through increased production while maintaining the integrity, safety and operational up-time of their subsea systems.

Quest Offshore has been tracking the global subsea market since its inception with Deep Data available on regional (country) activity, operator ownership & trends, water depth analysis and, importantly, age of the wells. As an extension of the Quest Subsea Database, Quest is pleased to offer strategic analysis on the active installed base of subsea trees worldwide to enable companies involved in this market sector to gain a better understanding of future opportunities.

For more information, visit www.QuestOffshore.com.

Range Resources Corporation announces merger with Memorial Resource Development Corp.

Range Resources Corporation and Memorial Resource Development Corp. announced a definitive merger agreement under which Range will acquire all of the outstanding shares of common stock of MRD in an all-stock transaction valued at \$4.4 billion.

Jeff Ventura, Range's CEO, said, "This is an exciting announcement that brings together two high-quality unconventional producers with large de-risked, high-return projects into one portfolio. This acquisition will give Range strategic positioning in both the Appalachian and Gulf Coast regions, providing greater marketing capabilities and opportunities, with added beneficial exposure to growing natural gas demand. The transaction is also accretive to our cash flow, bolsters our credit profile and enhances the overall portfolio. Like Range, the MRD team has a strong culture and track record of safe and efficient operations. We look forward to adding their talents and capabilities to our company, strengthening one of the top overall technical teams in the industry. We believe this combination will create significant value for our existing and new shareholders."

Jay Graham, MRD's CEO, stated, "This transaction combines two complementary companies with a deep, stacked pay portfolio of assets in two leading unconventional resource basins. The cash flow from our strong asset base and the all-stock nature of the transaction will allow our shareholders to benefit from the combined assets. I am confident the combined team, strong balance sheet and premier assets are well-positioned for further success and shareholder value creation."

Under the definitive agreement, MRD shareholders will receive 0.375 shares of Range common stock for each share of MRD common stock held. Based on the Range closing price on 13 May 2016, the transaction has an implied value to MRD shareholders of \$15.75 per share, representing a 17% premium to the closing price of MRD stock. Following the transaction, shareholders of MRD are expected to own approximately 31% of the outstanding shares of Range. MRD will have the right to nominate an independent director from MRD to a seat on Range's Board.

For more information, visit <http://ir.rangeresources.com>.

Deepocean awarded EPRD contract on Varg field by Repsol

DeepOcean AS, a subsidiary of DeepOcean Group Holding BV (DeepOcean), announced that the company has been awarded a contract for provision of Engineering, Procurement, Removal and Disposal (EPRD) of Varg Subsea facilities by Repsol Norge AS.

The scope of work covers a subsea pre-decom survey, recovery of FPSO mooring lines, anchor piles, risers, midwater-arch buoy and subsea structures as well as onshore disposal and recycling of the recovered items.



"In the current market, with tough competition for every job, I am pleased that DeepOcean has been selected by Repsol for this project. DeepOcean already has an in-depth knowledge of Repsol's assets in the North Sea, through our long-term relationship on maintaining the integrity of their assets. Coupled with our significant experience for similar operations it is great to learn that our project team has been able to take advantage of this and develop a cost-efficient solution for Repsol."

Further, the new construction vessel Edda Freya, arriving in our fleet in 2Q16 has been specially designed for multiple types of subsea operations, and hence prove very cost efficient for subject scope," says Rolf Ivar Sørdsdal, DeepOcean's commercial director for subsea services in the greater North Sea.

For more information, visit www.deepoceangroup.com.

Simmons Edeco awarded key contract by major oil and gas operator

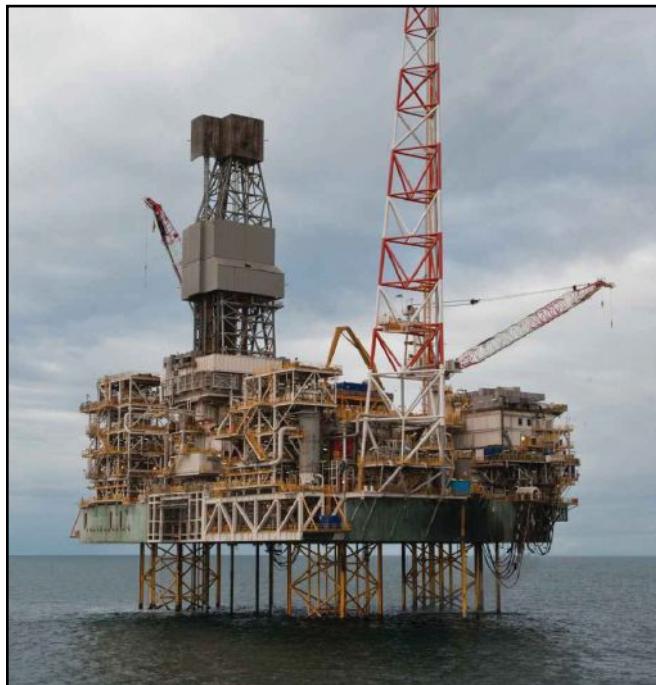
Simmons Edeco, a leading supplier of wellhead and valve maintenance and onshore drilling services to the global oil and gas industry, announced that it has been awarded a multi-million pound contract by a major North Sea oil and gas operator.

"By working with this valued customer over the past 13 years, we have developed a very positive working relationship and a thorough understanding of their operations in the North Sea," said Gavin Sherwood, business development manager. "As a result, we are able to respond immediately when unforeseen challenges arise and to provide them with innovative, cost-effective solutions to meet their asset integrity management needs. It is very rewarding that the company continues to put its faith in Simmons Edeco by awarding this key contract."

In addition to maintaining wellheads, Simmons Edeco will deliver onshore repair and refurbishment services, equipment management and supply, and bespoke engineering solutions. To ensure integrity of all production valves, the company will also continue to operate its ongoing program of valve integrity testing and maintenance.

For more information, visit www.simmonsedeco.com.

Saipem awarded \$1.3 B contract for Shah Deniz Stage 2



Shah Deniz gas field in the Caspian Sea. Photo credit: BP.

Saipem and its consortium partners Bos Shelf and Star Gulf have been awarded call-off 007 under the Shah Deniz Stage 2 Master Agreement by BP, on behalf of the Shah Deniz partnership. The total value of the contract is approximately \$1.5 billion (Saipem share approximately \$1.3 billion), with a duration of 5 years plus a possible extension for an additional five.

The Shah Deniz field is located 90 km offshore Azerbaijan, in water depths from 75 to 550 m. The scope of work of the call-off refers to the transport and installation of subsea production systems and subsea structures; laying of fiber optic cables and production umbilicals, laying of 90 km of pipelines; the activation, crewing and operations management of the new-build Subsea Construction Vessel (SCV) Khankendi; the SCV diving support, remotely operated vehicle (ROV) support; and marine base management post 2017.

Saipem has been involved in the Shah Deniz Stage 2 project since 2014.

Commenting on the award, Stefano Cao, Saipem CEO, said: "We are delighted to have secured this major award, which enables us to continue and consolidate our 20-year relationship with BP and Socar in Azerbaijan and to put our world-class people and technologies at their disposal for the timely and efficient delivery of Shah Deniz Stage 2. This award also further strengthens Saipem's key role in the construction of the Southern Gas Corridor where the company has a total of four contracts, in the upstream segment and in gas transportation infrastructure both onshore and offshore."

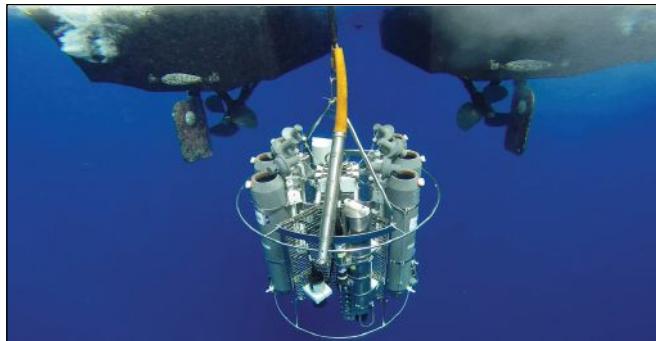
For more information, visit www.saipem.com.

CSA unveils risk management capabilities in latest international venture in Perth, Australia

CSA Ocean Sciences Inc. (CSA) continues to rise to challenges faced by the international oil and gas industry to identify, minimize, and mitigate environmental risk associated with offshore exploration and production activities. CSA announces its international venture in Perth, Australia, which will integrate the company's international network of marine environmental consulting services with the risk management expertise of Ms. Sarah Watson, the regional director and native Australian with extensive global experience in the oil and gas industry.

CSA's Perth office offers the region its global expertise in marine science, operations, and data services:

- Marine Environmental Services for Spill Response – From planning, permitting, monitoring, and impact assessment, CSA assists the industry with preparing for and responding to oil spills.
- Environmental Data and Geospatial Services – Leveraging technology, geographic information systems (GIS), and subject matter experts to provide comprehensive data collection and management solutions for a range of global projects and clients; in particular, EDGSonline, CSA's web-based data mapping application.
- Marine sampling capabilities – providing oceanographic expertise and equipment for conducting specialist studies for habitat characterization and sensitivity, discharge fate and effects, and regulatory compliance.



"The industry is under increasing pressure to minimize risk and environmental impact while maximizing efficiency," commented Ms. Watson. "Joining forces to offer CSA's services and experience in Australia and the Asia Pacific region allows us to better support industry activities in the region and to meet a spectrum of environmental risk management requirements."

CSA participated in the Asia Pacific oil spill response conference, Spillcon, from May 2-6, 2016 in Perth, where Ms. Watson and Mr. Bruce Graham, a Senior Scientist with CSA, exhibited CSA's capabilities.

CSA brings 46 years of specialized experience in marine environmental consulting, serving the energy industry worldwide through offices in the United States, the Eastern Mediterranean, Qatar, Trinidad, Brazil, Singapore, and Australia. CSA's expertise in coastal, marine, and deep ocean surveys, sampling, monitoring, assessment, and mitigation is built on the integration of science, operations, and an understanding of environmental data collection, management, and analysis within geospatial domains.

For more information, visit www.csaocean.com.

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37

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Wild Well raises the bar for riserless plug and abandonment

Wild Well Control, Inc., a Superior Energy Services company and a global leader in well control and engineering services, announces that its DeepRange™ tool, in conjunction with its 7Series riserless intervention system, has successfully performed full plug and abandonment operations on four subsea wells in the Gulf of Mexico. These wells are a part of a larger plug and abandonment campaign that began earlier this year.

"The new tools and techniques used on this project have already exceeded expectations," said Martial Burguières, Wild Well VP of marine well services. "Our methods offer reduced costs while maintaining full BSEE compliance."

Each of the first four wells used the new DeepRange tool to isolate an outer annulus by circulating a minimum of 200 ft of cement in place and pressure testing the plug as per BSEE regulation.

"This new technology and methodology will help operators reduce their subsea P&A liabilities as riserless operations represent dramatic cost reductions when compared to traditional subsea P&A operations," said Burguières.

For more information, visit www.wildwell.com.

Forum Energy Technologies delivers nine of its largest subsea PLR systems to North Africa

Forum Energy Technologies Inc. has successfully delivered a number of its largest subsea Pig Launchers and Receivers

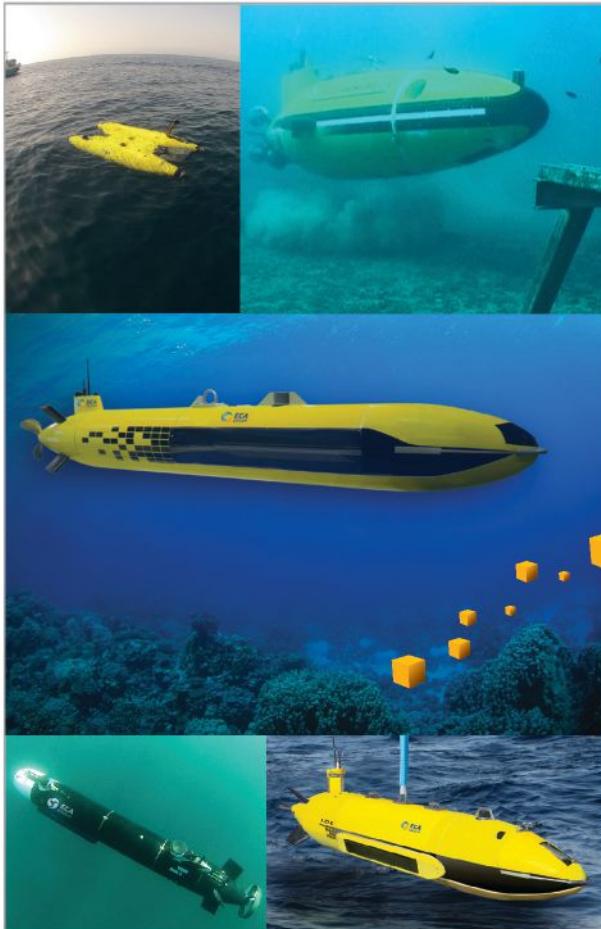


(PLRs) and laydown heads to a project in North Africa.

The nine PLRs have been deployed as part of a development of nine subsea wells, which vary from 4 to 24 in. in size, with water depths ranging from 300 to 800 m.

Manufactured at Forum's Moffat subsea engineering business in Northumberland, UK, the custom-designed units will be used in the completion of flooding, cleaning, gauging, strength test, intelligent pigging and dewatering activities.

John Thompson, operations director at Moffat, said: "Despite the market conditions, there has been a strong and continued demand for the capabilities and expertise held in our Moffat facility. We are engineering innovative products that are benefitting clients around the globe, and this latest contract is testimony to that."



An AUV for every purpose

ECA Group, a leading company in underwater robotics since 40 years, has developed a full range of AUV's: from man-portable to long-range, including mid-size vehicles (less than 500 kg); either mono-hull or twin hull. Every vehicle type in the portfolio is sea-proven.

ECA Group's AUV's are designed to match the whole spectrum of underwater applications: from MCM, Hydrographic Survey, Underwater Inspection to Rapid Environmental Assessment (REA).



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"The scope of work for the project, which included the full design, manufacture and testing of the PLRs, underlines the fully integrated system we can offer from concept through to delivery."

In addition to their size and weight, Forum's PLRs have other additional capabilities compared with conventional systems because they are also equipped with an ROV readable subsea flow meter, and an ROV operable choke valve for discharge throttling to control the pigging velocity. Forum also developed and manufactured a landing interface from the PLRs to the pipeline end terminator (PLET) with a horizontal driverless connection system.

For more information, visit www.f-e-t.com.

BMT delivers CFD study for oil and gas major

BMT Fluid Mechanics (BMT), a subsidiary of BMT Group Ltd, the leading international design, engineering and risk management consultancy, has recently completed a comprehensive computational fluid dynamics (CFD) study for an oil major operating offshore Nigeria.

BMT's scope of work included an assessment of the current loading to which the FPSO hull is subjected to, which has enabled the oil major to ensure its mooring systems are fit for purpose. Johnathan Green, manager for BMT Fluid Mechanics' Numerical Modelling Group explains: "CFD is becoming more commonplace in the oil and gas sector with many customers recognizing it to be an effective tool for solving challenges the industry faces in a less conservative and more efficient manner. In this project, we were able to use CFD to more accurately analyze the hydrodynamic forces caused by current and waves and assess the subsequent effect these forces have on the bilge keels of the vessel which are designed to stop the vessel from rolling."

Through the creation of a 3D CAD model and representation of the FPSO below the water line, the team of specialists at BMT were able to run a comprehensive experimental and numerical study of the maneuvering characteristics. This looked at different parameters of current conditions to help build up a picture of how the forces and motions impact the vessel and how it performs.

CFD has a number of applications within the oil and gas market. BMT regularly uses CFD for consequence modelling (e.g., hydrocarbon fire & explosion and gas dispersion), flow assurance, and helicopter operations. While the aim of all of our work is to

ensure that risks to personnel, assets, and the environment are reduced to as low as reasonably practicable (ALARP) and although there may be a focus in today's current economic climate on reducing capital expenditure, BMT strongly believes that optimizing design early on in a project can considerably reduce costs by avoiding conservatism."

For more information, visit www.bmtfm.com.

Sonardyne SensorView reduces non-productive rig time at Ichthys

Software that enables acoustic data to be streamed in real-time from subsea structures as they are installed has helped to reduce non-production time (NPT) for independent oil and gas producer, INPEX, and its survey contractor, Neptune Geomatics, during construction of the Ichthys gas field, offshore Western Australia.



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Supplied by subsea technology company Sonardyne Asia Pte. Ltd in Singapore, the SensorView software allowed data gathered by an acoustic transponder mounted on Tubing Head Spools (THS) to be transmitted at high speed to rig personnel monitoring the installation operations. The parameters measured by the transponder's on-board sensors included heading, depth, sound velocity and inclination, and meant that delays previously incurred while aligning each THS to drilling templates could be substantially reduced.

Located 220 km off the coast, Ichthys represents the largest discovery of hydrocarbon liquids in Australia in over 40 years. It covers an area of around 800 sq. km in water averaging depths of around 250 m and is estimated to contain more than 12 tcf of gas and 500 mbbl of condensate.

The field will be developed using a semi-submersible central processing facility, the largest of its kind anywhere in the world, and an FPSO connected by 890 km of gas export pipeline to an onshore processing and storage facility at Bladin Point near Darwin.

As part of a 40-month contract, INPEX contracted Neptune to provide rig positioning and survey services during the drilling and completions phase of the project, work that is being undertaken by the Jack Bates and Ensco 5006 mobile drilling units.

For more information, visit www.sonardyne.com.

N-Sea Offshore, DOF Subsea announce cooperation agreement

Subsea IMR provider, N-Sea and Subsea Projects and Engineering provider, DOF Subsea have entered into a 2-year cooperation agreement to provide an Integrated Saturation (SAT) Dive Service.

The Cooperation agreement reflects both companies' strategic decision to increase their overall service offering through saturation diving across Europe, Africa, and Mediterranean.

The principles of the agreement are set out with DOF Subsea providing the dive support vessel, Skandi Achiever, while N-Sea will provide saturation diving resources. Project management, engineering and diving manual/procedures will be provided through an integrated team. N-Sea chief operating officer Roddy James said: "This Cooperation agreement with DOF Subsea reinforces N-Sea's key objective: to fully appreciate our clients' requirements and provide them with the safe, sound and swift service they have come to expect."

"The MOU allows both N-Sea and DOF Subsea to offer an integrated—and highly efficient—SAT diving service to our client, something we regard as particularly important in the context of current market conditions."



Skandi Achiever.

Commenting on the agreement, Robert Gillespie, managing director of DOF Subsea UK Ltd Services said: "We are very excited to work with our partner N-Sea. Teaming up with N-Sea to provide an Integrated Diving Solution will enable us to provide yet another service offering from one of our high specification vessels, namely the Skandi Achiever."

"This Cooperation Agreement exemplifies both N-Sea and DOF Subsea commitment to the Subsea market and reflects our desire to collaborate with companies to the benefit of our respective organizations and clients."

For more information, visit www.n-sea.com.

Sparrows Group seals inspection contract with Stena Drilling

Sparrows Group has been awarded a 20-month inspection services contract to cover Stena Drilling's global fleet of drilling vessels.

The agreement will see Sparrows Group deliver LOLER lifting gear surveys, potential dropped objects surveys, cargo carrying unit (CCU) and non-destructive testing (NDT) inspections as well as rig specific maintenance.

Sparrows Group had previously held a similar contract with Stena for an 8-year period.

This latest contract with Stena Drilling comes shortly after Sparrows Group announced it had secured a 5-year contract in the North Sea with Statoil. In March, the firm revealed it was to deliver cranes and maintenance services at the prestigious Mariner development.

For more information, visit www.sparrowsgroup.com.

Amec Foster Wheeler awarded Kenyan oil terminal contract

Amec Foster Wheeler announces the award of a project management consultancy contract by consultancy company NIRAS to support the next stages in the development of a Kenya Ports Authority project for the offshore relocation and expansion of the Kipevu Oil Terminal (KOT) in Mombasa, Kenya.

Amec Foster Wheeler's scope of work is to provide technical support and expertise to NIRAS for the development of an engineering, procurement and construction tender package and the evaluation of tenders. Amec Foster Wheeler previously supported NIRAS with the preliminary design stage for KOT.

The KOT in Mombasa, Kenya, will be relocated to a site adjacent to Mombasa port berth 16 and 17 overlooking the naval base in Mtongwe.

KOT presently handles more than 90% of the country's imports as well as transit products for Uganda, northern Tanzania, Rwanda, Burundi, Eastern DRC and South Sudan.

Refined petroleum products are offloaded at KOT and transferred to the Kipevu Oil Storage Facility in the coastal town.

For more information, visit www.amecfw.com.

Statoil awarded considerable position in 23rd licensing round

"The Norwegian continental shelf (NCS) is the core of Statoil's business, and we are very pleased with the award in the 23rd licensing round, which will strengthen our exploration portfolio. Gradually opening up new areas is crucial for us to maintain profitable and high-level production up to and beyond 2030," says Arne Sigve Nylund, Statoil's executive vice president for development & production Norway.

The award covers five commitment wells—one in the vicinity of Statoil's existing position and four in the south-eastern part of the Barents Sea, providing access to interesting acreage in a new area on the NCS.

"We will now be able to explore a very interesting area in the Barents Sea. There is always uncertainty related to probability of discovery in new areas. But if we make a discovery, it may involve considerable resources. Exploring in such areas and making substantial discoveries are vital if the NCS is to maintain its production," says Jez Averty, Statoil's senior vice president for exploration on the NCS.

"We have built on our 40 year-long history in North Norway, and our long experience from Barents Sea exploration. A large Statoil team has worked for 24 months to improve this application, and I am very proud of the effort made by everyone across Statoil that has led to this award," says Averty.

"Based on in-house work and seismic data acquisition in 2013 and 2014, Statoil is well prepared for exploration drilling. Through the Barents Sea Exploration Collaboration (BaSEC), the industry has laid the groundwork for conducting safe and cost-effective drilling. We expect to drill the first well already in 2017, and will cooperate with our partners to reach this goal," says Averty.

For more information, visit www.statoil.com.

INPEX and MHI conclude memorandum on joint study of technological challenges

INPEX Corporation and Mitsubishi Heavy Industries, Ltd. jointly announced that they have concluded a memorandum based on an agreement to jointly study solutions for various technological challenges in the energy sector.

Under the auspices of the memorandum, INPEX and MHI plan to jointly establish a working committee and address technological solutions including utilizing the Internet of Things (IoT) and robot technology to further optimize oil and gas production operations.

INPEX aims to sustainably grow its oil and natural gas development business while developing and evolving into an integrated energy company by contributing to the stable supply of energy with a focus on natural gas to a wide range of communities.

MHI will aim to cultivate the energy market with a focus on the global oil

and gas industries by effectively combining its wide range of technologies in the fields of energy and the environment, starting with its advanced technology applicable to gas turbines. The conclusion of the memorandum results from converging the aims of the two companies. Going forward, INPEX and MHI will strive to create innovative business models and opportunities trans-

scending conventional frameworks through the joint study.

As companies representative of Japan's energy sector, INPEX and MHI will contribute to the realization of a sustainable society by combining the resources and technologies they have each cultivated over the years.

For more information, visit www.mhi-global.com.

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Forum Subsea Rentals invests in multi-million rental order

Forum Subsea Rentals, a subsidiary of Forum Energy Technologies, Inc., has further strengthened its global offering of state-of-the-art rental equipment by placing a multi-million dollar equipment order with subsea technology provider, Sonardyne International Ltd.

This order demonstrates Forum's commitment to long-term growth and continued investment in new equipment to ensure customers are offered the latest, cost-effective rental solutions coupled with assurance of reduced downtime by utilizing new assets.

Some of the equipment ordered will be deployed within Forum's global rental pool; however, the majority is committed to secured field development projects in West Africa and North Africa.

Included in the order are multiple Ranger 2 GyroUSBL acoustic positioning systems that combine Sonardyne's 6G acoustic positioning transceiver technology and a Lodestar AHRS sensor in the same mechanical assembly. These systems are ideally suited for quick deployments on vessels of opportunity as without need for a USBL calibration to determine the alignment of the ship's motion sensors to the acoustic transceiver, they provide significant saving in vessel time and operational costs.

For more information, visit www.f-e-t.com.

£15m investment into UK marine autonomous systems

The Natural Environment Research Council (NERC) has announced an investment of £15m in Marine Autonomous Systems (MAS) and sensors over a 5-year development program.

The £10m investment will be made through the National Oceanography Centre (NOC) to ensure the UK remains at the forefront of global marine science and technology innovation.

The program will develop a new 1,500 m depth-rated Autosub Long Range (ALR1500) and a new 6,000 m depth-rated autonomous underwater vehicle (Autosub6000 Mk2). These will support future under-ice and deep-ocean science, including a number of upcoming major marine research programs such as the Changing Arctic Ocean program. The program will be carried out at the Marine Robotics Innovation Centre at NOC in Southampton.

NERC is also investing in command-and-control systems for efficient fleet management, and new equipment to support the NERC-EPSRC Centre for Doctoral Training in "Smart and Autonomous Observing Systems", called NEXUSS – "NEXT generation Unmanned System Science."

NERC will also invest up to £5m in an open call for novel sensor development suitable for deployment on various submarine and surface platforms including the new MAS platforms described above.

This new investment will provide unprecedented capability in ocean observing for all of the UK marine science community with persistent presence of hostile and previously inaccessible deployment of significant new capacity to tackle some fundamental "global environmental science" questions. Further information will be announced later this year.

For more information, visit www.noc.ac.uk.



DeepOcean prepares T3200—the most powerful subsea trencher



DeepOcean 1 UK Ltd., a subsidiary of DeepOcean Group Holding BV, announced that the company has placed a contract with subsea equipment manufacturer SMD to deliver a mechanical cutting boom and associated cable handling system for its tracked trenching vehicle the T3200. The cutting boom will be twice as powerful and deliver double the torque of any other comparable subsea trenching asset in the industry, enabling unrivalled power cable trenching capability in hard ground regions.

The T3200 is the world's most powerful subsea trenching vehicle offering 3200 HP of effective trenching power and is currently equipped with an interchangeable jet trenching cassette that delivers unrivalled jetting power in softer ground. SMD is part of DeepOcean's high-value supply chain in the UK and will deliver an ultra-high torque, boom-cutting cassette for simultaneous mechanical and jet trenching, thus enabling the protection of bundled and un-bundled power cables in rock and other hard ground areas that cannot be trenched with less capable machines.

Pierre Boyde, DeepOcean's commercial director, commented: "The T3200 is a game changer for the offshore power cable industry and sets a new standard for cable burial. In addition to the vehicles unrivaled power and ability to protect product to 3 m in challenging seabed conditions, the asset incorporates HUMS (Health Usage and Monitoring System) for real-time analysis of work rate and asset condition. This important technology increases reliability and sustains subsea operations. We will be using the T3200 for the burial of export cables on a UK based windfarm in 2016 followed by the Nemo Link® interconnector project in 2017 and 2018."

For more information, visit www.deepoceangroup.com.

Second Kongsberg AUV and subsea technology equipped Indonesian survey vessel

The second of two 60-m oceanographic and hydrographic vessels designed and built by OCEA in France for the Indonesian Navy was handed over following a commissioning ceremony in Jakarta this March. The KRI 934 Spica is the sister ship to the June 2015 delivered KRI 933 Rigel, which is already on active survey duty in Indonesian waters. Both are highly advanced aluminium multi-purpose ships, with "Full

Picture" technology packages delivered by Norway's Kongsberg Maritime.

OCEA's unique vessel design and aluminium construction is ideally suited to achieving highly accurate survey results at speed due to producing less cavitation across the hull during surveying. According to OCEA's director of sales, Fabrice Epaud, this enables Kongsberg Maritime's hydroacoustic systems on board to operate optimally and deliver highly accurate data at speeds up to 15 kts, close to almost twice that of standard survey operations.

The Indonesian Navy's new vessels will be utilized to gain a better understanding of the seabed and waters of the Indonesian archipelago, so have been equipped with the most efficient and up-to-date technical and scientific equipment. OCEA worked in partnership with SHOM, the Hydrographic and oceanographic service of the French Navy, to optimize the selection and integration of the hydroacoustic equipment in addition to providing scientific training for crews and technical assistance in Indonesia.

The identical Kongsberg scope of supply for both the KRI 934 Spica and

KRI 933 Rigel includes a Hugin AUV per vessel, EM 2040 and EM 302 multi-beam echo sounders, EA 600 single beam echo sounder and side-scan sonar, in addition to HiPAP hydroacoustic positioning systems. Both vessels have their own 8-m survey launches also equipped with Kongsberg Maritime subsea technology including the EM 2040 multibeam and EA 400 single beam echo sounder. The KRI 933 Rigel also makes use of an advanced Kongsberg Maritime Dynamic Positioning system.

For more information, visit www.km.kongsberg.com.

Bibby HydroMap upgrades Bibby Tethra

In addition to performing planned 5-year vessel maintenance, Bibby HydroMap have also upgraded a number of key systems on the 27.5-m DP1 catamaran, Bibby Tethra.

The most notable of these is the installation of a dual head Kongsberg EM2040 multibeam echo sounder, providing superior sounding density along track at a reasonable vessel speed. The single transmitted, dual receiver system

allows surveying of up to 10 times water depth, matching the capability of the dual head Reson 7125 on Bibby Athena.

Bibby Tethra was also upgraded with the Sonardyne Scout USBL. The Mini Ranger 2 utilizes Sonardyne 6G and Wideband 2 digital signal technology to deliver a maximum 0.2% slant range accuracy, with the ability to simultaneously track up to 10 subsea targets at very fast update rates, again mirroring the capabilities of Bibby Athena.

The iXBlue Octans 3000 FOG has been fitted within the 2040 mounting arrangement and is being upgraded to a Rovins INS, providing a heading accuracy of 0.05° secant latitude, a roll and pitch accuracy of 0.01° and a heave accuracy of 2.5 cm/2.5%.

For more information, visit www.bibbyhydromap.com.



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DTG2 used to uncover missing German warship from WWII

On 22 June 2015, after a 6 year-long-search for the Rio de Janeiro, a sunken German warship, Agder-tech, A-Dykk, and Seabed Services found the vessel sitting off the coast of Lillesand, Norway. The three companies teamed up and set out every spring for 6 years to find the warship that sank on 8 April 1940. This historically significant vessel was the only German ship to be sunk by the Polish during World War II. Part-way through their expedition, the team turned to the Deep Trekker mini-ROV to help with the task at hand.



"The debris was laying as a trail heading to the wreck," explained Espen Johannson from Agder-Tech. "Without the Deep Trekker we would have had to use a bigger vessel and work-class ROV. I don't know of any affordable mini-ROVs that can work in the currents out there."

For more information, visit www.deptrekker.com.

CLIO Offshore launches survey, ROV and recovery services

CLIO Offshore, a division of OMEX—a world leader in deep-ocean exploration—is now offering client packages focused on survey, ROV and recovery for projects down to 6,000 m depth. The containerized packages are designed for fast and efficient mobilization to drive operations from conceptual stages to completion.

"Our goal is to provide efficient and practical support to supplement our client's projects. Our work is underpinned safety first with an aim to deliver an advantage by employing tried and tested OMEX technology and techniques to deliver results in a fair and cost-effective manner," said Andrew Craig,



OMEX director of marine operations. "One key advantage that we offer is the ability to work with our experienced and qualified technical crew that has been working together as a team for over 12 years on various deep-ocean challenges."

Project solutions delivered by CLIO Offshore may encompass a suite of individual tools and services to supplement existing operations or complete project delivery and management to meet a specific objective successfully ranging from desktop study through marine asset procurement and mobilization to execution and reporting.

In addition to the traditional site and route surveys for the offshore energy markets, CLIO Offshore's experience includes deep-ocean natural resource exploration, ship and airplane wreck exploration, archaeological recovery and conservation, and insurance documentation. Our tools can also be used for a wide-spectrum of subsea projects requiring the tools, team and technology that OMEX has assembled.

For more information, visit www.ClioOffshore.com.

Scripps procures advanced ROV technology from Shark Marine

Scripps Institution of Oceanography, one of the U.S.' most technically advanced and highly regarded oceanic research institutions, has recently acquired the Shark Marine Barracuda ROV. The Barracuda will be used in conjunction with the Shark Marine Navigator, procured by the institute just a couple years back.

The Barracuda is a high power, yet lightweight two-man deployable ROV, packed with technology and plenty of thrust to get the job done. The ROV can operate at multiple power levels, from 2,000 W to 6,000 W, allowing for a small or large generator depending on the thrust required for the job. The Barracuda boasts a constant forward bollard thrust of up to 85 lbs, allowing the vehicle to be deployed from vessels of opportunity, whether a small RHIB or a full ocean going vessel. Scripps Barracuda ROV is equipped with Shark Marine's internal navigation system comprised of GPS and Doppler Navigation System (DNS), with the option to use LBL or USBL systems.

The Barracuda ROV is controlled with Shark Marine's powerful yet simple to use "DiveLog" software. DiveLog provides all the capability for manual, semi-autonomous or full-autonomous operation. Using "DiveLog" the user can input known targets or mark new targets "On The Fly," or input routes and differ-



ent map formats. By setting routes, search patterns, and known target positions, reacquiring targets has never been so easy. Simply telling the ROV to go to a target or perform a route unleashes the real power of the DiveLog software as the Barracuda cruises over the bottom on a precise course compensating for depth and currents, while recording data and searching for targets, with or without input from the user.

For more information, visit www.sharkmarine.com.

Proteus announces another successful delivery of a satellite-derived bathymetry project

Proteus, a provider of satellite-derived mapping and geospatial services, has successfully delivered satellite-derived bathymetry to Royal Haskoning DHV during April 2016. Proteus was commissioned by Royal Haskoning to deliver the data as part of a port design project in Saudi Arabia and to identify suitable and cost-effective approaches to the port. The 8,000 sq. km area of interest was surveyed and delivered within 6 weeks and depths up to 20 m were successfully reached.

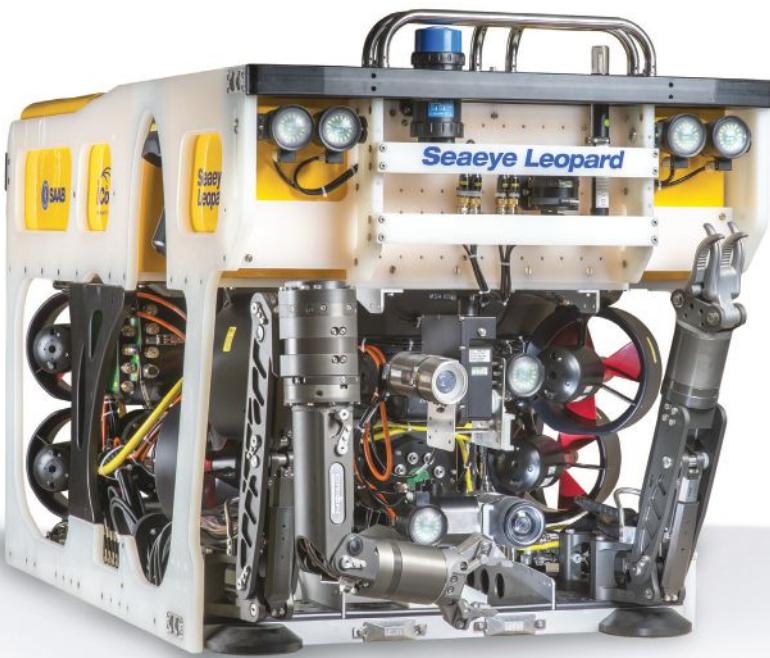
Peter Simpson, coastal engineer from Royal Haskoning DHV states, "Partnering with Proteus helped Royal Haskoning DHV to deliver our project on time and on budget. Proteus' satellite-derived bathymetry data was a quick and cost-effective source of information."

"The advantage of using satellite derived bathymetry in this region allowed RHDHV to easily identify shallow areas and perform hydrodynamic modelling and carry out a cost-effective and fast feasibility study for the approaches to the new port," commented David Critchley, CEO of Proteus.

The work was completed in just under 6 weeks from receipt of order, proving the time and financial benefits of using satellite-derived bathymetry for mapping large areas.

For more information, visit www.proteusgeo.com.

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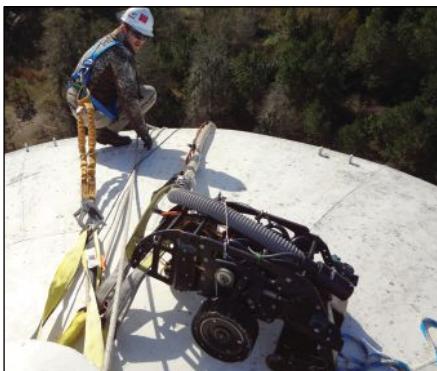
SeaRobotics' tank cleaning ROVs increase safety among inspectors

SeaRobotics Corporation announced the delivery of five production TankBUG ROV systems to the Pittsburg Tank & Tower Group of Henderson, Kentucky. Pittsburg Tank & Tower Group (PT&T) is an industry leader in the field of tank fabrication, installation, cleaning and inspection, with service operations throughout North America and internationally. Applicable to steel, concrete or fiberglass, the TankBUG provides safe, cost-effective removal of sediments and debris from water storage facilities and reservoirs. The reliability and efficiency of the TankBUG allows maintenance inspection to occur on a predictable schedule.

Fabricated in SeaRobotics' high-specification manufacturing facility, the TankBUG ROV system is built around a compact reliable vehicle base with a forward-mounted articulated suction and brushing assembly. The design has been optimized to handle the rigors of working on ground and elevated storage tanks. Regular cleaning and inspection of in-service tanks without the use of divers will reduce the cost of maintenance, improve tank life, and reduce the risk to human life. When equipped with plate thickness, coating thickness, and other sensors, the TankBUG inspection report will lead to proactive maintenance procedures.

"Use of TankBUG has allowed us to improve the efficiency of cleaning and inspection, improve the safety of operations, and reduce the disruption of our client's processes," stated Shawn Potoka, manager of field operations of PT&T. "We have been pleased with the TankBUG's performance after numerous cleanings, and it has been well received by our clients. Without TankBUG we were required to manually drain the tanks, then clean and inspect them. That could take up to 3 days. The equivalent process with a TankBUG can be done in 1 day," stated Shawn.

For more information, visit www.searobotics.com.



The Underwater Centre delivers ROV training to NZ dive team

A team from the Royal New Zealand Navy has recently finished an intensive ROV training course, delivered by The Underwater Centre at the Naval Base at Devonport, New Zealand.

The 9-day course focused on in-water operation training of the Saab Seaeye Falcon ROV, which is regularly used by the Navy for reconnaissance and security missions.

Warships were berthed very closely, allowing the candidates to work under and around the vessels, carrying out a range of training exercises.

The course was split between classroom lectures and practical/in-water operational training and was specifically tailored by The Underwater Centre for the Navy, allowing the candidates to train within their own site with their own ROVs.

The candidates were put through their paces by ROV training and operations superintendent, Paul Bury, who has 15 years' experience in the ROV industry, and has been training industry-ready ROV pilot technicians for over 13 years at The Underwater Centre.

For more information, visit www.theunderwatercentre.com.

Acoustic devices help researchers and marine scientists

Attempting to relocate underwater objects in open ocean or a low visibility environment can be a difficult and time consuming task. Acoustic pingers and transponders solve this problem. These acoustic beacons are attached to an underwater site or instrument package and transmit a sonar signal. A gun-like device, either carried by a diver or deployed from a boat, detects the signal and guides the operator directly to the beacon. Today, these acoustic devices are being employed by many marine scientists and researchers to keep track of expensive oceanographic equipment allowing instruments to be quickly relocated and retrieved.

Dr. Ana Sirovic, an assistant researcher at Scripps Institution of Oceanography's Marine Bioacoustic Lab, studies the effects of ocean noise on marine life. On a research project in the Cayman Islands studying the spawning behavior of the Nassau grouper, Dr. Sirovic deployed an array of hydrophones to listen to the sounds of the underwater environment. To ensure the hydrophones could be easily relocated, their position was marked with a JW Fishers SFP-1 acoustic pinger. "In addition to marking the location, the pinger was also useful in synchronizing the clocks on the array hydrophones," reports Dr. Sirovic.



The Naval Engineering and Test Establishment (NETE) located in Lasalle, Quebec is the Royal Canadian Navy's principal test and evaluation center. NETE is a government-owned-contractor-operated (GOCO) organization providing a broad range of multidisciplinary services directed at naval equipment, combat, and control systems. Their mission is to provide independent and expert testing and evaluation of naval material supplied to the Canadian Forces. To assist in these operations, NETE is using several of Fishers MLFP-1 low frequency pingers. The primary advantage of these pingers is their low frequency acoustic signal that can be detected at a distance of 5 to 10 km. This is a very important feature when deploying mobile equipment in open ocean where the ultimate location may be unknown and retrieval is essential.

For more information, visit www.jwfishers.com.

New ROV tests the waters at MBARI

Over the past week, a team of engineers from the Schmidt Ocean Institute (SOI) has been testing a new ROV, SuBastian, in MBARI's test tank. This is the first time the vehicle has been immersed in salt water, and the first time all of its power systems have been tested. So far the vehicle has been working great. After another week of testing at MBARI, the ROV will be shipped to Guam, where it will undergo ocean testing this summer aboard Schmidt Ocean Institute's research vessel Falkor.



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The new ROV will be able to dive to 4,500 m, providing researchers from around the world with opportunities to explore and study the deep ocean. It carries a state-of-the-art 4K Ultra High Definition video camera that can also capture 20-MP still images. When the ROV is performing scientific dives, video from the vehicle will be streamed live over the SOI website.

For more information, visit www.mbari.org.

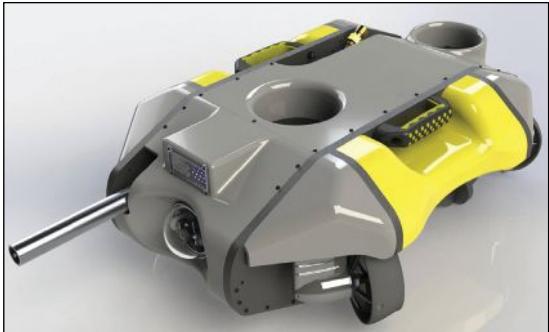
VideoRay mission specialist series

The all new VideoRay Mission Specialist Series (MSS) ROV systems are a customizable and flexible platform that use a system of interchangeable, modular components, communicating through a single intelligent network. The topology of the MSS ROV systems provides an extremely flexible and customizable platform that can be easily adapted to target specific missions. The philosophy behind the MSS is fitting each system to the sensors, tools, depth rating, and thrust needed for the job at hand, rather than retrofit accessories to a standard ROV.

VideoRay MSS ROVs are configured from modular components. Available MSS modules include cameras with a wide range of resolutions, LED lighting, powerful thrusters capable of up to one horsepower operation, and power systems ranging from 75 to 1,600 V as well as an on-board battery option; different manipulators; positioning and sensors for radiation, water quality, and metal thickness; imaging and multibeam sonars; and a purpose-built frame customized around the payload requirements of the operator's chosen sensor and tooling package.

As with existing VideoRay Pro 4 systems, the MSS ROV will offer a wide range of the best underwater sensors and tools available on the market, including sonars, positioning systems, cavitation cleaners, manipulators, DVLs, autonomous control features, and water parameter sensors.

For more information, visit www.videoray.com.



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SpeedCast, Beijing Marine Communications sign MOU

SpeedCast International Limited and Beijing Marine Communications and Navigation Co. Ltd (MCN), a subsidiary of the China Transport Telecommunications & Information Centre (CTTIC), have signed a Memorandum of Understanding (MOU) for Strategic Cooperation.

Under the MOU, MCN and SpeedCast will form a strategic partnership by integrating MCN's VSAT network in Asia Pacific and SpeedCast's global VSAT networks to provide global connectivity to the maritime industry. This partnership will provide seamless connectivity for both MCN and SpeedCast customers wherever they are, as well as providing a wide portfolio of applications enhancing productivity, crew welfare and safety. SpeedCast will assist MCN to expand its infrastructure to provide service coverage in the South China Sea, which will be integrated to SpeedCast global network. MCN will also be able to leverage SpeedCast's extensive network of field engineers located in key ports around the world.

For more information, visit www.speedcast.com.

Satlink appointed as an Inmarsat partner

Satlink Satellite Communications Ltd., part of The Tototheo Group, has become an Inmarsat Partner for Fleet Xpress and FleetBroadband. As part of the partnership Satlink's solutions will be integrated with Inmarsat's Fleet Xpress service to deliver value-added services including their in-house developed s@tLiTE, and Tracklite service that enhances connectivity to their existing global customer network involving merchant shipping, offshore, fishing and leisure markets.

Socrates Theodossiou, joint managing director of The Tototheo Group, said, "On-board bandwidth requirements keep growing, driving the satellite communications industry to integrate and develop in-house, tailor-made solutions for end-users. This strategic alliance with Inmarsat enables a closer relationship and development of our solutions for the industry and ultimately for the global satellite communications market."

For more information, visit www.tototheo.com.

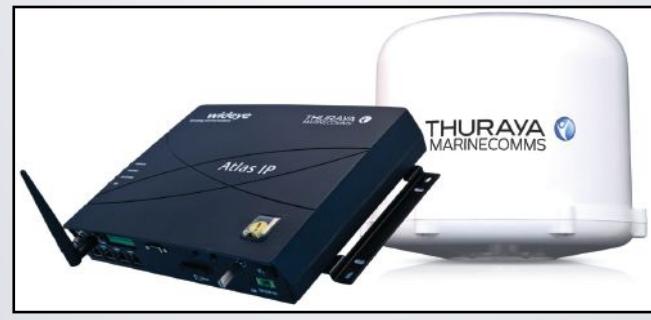
Thuraya signs Elcome to boost support to GCC and Egypt

Thuraya Telecommunications Company has announced an agreement with Dubai-based marine solutions provider, Elcome International, to offer technical support to Thuraya's service partners throughout the GCC and Egypt.

The new contract will ensure faster response times to requests made by service partners needing maintenance work, fault rectifications, and the installation of Thuraya maritime equipment. The agreement comes after Thuraya's recent expansion of its maritime portfolio with the launch of the Atlas IP. Atlas IP is an easy-to-install terminal that offers managers and crew seamless access to the Internet, enhanced connectivity, and high-speed onboard efficiency with best-in-class data rates.

At agreed rates, Thuraya's service partners will have the benefit of being able to call on Elcome's fully-trained engineers to avoid extensive downtime in the event of equipment problems. As Thuraya's maritime business continues to experience substantial growth, this convenient maintenance and service contract comes into effect following an increase in regional customers signing up with the leading mobile satellite services operator.

For more information, visit www.thuraya.com.



SeaVsat selects SES Enterprise+ Broadband



SES S.A. announced that SeaVsat, a global mobile broadband communication solutions and maritime communications provider, has chosen to use the SES Enterprise+ Broadband service and to utilize additional SES capacity to deliver connectivity to vessels worldwide.

Under the new agreements, SeaVsat will be providing broadband connectivity and VoIP services to its maritime customers. This will enable secure and reliable communications for offshore operations and enhanced crew welfare communication services.

The SES Enterprise+ Broadband service offers high-speed broadband and is a competitively priced flexible connectivity platform that has a "plug 'n' play" offering, with pay-as-you-go options to ensure the service can quickly be accessed. SES Enterprise+ Broadband is the first product offering of SES's enhanced data network—SES Plus—that will offer customized products and solutions to tackle the evolving needs of the data markets.

For more information, visit www.ses.com.

Fujitsu builds industry-first maritime big data platform

Fujitsu Limited announced that it has built a maritime big data platform for Nippon Kaiji Kyokai, an international ship classification society also known as ClassNK. The platform will be available from April 2016.

Fujitsu has now built a platform with ClassNK that collects and accumulates machinery operational data from moving vessels, such as engine data, as well as marine weather information, as big data. This enables maritime businesses such as ship operators and shipyards to extract data about vessels under navigation, as needed. This will enable, for example, operations personnel to predict malfunctions using engine operations data, or to achieve more energy-efficient operations using voyage data and marine weather data.

This maritime big data platform, the first shared platform in the maritime industry, will be operated as a data center service by Ship Data Center Co., Ltd., a subsidiary of ClassNK established in December 2015. Fujitsu will support the further effective use of ship data by expanding the functionality of this maritime big data platform, contributing to the further development of the maritime industry.

With the development of broadband communications at sea, it has become possible to collect and monitor navigation-

al information and information from sensors mounted on ship equipment and machinery. There has also been a focus on new efforts using data, such as energy-efficient operations and malfunction diagnosis. When these systems are built separately, however, their use is restricted to a few ships and maritime businesses due to the burden of cost and effort, such as data use agreements and strong security measures.

This new ship data center, operated by Ship Data Center, is the industry's first effort that provides collected data as a shared platform to promote broad data use in the maritime industry.

The ship data center aggregates and stores navigational information sent from individual ships, such as from a Voyage Data Recorder, operational and measurement information for engines and all manner of ship-mounted equipment (machinery data), and worldwide marine weather information. Previously, in order to use ship data, maritime businesses had to individually collect the necessary data and integrate it as unified data, but now, because a wide variety of data is all collected together in the ship data center and is provided

through a web API that can generate a specialized data format for each business, they no longer need to prepare their own system from scratch to make use of big data. In addition, all sorts of data, collected in a variety of formats, can be converted to a variety of easier-to-use formats, such as CSV or JSON, when provided to users.

Because ship data is collected, stored, and transmitted through the Internet, the ship data center features security functionality, such as data virus checking and user authentication.

Fujitsu will continue to expand the functionality of the ship data center, such as through the use of AI-based data analysis technology. In addition, Fujitsu is currently working to support the regulations proposed as new international standards for the handling of ship data as soon as possible.

For more information, visit www.fujitsu.com.

KVH ships over 6,000 systems for global maritime VSAT market

KVH Industries, Inc. announced that as of the end of 2015, it had shipped more than 6,000 TracPhone satellite

communications antenna systems for the mini-VSAT Broadband network. This milestone reaffirms the company's top market share position in the maritime VSAT industry by vessels in service, a benchmark noted in the COMSYS Maritime VSAT Report, 4th Edition, March 2015. The company also announced that it recently expanded the capacity on its global mini-VSAT Broadband network, which provides essential connectivity to vessels around the world.

"Our solution has been widely adopted because it brings simplicity and value to ship owners and operators, fleet IT managers, operations professionals, officers, and captains operating in a highly competitive global environment," says Martin Kits van Heyningen, KVH's chief executive officer. "When we entered the market in 2007, our goal was to win a leadership position through market disruption, changing the way mariners thought about satellite communications by offering a complete solution encompassing small, simple, easy-to-install equipment, fast data speeds, and cost-effective airtime."



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Since that early market introduction, the company has ramped up to an average of nearly 1,000 systems per year for five consecutive years, 2011-2015, as reliance on fast and reliable satellite broadband connectivity has spread throughout the maritime industry. In 2012, the mini-VSAT Broadband service became the maritime VSAT market share leader according to leading market research reports, a position that has been repeatedly re-confirmed in report updates.

To provide the most robust coverage possible, the company continually monitors and upgrades its mini-VSAT Broadband service and recently expanded its network via an additional Ku-band service beam that provides Pacific Northwest U.S. coverage, where fishing fleets operate and rely on connectivity from KVH.

"Operating our own network provides us with unique opportunities to offer creative solutions to our customers' problems," says Mr. Kits van Heyningen. "Already, more ships rely on KVH's mini-VSAT Broadband network than the next two maritime VSAT providers combined, and our growing customer base and satellite capacity are testimony to our forward thinking approach to technology and services."

Thome selects KVH Media Group's MOVIElink service for 41 vessels

KVH Media Group, the largest and leading distributor of licensed films to the maritime market, and part of KVH Industries, Inc., has announced an agreement with Thome Ship Management to provide 41 Thome vessels with the MOVIElink service. Part of the Thome Group, which is one of the world's leading ship managers, Thome Ship Management will initially roll out the MOVIElink service to product tankers and LPG carriers.

The MOVIElink service delivers films, including the latest releases, to vessels around the world, contributing to more productive and loyal crews and assisting shipping companies in complying with the standards and recommendations of MLC-2006. These recommendations include providing regularly replenished film entertainment to crew members.

An important aspect of the MOVIElink service is that the content provided is licensed in accordance with the requirements of copyright holders. Shipping companies have become increasingly aware of the potential liabilities they face under international copyright laws and treaties for any unlicensed viewing of movie downloads, DVDs, and video cassettes, including those that crew members bring onboard. With content provided by the MOVIElink service, vessels receive the required license for non-theatrical viewing on commercial vessels.

KVH Media Group's MOVIElink films are provided in a range of formats, from delivery of hard-copy DVDs direct to ship agents anywhere in the world, to a fully digital service for fleets with VSAT communications capacity. KVH Media Group has been delivering movie entertainment to seafarers for more than 50 years—beginning with the Walport movie service, which delivered films to crews on reels and became the backbone of "Walport movie nights," which are still fondly remembered today for bringing crew together in their leisure time onboard. MOVIElink content is also available via KVH's IP-MobileCast content delivery service, which utilizes multicasting technology to deliver large multimedia files via KVH's mini-VSAT Broadband satellite communications service.

For more information, visit www.kvh.com.

U.S. Coast Guard expands AIS requirements

The U.S. Coast Guard is expanding Automatic Identification System (AIS) requirements to include additional commercial vessels.

The change, which applies to U.S.-flag and foreign-flag vessels that are 300 gross tons or less, went into effect in April 2016.

Most commercial vessels operating on American waterways are required to have AIS, a navigation safety communications system designed to mitigate collisions and enhance maritime situational awareness.

The International Maritime Organization adopted the use of AIS for ocean-going vessels in 2000, and the Maritime Transportation Security Act of 2002 mandated AIS usage for most commercial vessels operating on the U.S. navigable waters.

All AIS users must abide by certain Coast Guard regulations published January 2015 regarding its operation and programming.

"For AIS is to be as effective as it was designed to be, it is imperative that all AIS users keep it in proper operating condition and up-to-date with vessels' particulars," said Jorge Arroyo, the senior civilian in the U.S. Coast Guard's navigation technology and risk management division who has been involved with AIS technology since its inception.

AIS increases situational awareness across the U.S. Marine Transportation System (MTS), the vital economic arteries that enable the movement of \$8.7 billion worth of goods and commodities every day.

Cmdr. John M. Stone, the chief of the Coast Guard navigation technology and risk management division, said AIS can also be used to augment the nation's Aids to Navigation system by extending the effective range of buoys, beacons, ranges and sound signals.

Stone said the Coast Guard is partnering with the National Oceanic and Atmospheric Administration's Office of Ocean Services to add Physical Oceanographic Real-time System (NOAA PORTS) meteorological and hydrological information into the Coast Guard's AIS transmissions.

"Mariners will be able to receive real-time weather and tidal information," said Stone. "We are also pursuing an initiative to augment our voice Broadcast Notice to Mariners transmissions by providing this vital Marine Safety Information via AIS, thus digitally to shipborne information systems."

For more information on the new requirements that apply to all AIS users, the AIS Encoding Guide and the U.S. AIS Network, visit the Coast Guard Navigation Center (NAVCEN) website at www.navcen.uscg.gov.

Cobham, Inmarsat enable smart shipping for Nanjing Tanker Corporation

Inmarsat and Cobham SATCOM announced that their partner Beijing Marine Communication & Navigation Company Ltd. (MCN) has won the largest Inmarsat Fleet Xpress installation

project to date, with Nanjing Tanker Corporation of China. Just 2 weeks after the launch of Inmarsat's Fleet Xpress service, the agreement brings always-on, next generation high-speed broadband capability worldwide to 70 ships; delivering "smart shipping" connectivity to drive performance optimization and a step change in crew communications and welfare for Nanjing Tanker Corporation (NTC) vessels.

Cobham and Inmarsat partner Beijing Marine Communication & Navigation Company Ltd. (MCN) will manage the roll-out of Cobham's SAILOR 100 GX and SAILOR 60 GX antenna systems to NTC.

"Fleet Xpress with SAILOR antennas will open the way for Nanjing Tanker Corporation to exploit greater use of data and collaboration focused on 'smart shipping' applications, including video conferencing, remote vessel assistance/diagnostics, telemedicine, video surveillance and information management systems for maritime 'big data' applications," said Song Zhen, vice president of sales and marketing for MCN.

The choice of SAILOR 60 GX and SAILOR 100 GX supports high reliability and availability of Fleet Xpress communication services for crew, ensuring their ability to contact friends and family, use social media or browse their favorite websites and forums. With demand for crew voice and data services continuously growing, the field-proven reliability of SAILOR satcom antennas helps vessel owners and operators to get the most from Fleet Xpress, contributing significantly to crew recruitment and retention strategies.

The 1-m SAILOR 100 GX is based on Cobham SATCOM's sophisticated SAILOR VSAT Technology platform, designed to simplify installation and operation while delivering class-leading radio performance through unmatched link stability and service reliability. The 60-cm SAILOR 60 GX leverages an entirely new compact, lightweight carbon fiber composites/aluminum design. By enabling a high-throughput link to Fleet Xpress in a smaller antenna package, SAILOR 60 GX introduces smart shipping applications to smaller platforms, including workboats, fishing vessels and yachts. In March 2016,

SAILOR 60 GX won the Mobile Satellite Users Association's (MSUA) 2016 Top Maritime Mobility Satcom Innovation award, highlighting it as one of the most innovative maritime VSAT systems available today.

For more information, visit www.inmarsat.com.

SES to take control of O3b Networks

SES S.A. has agreed to increase its interest in O3b Networks (O3b) to 50.5% and, in doing so, will take a controlling share in the company. The transaction is subject to regulatory approvals that are expected to be completed during H2 2016.

SES will pay US\$20 million to increase its fully diluted ownership of O3b from 49.1% to 50.5%, bringing its aggregate equity investment in O3b to date to US\$323 million. On completion, SES will consolidate O3b's net debt, which is currently US\$1.2 billion. The transaction is expected to generate returns exceeding SES's hurdle rates for infrastructure investments.

For more information, visit www.ses.com.

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Africa-1 consortium sign MOU

MTN Group, PCCW Global, Saudi Telecom Company (STC), Telecom Egypt (TE) and Telkom South Africa have signed a Memorandum of Understanding (MOU) with the intention of constructing the new Africa-1 submarine cable system. This consortium-funded system will connect Africa with the Middle East and South Central Asia and provide onward connectivity to Europe.

Companies named in the MOU represent a wealth of experience and expertise in deploying major cable systems, and they are expected to be joined in the consortium by other carriers seeking to contribute to and to share in Africa-1's success. The consortium members have access to landings at all major cable systems in the Middle East, which will facilitate efficient and effective connectivity between Africa-1 and the rest of the world.

Africa-1 will have at least 3-fiber pair core that extends more than 12,000 km along Africa's East Coast towards Saudi Arabia, Egypt and Pakistan, with up to an additional 5,000 km for branches. Africa-1 will leverage the latest state-of-the-art 100G technology and will be initially equipped to accommodate several terabits of capacity from day one. Along with comprehensive interconnection with other cable systems and full Open Access at all cable landing points, Africa-1 will be technically and commercially designed to be attractive, delivering easy accessibility and a unique low-latency direct express route. The Construction and Maintenance Agreement is expected to be signed by June 2016, with a target ready for service timeframe of the third quarter of 2017.

For more information, visit www.pccwglobal.com.

Groundbreaking workshop on HVDC power cables held in Turkey

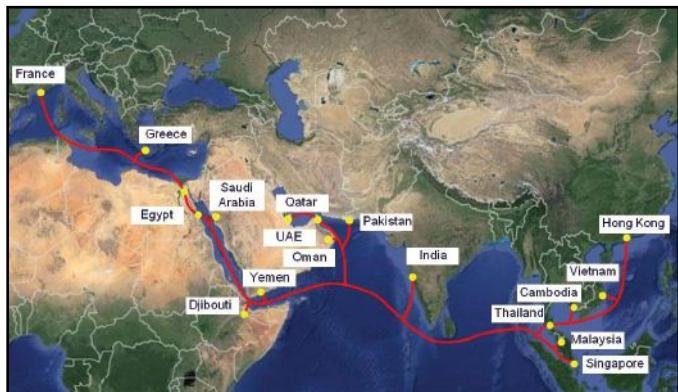
On 7-8 April 2016, in Ankara, Turkey, an important academic milestone was reached when High Voltage Direct Current (HVDC) cables in the Area Beyond National Jurisdiction (ABNJ), or high seas proper, were studied by a blue ribbon team of international legal scholars, diplomats, environmental scientists, and industry experts. This study was a part of the DEHUKAM International Workshop 2016 entitled, "Legal Status of Submarine Cables, Pipelines and ABNJ," the inaugural workshop by the Research Center of the Sea and Maritime Law of Ankara University (DEHUKAM). The workshop was held jointly by the Center for Oceans Law and Policy (COLP) of the University of Virginia, the Center for International Law (CIL), National University of Singapore, the University of Bergen in Norway, and the International Cable Protection Committee (ICPC). State participation included representatives of the Ministries of Foreign Affairs of Turkey and Iceland. Distinguished participants from the International Tribunal of the Law of the Sea included the President Judge Vladimir Vladimirovich Golitsyn (Russian Federation), Vice-President Judge Boulalem Bouguetaia (Algeria), and Judge Markiyana Kulyk (Ukraine).

The workshop drew over 100 international participants who heard and exchanged detailed information with legal, scientific, and industry experts who examined the applicable legal provisions of the United Nations Convention on the Law of the Sea (UNCLOS), the operational realities of laying and repairing international cables in ABNJ, and the well-established peer reviewed science about these activities and the marine environment in ABNJ. While submarine fiber optic cables have been studied before in international workshops, this was the first time that HVDC power cables received such careful scrutiny and study in an international multidisciplinary forum. Particular emphasis was placed on a modern review of the environmental impacts of submarine cables in the ABNJ marine environment. The workshop marked the debut of a new educational video "Ocean Currents" on submarine power cables that is now available to the public through the ICPC.

Participants remarked that the timing of the long-planned workshop could not have been better, given the discussions at the Preparatory Commission convened this year by the United Nations to examine activities in the BBNJ, and the possible need to allow for a new implementing agreement that may deal with Marine Protected Areas (MPAs) and Environmental Impact Assessments (EIA).

For more information, visit www.iscpc.org.

AAE-1 lands in Greece



OTEGLOBE announces that Asia Africa Europe-1 (AAE-1) subsea cable system has successfully landed at OTE's international Chania landing station in the island of Crete, in Greece. All shore end works at Chania have been successfully completed and Greece is now officially connected to the AAE-1 cable system. The AAE-1 submarine cable spanning approximately 25,000 km, will be one of the first unique cable systems connecting Hong Kong, Singapore, Middle East, Africa and Europe and providing an alternative low-latency route between Far East and Europe. Its completion will provide additional protection and diversity to the existing heavily congested cable systems.

AAE-1 subsea cable will be ready for service at the end of 2016. OTEGLOBE has been a full member and landing party in AAE-1 from its initial conception back in 2012. Landing the cable in Greece marks a significant milestone for AAE-1 project, since OTE's International landing station at Chania, Crete, is the first entry point in Europe and where diverse routes towards East and West Europe are available over OTEGLOBE's network footprint.

OTEGLOBE is the only carrier that reaches Western Europe through Greece with two fully owned, geographically diverse networks, the GWEN and the TBN, while operating a private IP network with presence in the main telecom hubs in Europe. Hence, by offering an alternative transit route, connecting Europe to Asia and the world through Greece, OTEGLOBE combines both a resilient subsea route with a terrestrial reliable solution and is emerging as a reliable hub in the Mediterranean basin."

When completed, AAE-1 will connect Hong Kong, Vietnam, Cambodia, Malaysia, Singapore, Thailand, India, Pakistan, Oman, UAE, Qatar, Yemen, Djibouti, Saudi Arabia, Egypt, Greece, Italy and France. AAE-1 cable system deploys 100Gbps transmission technology, with a minimum design capacity of 40 Terabits. It is a next generation subsea cable that bridges both the major Asian gateways of Hong Kong and Singapore with multiple Onward-Connectivity options in Europe featuring unique landing points in Greece, Italy and France. One of the unique features of AAE-1 is that while it terminates at two PoPs in Singapore, it also continues further into Asia via diverse terrestrial routes across Thailand, connecting Vietnam and Hong Kong. This routing enables AAE-1 to have one of the lowest latency's between Hong Kong, India, the Middle East and Europe.

For more information, visit www.oteglobe.gr.

TE SubCom to perform third capacity upgrade to Caucasus cable system

TE SubCom, a TE Connectivity Ltd. company and an industry pioneer in undersea communications technology, and Georgian telecommunications provider Caucasus Online, announced that they have signed a contract to perform a network upgrade to the Caucasus undersea cable system. The upgrade to the 1,200 km regional system will be completed by May 2016.

In service since 2008, the Caucasus Cable System was designed, manufactured and installed by TE SubCom. The system provides high bandwidth connectivity between Poti, Georgia and Balchik, Bulgaria, and successfully serves Georgian markets by providing direct access to Western Europe. Utilizing TE SubCom's 100 Gb/s coherent transmission technology, the system can now support over 9 Tbps, more than seven times (7x) the initial design capacity. This latest upgrade will increase lit capacity to 780 Gb/s.

"As the project supplier for both the full system construction and previous upgrades, we greatly value Caucasus Online's confidence in TE SubCom," said Aaron Stucki, president, TE SubCom. "We look forward to continuing our support of this essential cable route by providing state-of-the-art technology that enables Caucasus Online to bring high-volume capacity to its customers."

"Our system has proven vital to achieving connectivity throughout the Caucasus region, and a network upgrade will only improve our service offerings," said Nikolai Tchiaureli, CEO, Caucasus Online. "TE SubCom's familiarity with the system will bring with it a seamless capacity increase, and we're pleased to continue our longtime collaboration with them."

For more information visit, www.co.ge.

Xtera unveils innovative branching unit

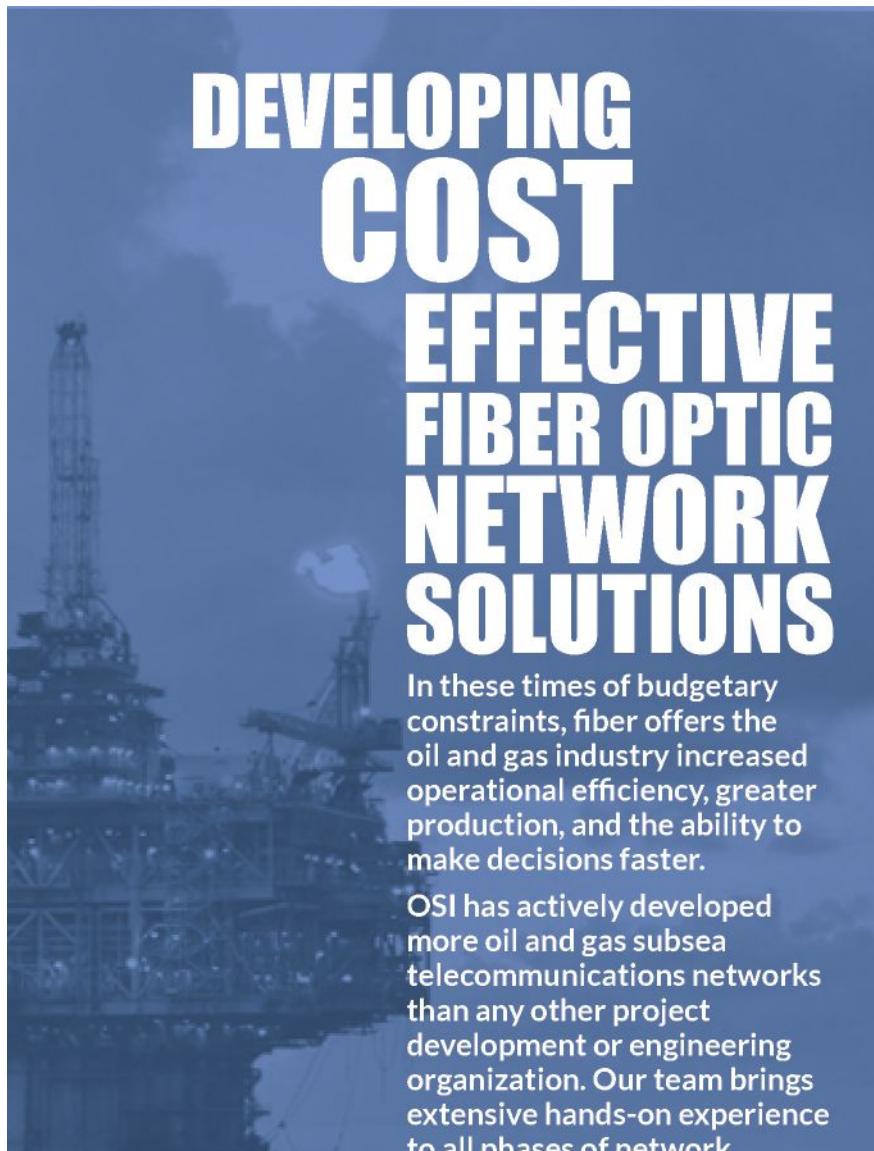
Xtera Communications, Inc. announced the release of its subsea branching unit (BU) that builds on the technology successfully deployed in its repeater. Branching units are used in submarine cable systems to provide traffic and power routing between the trunk and branch cables, enabling complex and reconfigurable network architecture for more flexible capacity con-

figurations (as requested in networks where IP packets form the dominant traffic), and simpler fault recovery.

Following customer feedback that re-configuring the powering of a system can be time-consuming and difficult, Xtera has used the supervisory system to allow operators to switch the BU powering simply by sending commands. This avoids the need to disconnect or change the polarity of Power

Feed Equipment (PFE) or arrange for synchronized ramping to ensure the desired current flow during re-configuration. There is also circuitry to minimize the effects of current surges, to allow hot-switching and to hold the configuration during a power dip.

"We have focused on making the BU robust and easy to use," said Stuart Barnes, senior vice president and general manager, Xtera Submarine



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Business. "Our innovative supervisory also makes it possible for a user to check the BU operation via the network management system."

For more information, visit www.xtera.com.

ASN to upgrade transoceanic cables

Alcatel-Lucent Submarine Networks (ASN), now part of Nokia, will implement two major upgrades on transpacific and transatlantic routes to further enhance global connectivity for broadband content and applications as well as for bandwidth-intensive cloud computing services.

The upgrades will add terabits of capacity on each route bringing more scalability and redundancy to the delivery of high-speed, low-latency services over resilient high-capacity systems.

On the transpacific route, ASN will upgrade a new cable system that will connect major cities along the West Coast of the United States to two coastal locations in Japan and Taiwan. On the transatlantic route, ASN will upgrade a submarine cable system link-



ing the UK to the U.S. over a distance of 6,500 km.

Both upgrades will be implemented with ASN's latest technology, the 1620 SOFTNODE, which offers the best spectral efficiency on the market on both new and legacy systems with third generation coherent technology at bit rates up to 400 Gbps.

For more information, visit www.alcatel-lucent.com.

ASN to deploy BRUSA

Telefónica and Alcatel-Lucent Submarine Networks (ASN), now part of Nokia, have signed a turnkey agreement to deploy a nearly 11,000 km submarine cable system linking Brazil to the United States. Named BRUSA, the system will increase end-to-end connectivity and the availability of ultra-high-speed broadband services in the region.

BRUSA will support ultrafast transmission allowing Telefónica to strengthen its offer in the wholesale market and addressing the exponential growth of data transmission generated by its business-to-business customers, telecom operators, webscale operators, and end-users. Linking Rio de Janeiro and Fortaleza (Brazil) with San Juan (Puerto Rico) and Virginia Beach (USA), the system will also deliver enhanced resiliency over the Brazil-to-U.S. route.

Philippe Piron, president of Alcatel-Lucent Submarine Networks, said, "BRUSA comes at a moment of continued interest in the Brazil-U.S. route to reliably carry increasing volumes of data traffic as global demand for ultra-broadband access rises."



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BRUSA will deploy Alcatel-Lucent Submarine Networks' technology, which provides full scalability that covers large system deployments and web-scale connectivity. Thanks to stepless optical transmission tuning capabilities offered by ASN's technology, operators can extract maximum capacity from the wet plant and dry plant and create economies of scale by offering fast and dynamic provisioning.

BRUSA will further integrate Telefónica's global fiber optic network, which consists of more than 65,000 km of subsea cable, of which 31,000 km is proprietary submarine fiber optic cable, connecting the U.S., the Americas, and Europe.

For more information, visit www.alcatel-lucent.com.

KDDI selects Ciena for JIH upgrade

Ciena® has been selected by KDDI Corporation for the Japan Information Highway (JIH) submarine cable upgrade to help meet surging demand driven by factors such as increased data communications. Deploying Ciena's GeoMesh submarine solutions, KDDI will be able to provide high-capacity 100G services on its 3,000-km link from Miyazaki-to-Okinawa and Shima-to-Okinawa.

KDDI is enabling the high-capacity, cost-effective JIH submarine link with Ciena's 6500 Packet-Optical Platform, powered by WaveLogic coherent optics, while Ciena's unified management capability ensures an end-to-end view of the network for faster service turn-up, complete visibility of performance and remote troubleshooting.

With Ciena's WaveLogic coherent optics service providers like KDDI can efficiently scale their networks to support today's surging web-scale demands driven by cloud computing, mobile connectivity and HD video.

Since 1999, KDDI's JIH submarine cable has been providing connectivity to the Japanese main islands. This enhancement will add significant capacity on this vital network route, ensuring that Japan has the scalability needed for future high-bandwidth services and applications and maintain the country's position with one of the fastest Internet connection speeds in the world according to Akamai Technologies.

For more information, visit www.ciena.com.

Huawei Marine announces the launch of new ADIMS

Huawei Marine announced the launch of their new Automatic Digital

Injection Molding System (ADIMS).

Huawei Marine's broad commitment to innovation builds further on the successes of the second-generation titanium repeater technology, as ADIMS brings creative thinking and new technology into the wet plant and cable integration domain. ADIMS' customized design comprises a modular, compact, fully integrated and portable molding system, which is designed to be fully flexible across Huawei Marine's product portfolio and beyond.

The adoption of a pioneering modular heat/cool bolster with interchangeable mould cavity inserts and independently adjustable extruder positioning allows the ADIMS system to be fully configurable for any cable or wet plant molding activity.

The adaptability and flexibility of the tool is further enhanced by the availability of multiple channels of heat control, allowing the heat/cool profile of the tool to be accurately defined to ensure repeatability of any molding application.

Using the ADIMS ingenious independent twin extruder technology it is also possible to conduct re-instatement moldings using different injectate material simultaneously at either end of the molding cavity should the need arise. This unique design has been possible with Huawei Marine's partnership with twin screw extruding specialists, Xtrutech Ltd of the United Kingdom.

For more information, visit www.huawaimarine.com.

Ulstein designs cable ship with new cable arch system

Ulstein, a company specializing in ship design, maritime solutions and

shipbuilding, announced a design for a cable lay vessel with a new cable arch system at OTC Houston in May.

The patent-pending ULSTEIN Cable Arch system, in combination with open top vessel design, results in an unprecedented total of 12,500 tons of power cable that can be laid as one single piece. The system is implemented in an LX109 design, a high capacity, highly efficient cable lay vessel with compact dimensions.

A unique feature is the ULSTEIN Cable Arch connecting the forward and aft turntables, allowing it to load and lay one continuous cable of up to 12,500 tons. This capacity was made possible by positioning the turntables into the hull instead of their conventional location on deck, improving vessel's stability. A feature also applied by Ulstein on a rock installation vessel currently under construction. This approach resulted in a slim vessel that can transport and lay cable much more efficiently than conventional vessel designs with larger beams.

Locating the asymmetrical bridge aft, with the cable passing underneath, provides clear and unobstructed views on the cable lay work deck and cable stingers aft and the turntables forward. Furthermore, the vessel features a large hangar with ROV moonpool and workboat storage. In combination with the well-known X-BOW® and X-STERNTM hull features, this results in a very cost-efficient, safe and comfortable platform with superior operational uptime and transit speed compared to more traditional cable lay units.

For more information, visit www.ulstein.com.



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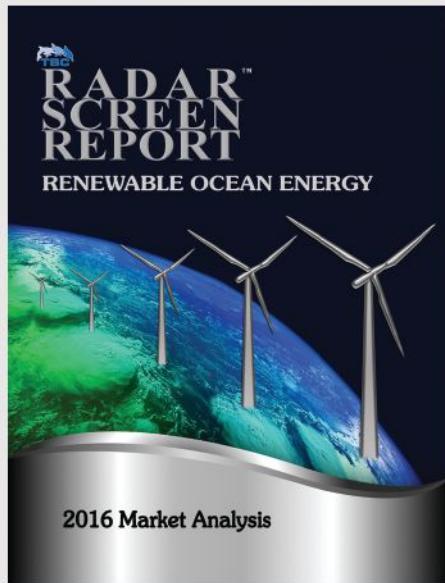
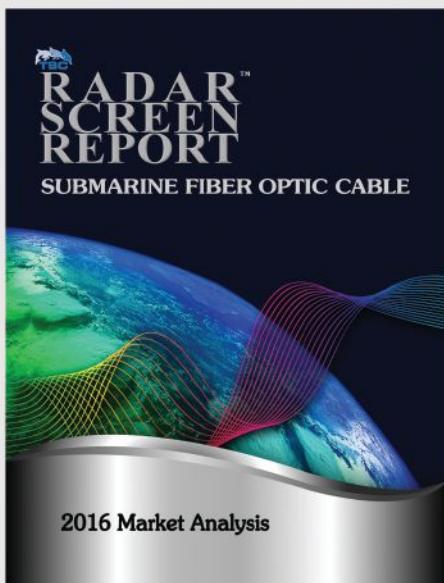
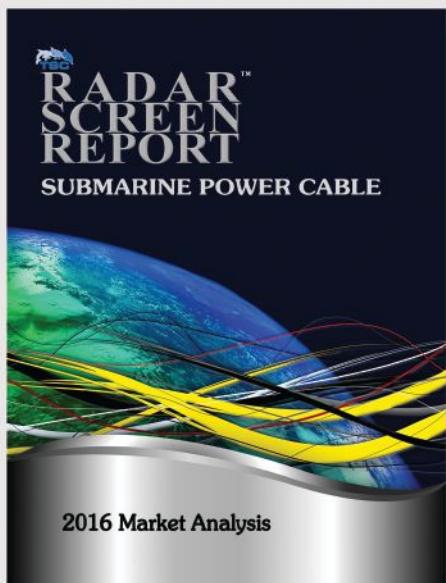
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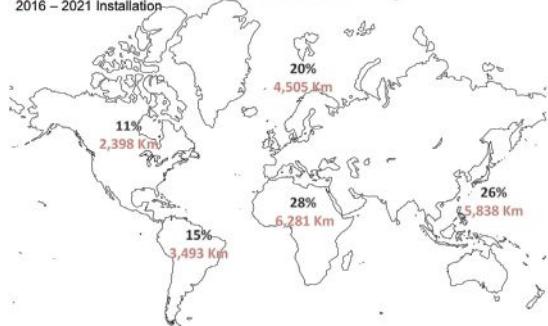
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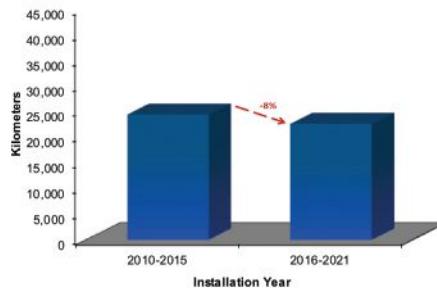
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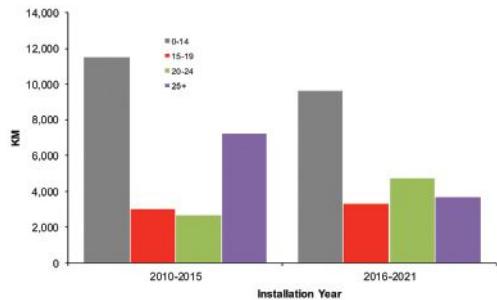
Deepwater Pipeline Demand: Regional Share
2016 – 2021 Installation



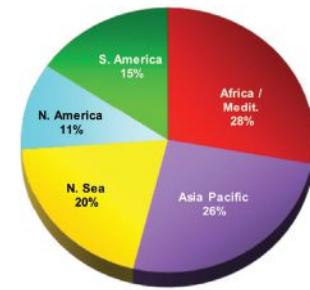
Worldwide Pipeline Demand Growth
2010 – 2015 vs. 2016 – 2021



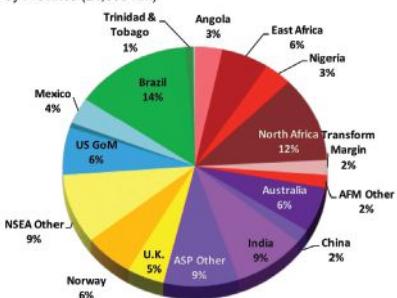
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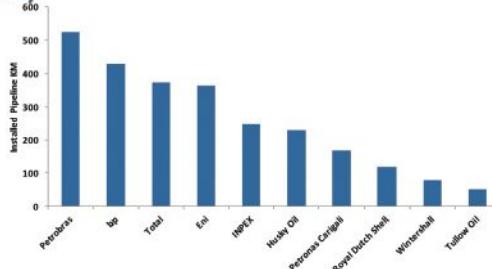
Worldwide Pipeline Demand by Region
2016 – 2021 Installations (22,515 KM)



Worldwide Pipeline Demand
2016 – 2021 by Province (24,856 KM)



2016e Top Operators by Pipeline Installation (KM)



Note: Top Operator Analysis is inclusive of infield flowline and export pipelines only. Trunk lines are excluded.

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Monthly Stock Figures & Composite Index

Industry Company Name	Symbol	Close(Mid) May	Close(Mid) April	Change	Change %	High 52 week	Low
Diversified, Production Support and Equipment Companies							
Baker Hughes, Inc.	BHI	46.19	43.32	2.87	6.6%	66.08	37.58
Cameron Intl. Corp.	CAM	66.01	66.01	0.00	0.0%	71.22	40.50
Drill-Quip, Inc.	DRQ	59.62	58.86	0.76	1.3%	79.20	48.88
Halliburton Company	HAL	40.40	38.35	2.05	5.3%	46.79	27.64
Tenaris SA	TS	26.23	26.07	0.16	0.6%	30.52	18.53
Newpark Resources, Inc.	NR	4.72	4.64	0.08	1.7%	9.33	3.35
Schlumberger Ltd.	SLB	74.04	76.67	-2.63	-3.4%	93.00	59.60
Superior Energy Services, Inc.	SPN	16.00	14.24	1.76	12.4%	24.08	8.25
Weatherford International, Inc.	WFT	5.83	7.73	-1.90	-24.6%	14.90	4.95
Deep Down, Inc.	DPDW	0.90	0.81	0.09	11.1%	0.98	0.37
FMC Technologies	FTI	28.89	27.66	1.23	4.4%	43.68	22.30
Total Diversified, Production, Support and Equipment.....	368.83	364.36	4.47	1.2%	479.78	271.95	
Geophysical / Reservoir Management							
Dawson Geophysical Company	DWSN	5.80	4.83	0.97	20.1%	6.11	2.90
Mitcham Industries, Inc.	MIND	3.59	3.27	0.32	9.8%	5.46	2.24
Compagnie Gnrale de Gophysique-Veritas	CGV	0.80	0.90	-0.10	-11.1%	7.70	0.59
Total Geophysical / Reservoir Management.....	10.19	9.00	1.19	13.2%	19.27	5.73	
Offshore Drilling Companies							
Atwood Oceanics, Inc.	ATW	11.68	9.08	2.60	28.6%	33.63	4.82
Diamond Offshore Drilling, Inc.	DO	24.04	22.36	1.68	7.5%	33.63	14.18
ENSCO International, Inc.	ESV	10.79	10.61	0.18	1.7%	25.71	7.25
Nabors Industries, Inc.	NBR	8.42	9.78	-1.36	-13.9%	16.14	4.93
Noble Drilling Corp.	NE	9.13	10.40	-1.27	-12.2%	17.79	6.66
Parker Drilling Company	PKD	2.42	2.74	-0.32	-11.7%	3.81	0.98
Rowan Companies, Inc.	RDC	17.18	15.58	1.60	10.3%	23.61	10.67
Transocean Offshore, Inc.	RIG	9.65	9.77	-0.12	-1.2%	20.97	7.67
Total Offshore Drilling.....	93.31	90.32	2.99	3.3%	175.29	57.16	
Offshore Contractors, Services, and Support Companies							
Helix Energy Solutions Group, Inc.	HLX	7.22	6.48	0.74	11.4%	16.98	2.60
Gulf Island Fabrication	GIFI	6.71	7.6	-0.89	-11.7%	13.64	6.56
McDermott International, Inc.	MDR	4.6	4.22	0.38	9.0%	6.00	2.20
Oceaneering International	OII	32.39	32.79	-0.40	-1.2%	53.77	25.33
Subsea 7 SA	SUBCY.PK	8.8	8.48	0.32	3.8%	11.74	4.86
Technip ADS	TKPPY.PK	13.04	14.06	-1.02	-7.3%	17.82	9.69
Tetra Technologies, Inc.	TTI	5.24	7.10	-1.86	-26.2%	9.44	4.62
Total Offshore Contractors, Service, and Support.....	78.00	80.73	-2.73	-3.4%	129.39	55.86	
Offshore Transportation and Boat Companies							
Seacor Holdings, Inc.	CKH	56.11	54.91	1.20	2.2%	73.74	41.24
Gulfmark Offshore, Inc.	GLF	4.88	5.33	-0.45	-8.4%	14.92	2.50
Bristow Group	BRS	15.36	19.94	-4.58	-23.0%	61.86	11.02
PHI, Inc.	PHII	19.09	19.25	-0.16	-0.8%	35.74	15.01
Tidewater, Inc.	TDW	7.46	7.48	-0.02	-0.3%	28.75	4.24
Trico Marine Services, Inc.	TRMAQ.PK	10.64	10.92	-0.28	-2.6%	13.86	9.06
Hornbeck Offshore	HOS	10.07	9.80	0.27	2.8%	23.75	5.58
Total Offshore Transportation and Boat	123.61	127.63	-4.02	-3.1%	252.62	88.65	

June 2016

58

Ocean News & Technology

Monthly Stock Figures & Composite Index

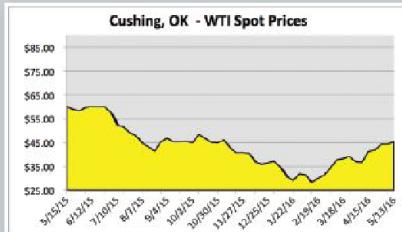
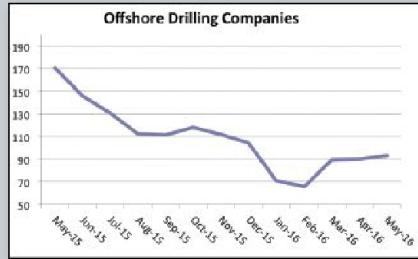
Industry	Close(Mid) May	Close(Mid) April	Change %	Change 52 week	High 52 week	Low
Diversified, Production Support & Equipment Companies	368.83	364.36	4.47	1.2%	479.78	271.95
Total Diversified, Production, Support and Equipment	368.83	364.36	4.47	1.2%	479.78	271.95
Total Geophysical / Reservoir Management	10.19	9.00	1.19	13.2%	19.27	5.73
Total Offshore Drilling	93.31	90.32	2.99	3.3%	175.29	57.16
Total Offshore Contractors, Service and Support	78.00	80.73	-2.73	-3.4%	129.39	55.86
Total Offshore Transportation and Boat	123.61	127.63	-4.02	-3.1%	252.62	88.65
Total Offshore Source Index	673.94	672.04	1.90	0.3%	1,056.35	479.35

DISCLAIMER

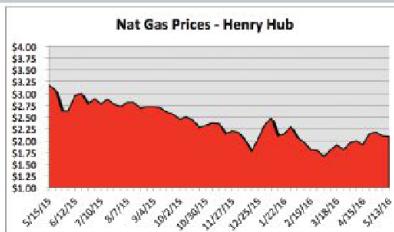
The information on this page is provided for information and comparison purposes only and should not be used to make financial and business decisions and is accurate to the best of our knowledge for the period indicated.

Oil & Gas Industry Trends

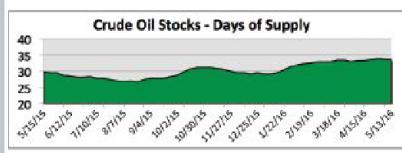
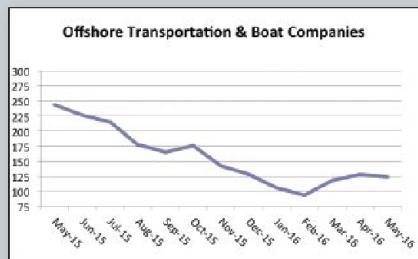
Monitoring the Pulse of the U.S. Offshore Oil & Gas Industry



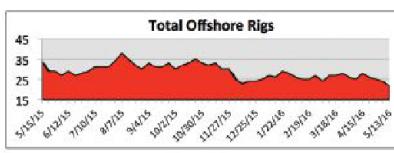
*Source - EIA



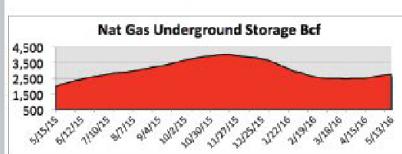
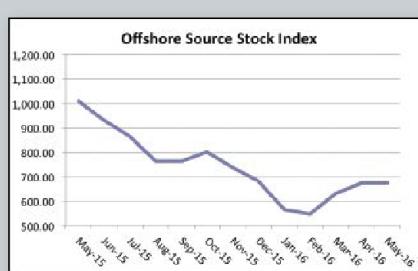
*NYMEX Close



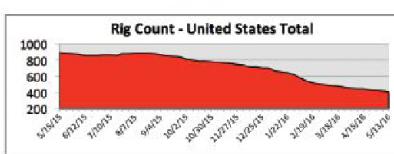
*Source - EIA



*Baker Hughes



*Source - EIA

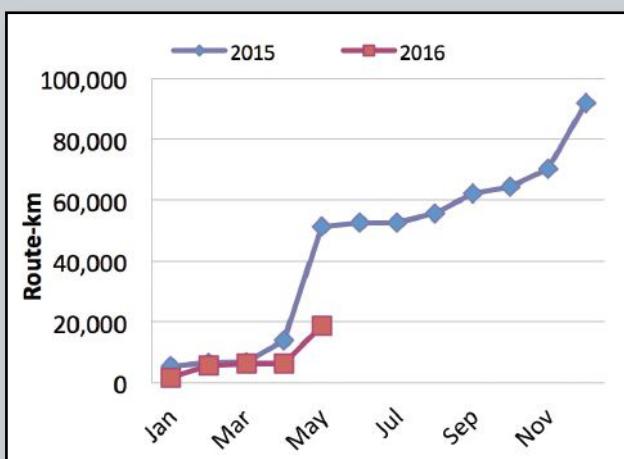


*Baker Hughes

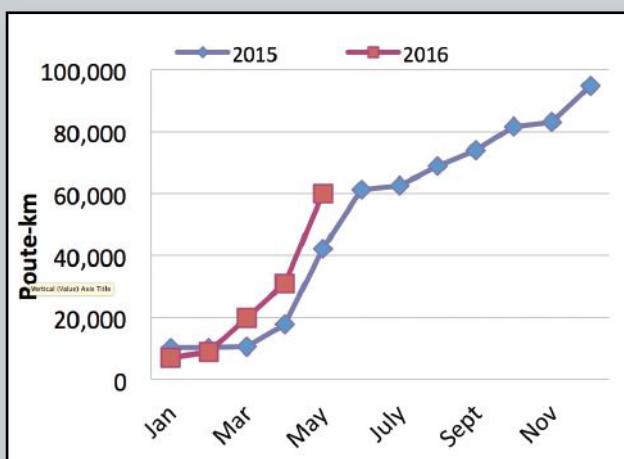
Positive trend, at least 3 weeks
 Changing trend, less than 3 weeks
 Negative trend, at least 3 weeks

Subsea Telecom & Power Cable Data

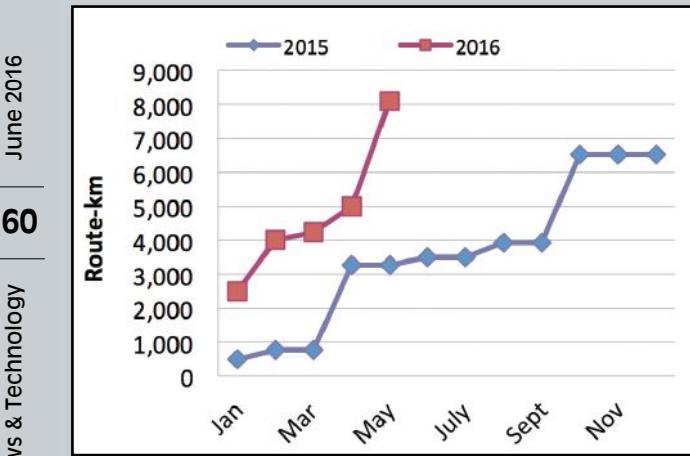
FO Cable Awards by Month



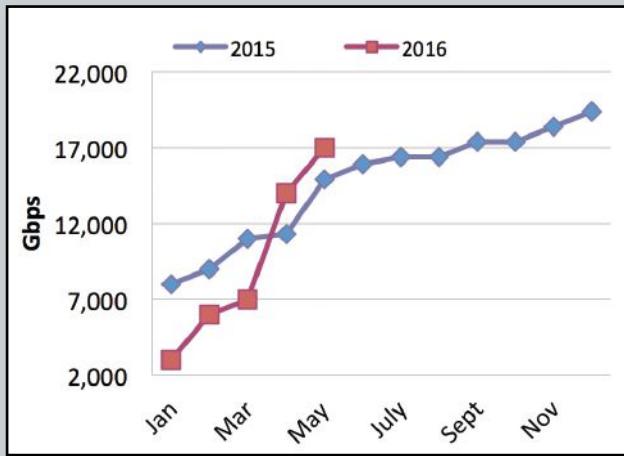
FO Cable Announcements



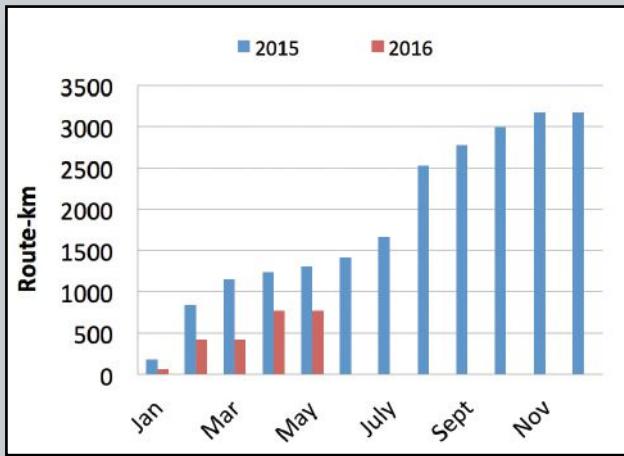
Submarine FO Cables Entering Service in Route-km



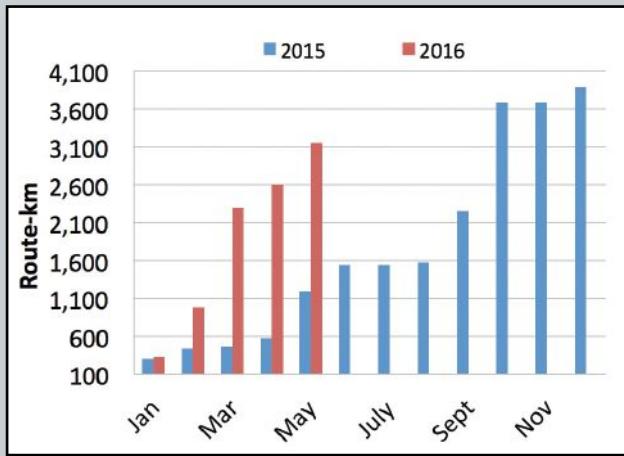
Upgrades of Existing Cable Systems in Gbps



Submarine Power Cable Awards in Route-km



Submarine Power Cable Announcements in Route-km



Gulf of Mexico Data

Current Deepwater Activity

Operator	Area	Block	Lease	OCS Rig Name	Prospect Name	Water Depth (ft)
SHELL OFFSHORE INC.	WR	508	G17001	T.O. DEEPWATER THALASSA	STONES	9,554
ANADARKO PETROLEUM CORPORATION	AT	37	G21825	ROWAN RESOLUTE	Merganser 7,933	
SHELL OFFSHORE INC.	AC	857	G24593	H&P 205	Great White	7,822
SHELL OFFSHORE INC.	MC	392	G26253	T.O. DEEPWATER PROTEUS	APPOMATTOX	7,259
MARUBENI OIL & GAS USA INC.	MC	348	G19939	ENSCO 8505	APPOMATTOX	7,209
EXXON MOBIL CORPORATION	WR	584	G20351	MAERSK VIKING	Julia	7,148
BP EXPLORATION & PRODUCTION INC	GC	743	G15607	SEADRILL WEST AURIGA	ATLANTIS(GC) 6,820	
ANADARKO PETROLEUM CORPORATION	KC	875	G21447	* WIRELINE UNIT (LAF DIST)	LUCIUS 6,820	
ANADARKO PETROLEUM CORPORATION	KC	875	G21447	NOBLE BOB DOUGLAS	LUCIUS	6,820
UNION OIL COMPANY OF CALIFORNIA	WR	634	G21245	T.O. DISCOVERER CLEAR LEADER	Saint Malo	6,804
SHELL OFFSHORE INC.	MC	475	G35335	NOBLE GLOBETROTTER		6,590
BP EXPLORATION & PRODUCTION INC	MC	822	G14658	T.O. DEVELOPMENT DRILLER III	Thunder Horse South	6,263
BP EXPLORATION & PRODUCTION INC	MC	778	G14658	THUNDER HORSE PDQ	Thunder Horse NORTH	6,033
ANADARKO PETROLEUM CORPORATION	WR	51	G31938	* WIRELINE UNIT (HOUMA DIST)	Shenandoah	5,847
ANADARKO PETROLEUM CORPORATION	WR	51	G31938	DIAMOND OCEAN BLACKHAWK	Shenandoah	5,847
BP EXPLORATION & PRODUCTION INC	MC	776	G09866	SEADRILL WEST VELA	Thunder Horse North	5,742
BP EXPLORATION & PRODUCTION INC	MC	778	G09867	HELIX Q5000	Thunder Horse NORT	5,631
ENI US OPERATING CO INC	MC	773	G16647	* COIL TUBING UNIT (N.O. DIST)	Devil's tower	5,610
ENI US OPERATING CO INC	MC	773	G16647	NABORS POOL 140	Devil's tower	5,610
COBALT INTERNATIONAL ENERGY LP	KC	129	G30924	ROWAN RELIANCE		5,519
ANADARKO PETROLEUM CORPORATION	GC	903	G24197	DIAMOND OCEAN BLACKHORNET	HEIDELBERG	5,257
W & T OFFSHORE INC	VK	1003	G21160	CAL-DIVE Q-4000	Fastball	4,858
CHEVRON USA INC	KC	96	G33531	PACIFIC SANTA ANA	Ludlow	4,838
CHEVRON USA INC	GC	806	G31751	PACIFIC SHARAV		4,720
BP EXPLORATION & PRODUCTION INC	GC	782	G15610	MAD DOG SPAR RIG	Mad Dog Phase 2	4,428
FREEPORT MCMORAN OIL & GAS LLC	GC	645	G11080	* COIL TUBING UNIT (HOUMA DIST)	Holstein	4,344
HESS CORPORATION	MC	725	G22898	STENA FORTH	Tubular Bells	4,334
CHEVRON USA INC	GC	640	G20082	T.O. DISCOVERER INSPIRATION	Tahiti 2	4,292
LLOG EXPLORATION OFFSHORE LLC	VK	959	G34874	SEADRILL WEST NEPTUNE	Imtgral	4,252
CHEVRON USA INC	GC	640	G20082	T.O. DEEPWATER ASGARD	Tahiti 2	4,248
LLOG EXPLORATION OFFSHORE LLC	MC	769	G35641	SEADRILL SEVEN LOUISIANA 4,161		
HESS CORPORATION	GC	512	G26315	DIAMOND OCEAN BLACKLION	Stampede	3,577
MURPHY EXPLORATION & PRODUCTION	GC	338	G21790	* COIL TUBING UNIT (HOUMA DIST)	Front runner	3,330
SHELL OFFSHORE INC.	MC	764	G08852	NOBLE BULLY I	King	3,289
SHELL OFFSHORE INC.	MC	807	G07963	OLYMPUS N88	MARS	3,039
SHELL OFFSHORE INC.	MC	807	G07963	* WIRELINE UNIT (N.O.DIST)	MARS	2,945
SHELL OFFSHORE INC.	MC	807	G07957	ATWOOD CONDOR	MARS	2,900
NOBLE ENERGY INC	GC	39	G34536	ATWOOD ADVANTAGE	GC039	1,921
CHEVRON USA INC	VK	786	G10944	NABORS 87	Petronius Compliant	1,754
HESS CORPORATION	GB	215	G09216	DIVE SUPPORT VESSEL (DSV)	Conger	1,457
HESS CORPORATION	GB	215	G09216	NOBLE PAUL ROMANO	Conger	1,453
HESS CORPORATION	GB	215	G09216	* COIL TUBING UNIT (LAF DIST)	Conger	1,450
UNION OIL COMPANY OF CALIFORNIA	GB	409	G15891	ENSCO 8503	Ladybug	1,360
FIELDWOOD ENERGY OFFSHORE LLC	GC	65	G05900	* COIL TUBING UNIT (HOUMA DIST)	Bullwinkle	1,353
STONE ENERGY CORPORATION	VK	989	G07923	H&P 100	Pompano i	1,295
WALTER OIL & GAS CORPORATION	EW	834	G27982	H&P 203	Hummingbird	1,183
ENVEN ENERGY VENTURES LLC	MC	194	G02638	NABORS S.D. XIV	Cognac	1,024
ENVEN ENERGY VENTURES LLC	MC	194	G02643	* LIFT BOAT (NEW ORLEANS DIST)	Cognac	1,024
FIELDWOOD SD OFFSHORE LLC	EB	159	G02645	* WIRELINE UNIT (L.J.DIST)	Ligera	924
FIELDWOOD SD OFFSHORE LLC	EB	165	G06280	* WIRELINE UNIT (L.J.DIST)	East breaks 164	863
EXXON MOBIL CORPORATION	SM	6636	P00188	* WIRELINE (GENERIC)		842
ENVEN ENERGY VENTURES LLC	EW	873	G12136	* WIRELINE UNIT (HOUMA DIST)	Lobster	773
WHISTLER ENERGY II LLC	GC	18	G05809	NABORS MODS 201	Boxer	760
CHEVRON USA INC	GB	189	G06358	* WIRELINE UNIT (L.C.DIST)	Tick	718
FIELDWOOD SD OFFSHORE LLC	EB	110	G02650	* NONE RIG PA OPERATION (LJ)	Tequila	660

Deepwater prospects with drilling and workover activity: 55

Current Deepwater Activity as of Tuesday, May 24, 2016

Activity by Water Depth

Water Depth (m)	Active Leases	Approved Applications	Active
0 to 200	1,183	36,329	2,220
201 to 400	78	1,134	21
401 to 800	161	904	10
801 to 1,000	234	577	9
1,000 & above	2,371	2,152	30

Rig Activity Report 20 May 2016

Location	Week of 05/20	Week +/- Ago	Week +/- Ago	Year
Land	375	-7	382	-478 853
Inland Waters	5	3	2	2 3
Offshore	24	2	22	-5 29
U.S. Total	404	-2	406	-481 885
Gulf of Mexico	23	2	21	-5 28
Canada	44	1	43	-28 72
N. America	448	-1	449	-509 957

Activity by Water Depth Information current as of Monday, May 23, 2016.

Maximum number of rigs operating in the deepwater Gulf of Mexico. The rig unit includes platform rigs operating on deepwater production facilities in addition to the MODU's. The numbers do not distinguish between rigs drilling and those in service for completion and workover operations.

Information provided courtesy of the U.S. Bureau of Ocean Energy Management and Baker Hughes

RBR

See ad on page 3

Not Your Average Forests: Two Researchers Use RBRsolo Loggers in Mekong Field Research

Mangrove forests offer coastline protection from tsunamis and storm surges, nursery grounds for fish, and refuge for endangered animals—and, in the last decade, they have been disappearing faster than tropical rainforests.

Julia Mullaney (University of Waikato, New Zealand) and Steve Henderson (Washington State University, USA) are part of an international collaboration investigating their stability. In February 2015, their research took them to the Mekong delta of Vietnam.



Xuan Tien Nguyen Vinh (from Vietnam National University of Science, HCMC) prepares to set up an eddy-covariance system used to understand turbulence and mixing. Photo credit: University of Waikato/Washington State University mangrove science team.

Under pressure

Mangrove trees' dense root systems buttress shifting sediment, while their specialized aerial roots (pneumatophores) stretch above the low-tide mark to absorb oxygen directly from the air.

"The currents and waves flow through the pneumatophores and that causes a lot more drag than what you would get if they weren't there," Mullaney said.

To investigate how tidal currents force water through the mangrove forest, the teams deployed several RBRsolo D compact pressure loggers. These instruments captured the small, horizontal pressure gradients associated with the currents.

"It's a touchy measurement," Henderson said. "You've got to get down to the millimetre or sub-millimetre water accuracy. However, that [data] is really helpful because one of the big questions with respect to vegetation is how much drag it exerts on the flow."

"If you can get the pressure gradient driving the flow and you measure the flow speed, you can get an idea of the effectiveness of the vegetation exerting drag on the flow." Those data are critical for modeling sediment transport—and how mangroves dissipate energy from tidal surges and tsunamis.



Technical officer Dean Sandwell (University of Waikato, NZ) crouches among the aerial roots of mangrove trees to photograph the eddy-covariance system used to capture data on turbulence and mixing, used to understand turbulence and mixing. Photo credit: University of Waikato/Washington State University mangrove science team.

Mixing and mingling: Eddy-correlated heat fluxes

"When the flood tide enters the mangroves, it's moved across wide tidal flats which are very hot in the tropical sun," Henderson explained. The first water entering can measure up to 38°C/100.4°F."

Using temperature gradients, oceanographers can trace how water masses then mix over time. "In this case, it was turbulent mixing of heat that we measured, but it's really the turbulent mixing rate that we want to understand so we can understand the mixing of sediment or nutrients."

"If you can get a flux of heat and you get the gradient in temperature from the stack of RBRs, then maybe we could get the turbulent diffusivities, measuring the effectiveness of mixing." – Dr. Steve Henderson, Washington State University (USA)

To investigate how eddies contribute to turbulence and mixing, the researchers looked for eddy-correlated heat fluxes; high-frequency fluctuations in temperature correlated with high-frequency variations in velocity.

They set up a dense stack of RBRsolo T temperature loggers (accuracy: $\pm 0.002^\circ\text{C}$; sample rate: up to 2Hz) to capture the mean temperature gradient along the water column. A velocimeter and a fast temperature sensor captured high-frequency temperature and pressure fluctuations.

"The idea was that if you can get a flux of heat and you get the gradient in temperature from the stack of RBRs, then maybe you could get the turbulent diffusivities, measuring the effectiveness of mixing," Henderson said.

An International Collaboration

The hydrodynamics models created by Henderson, Mullaney, and Dr. Karin Bryan (University of Waikato, New Zealand) form part of an international collaboration involving researchers from Vietnam National University of Science (Vietnam); Boston University, Tulane University, and Washington State University (USA); and DELFT University of Technology (Netherlands).

"There's no shortage of things to explore," Henderson said.



UNDERWATER SOLUTIONS WORLDWIDE

See ad on page 19

Phoenix International Holdings, Inc (Phoenix) provides worldwide subsea operations using divers, 6,000 m rated Remotely Operated Vehicles (ROVs), Atmospheric Diving Systems (ADS), and a 5,000 m rated Autonomous Underwater Vehicle (AUV). Phoenix also maintains a staff of highly skilled engineers experienced in developing unique subsea related solutions to address the challenges of operating in the deep sea.

Phoenix's AUV is a 5,000 m rated system named Artemis (Greek goddess of the hunt). The vehicle was initially configured with two mission payloads: an Acoustic Payload for conducting side scan sonar, multi-beam, and sub-bottom profiler operations and an Optical Payload for collecting photographic imagery. Phoenix recently developed a third mission payload designed to collect magnetometer and electric field sensor data.

To allow mission payload sensors to relay commands to the AUV's main control system, Phoenix installed open source software called Mission Oriented Operating Suite – Interval Programming (MOOS-IvP). Considered middleware, MOOS-IvP facilitates the integration of sensor data into new mission payloads and links data with Artemis' control system. This capability was recently used in support of an at-sea demonstration to detect hydrocarbon leaks. During the demonstration a



sensor mounted to the AUV was used to detect gas bubbles in the water column. Following detection, this information was relayed to the vehicle's control system via MOOS-IvP and Artemis was directed to return to the leak. Once in the bubble stream a different sensor mounted to the AUV was used to collect and analyze the leaking gas.

Phoenix's Artemis AUV is truly a one-of-a-kind capability. With its impressive depth rating and easily configurable mission payload design, the AUV is ready to perform tailored operations in response to unique customer requirements. In addition, the vehicle's MOOS-IvP middleware makes Artemis fully capable of responding to payload sensor data inputs without topside intervention—true autonomy!



See ad on page 17

Introducing the FlexSEA™ Modular Flotation System available for rent exclusively from Okeanus Science & Technology.

Okeanus offers FlexSEA™ flotation modules in a variety of sizes to supply different amounts of buoyancy for a variety of payload sizes and weights. The unique modules may also be configured to form arrays suitable for a wide variety of subsea modules, tools, instrumentation packages, vehicles and submersibles including ROV-mounted intervention packages.

FlexSEA modules are configurable to supply different amounts of buoyancy for a variety of payload sizes and weight conditions. The mounting arrangements are designed so that standard ROV manipulators can be used to remove, untether or detach some or all of the temporary flotation modules after use; this allows for recovery and re-use. The modules can be of equal size, or modules of different sizes can be configured to be attachable and detachable to form arrays. The arrays provide buoyancy to a wide variety of subsea modules, tools, instrumentation packages, vehicles and submersibles. Depth ratings of 2,000 to 4,000 m of seawater are available.



Modular Flotation Like Never Before

"The addition of the FlexSEA buoyancy line of products to our existing portfolio of flotation rental equipment is very exciting, as these modules were engineered and designed to take a 'building block approach' to a very critical component when working with ROVs in a subsea environment," stated Benton LeBlanc, president and general manager of Okeanus. "Being a fully customizable solution, we at Okeanus can put together a buoyancy package to fit the exact needs of our customer, eliminating waste and allowing our customers to realize a considerable cost savings."

MacArtney winch for deployment from vessels of opportunity

CORMAC M4C is a customized version of the MacArtney CORMAC M modular winch series intended for use together with the dotOcean DensX sediment density profiler. DensX is an *in-situ*, direct measurement mud density method using safe X-ray technology and an automated winch.

Being fully controlled by dotOcean's software for controlling the DensX, this customized MacArtney winch is supplied with a constant tension function and PC control. Besides, the winch is fitted with a special frame for housing the winch and the DensX.



The CORMAC M series includes five different standard winch models constructed from high-quality stainless steel. Customers choose between a broad range of specifications including speed, pull, motor size and cable capacity.

MacArtney CORMAC M winches are portable, dependable and versatile systems capable of handling multiple marine applications and tasks. The winches feature a modular and compact design allowing for flexible system installation on board vessels with confined deck space.

Dutch Rijkwaterstaat (RWS) is the end user of the integrated dotOcean/MacArtney solution and it is to be deployed from vessels of opportunity within the RWS fleet. As such, the winch design has been adapted in order for the level wind to be variable between 0° and 90° depending on the winch position in relation to the vessel's A-frame.

Due to the request for portability in order to be used on board vessels of opportunity, the complete solution has been designed to fit onto a standard block pallet for transportation purposes.

The winch comes with the MacArtney type 2019/B power/signal cable, fitted with a standard TrustLink stress termination. The Focal model 180 slip ring has been fitted with SubConn® DBH13 Ethernet connectors allowing for transfer of the up to 100 Mbit Ethernet signal necessary for operating the DensX.

For more information, visit www.macartney.com.

New ultra-miniature connector

64
Fischer Connectors, the worldwide innovator in push-pull circular connectors and cable assembly solutions, has launched an even smaller ultra-miniature connector, MiniMax 06, as an extension of its miniature high-density product range, the Fischer MiniMax™ Series.

The MiniMax 06 connector can include up to 12 power and signal contacts in a footprint of only 10 mm. This corresponds to a density factor of 0.83—a unique technological feature for a connector with standard 0.5 mm contacts. The new MiniMax 06 connector also includes a new unique configuration with two signal and two high-power 1.3 mm contacts for applications needing 10 Amps or more power, doubling the standard 5 Amps current rating of the existing MiniMax product line.

MiniMax 06 is easy to use and ensures premium performance even in harsh environments. Also available as a pre-cabled solution ideally suited for handheld or body-worn applications when space is limited, in such fields as defense & security, instrumentation, testing equipment, civil or military UAVs, among many others.

These connectors are also rugged, with IP68 sealing (2m/24h), both mated and unmated, an unbreakable keying system, and over-molded cable assemblies. Available in three locking systems (push-pull, screw and quick-release), they are easy to connect and disconnect up to 5,000 times.

For more information, visit www.fischerconnectors.com.



Extensive use of buoy on projects

International data buoy manufacturers Ocean Scientific International Ltd (OSIL) are reporting extensive use of their 0.7-m Small Field Buoy on international dredging projects.

The lightweight, easily repositionable buoys can be repeatedly deployed to follow in the path of dredgers in order to monitor plume activity and are often complimented by the OSIL 1.2-m Tern buoys, which provide more permanent monitoring stations for long-term projects.

The robust buoys are constructed from rotationally moulded polyethylene hulls that are foam filled for added security. Instrumentation is securely protected from damage and interference by the integral stainless steel deployment frame/cage without interrupting the flow of water around instruments such as water quality sensors or turbidity meters.

The durable top frame incorporates two 12-W solar panels, a 2-Nm navigation beacon, antenna, telemetry and logging equipment (within the waterproof electronics canister), and sturdy grab handles to assist with deployment and recovery of the buoys.

For more information, visit www.osil.co.uk.



New SeaSEVEN ADCP

RoweTech has designed a new ADCP that contains the features of RoweTech's dual frequency ADCP and their wave measurement ADCP SeaWAVE. Additionally, this new product named SeaSEVEN has all the features of RoweTech's standard ADCPs, which include:

- 24-bit front end A/D converter;
- multi-mode and multi-missions;
- high ping rates;
- high capacity data storage; and
- high speed serial and Ethernet data comms interface.

These standard ADCP features allow total control over each beam, beam pair, Janus beams and 3-D profiling.

RoweTech's new product has two pairs of three beams splayed around the vertical beam. It has 60° azimuths between the beams and a 20° elevation, which allows the SeaSEVEN to make measurements never before available from a traditional three, four or five beam current profiler. SeaSEVEN is also able to make the basic measurements of Doppler shift, echo intensity, correlation, depth, and temperature at a high speed (10+ Hz) and store it on up to 64 GByte of memory. Researchers now have the ability to achieve applications, which have been difficult or impossible with standard ADCPs.

RoweTech has launched the SeaSEVEN research-grade Doppler profiler and identified seven applications that are much easier to accomplish using this new ADCP:

- Waves: Wave measurements can be accomplished in coastal waters using the vertical beam for direct surface height measurements and with a pressure sensor, both sampled at 2 Hz.
- Turbulence: High data rates and small bins allow the high temporal and spatial measurements needed for calculating turbulence.
- Renewable Energy: Use as a vessel-mounted, buoy-mounted, or bottom-mounted platform allows SeaSEVEN to be used as a site selection, resource measurement, environmental monitoring, or turbine wake characterization tool.
- Bottom Boundary Layer: With a low profile, short blank, high resolution, high ping rate, BBL measurements can be achieved.
- Sediment Transport/Scour: High-resolution echo intensity, echo sounder function combined with dual frequency profiles makes the SeaSEVEN an excellent measurement tool.
- Reynolds Stress: High ping rate and fine resolution in space and time provide data used in measurements.
- Tidal Measurements: With a high-resolution surface track/echo sounder measurement, and high-resolution current profiles, tidal measurements can be made from either a surface or bottom-mounted ADCP.

For more information, visit www.rowetechinc.com.



ACR Electronics expands commercial survival product portfolio

An important addition to any commercial vessel's survival gear kit, the Pathfinder™ PRO SART is introduced by ACR Electronics, Inc. The new search and rescue transponder expands the broad range of commercial maritime survival products offered by ACR, global leader in safety and survival technology.

The Pathfinder PRO is a fully approved SART that complies with IMO SOLAS regulations and is suitable for all commercial vessels that are mandated to carry a SART, including vessels that must conform to GMDSS and those carrying more than one life raft.

Greatly enhancing search and rescue efforts, the manually activated ACR device can be used on ships, lifeboats and life rafts.

It transmits a series of pulses that are displayed on a ship's radar screen as a line of dots, providing a bearing to the survival craft. When powered on, the SART remains in a standby mode until it is automatically activated by an X Band Radar sweep that may come from any vessel in the vicinity.

The user replaceable, superior lithium battery provides over 96 hrs of operating life in standby mode and provides 12 hrs of active operating life while being interrogated by radar. The batteries have a 5-year storage life

before any significant reduction in capacity. The Pathfinder PRO SART should not need servicing during its lifetime with the exception of changing the battery before the marked expiry date.

Compact for easy life raft packing, the Pathfinder PRO SART is supplied with a mountable storage bracket and a black telescopic pole, which conveniently connects to the bottom of the SART allowing maximum height and visibility out of a life craft.

The SART is waterproof to a depth of 10 m and operates between -20°C and +55°C.

For more information, visit www.acrartex.com.

Delivery of ultra-deep acoustic zooplankton and fish profiler

ASL Environmental Sciences Inc. has successfully collaborated with the Institute of Oceanography and Global Change for the adaption of ASL's Acoustic Zooplankton and Fish Profiler (AZFP) for use as a tool to study the deepwater (1,000 m+) zooplankton and micronekton in the subtropical waters of the Atlantic Ocean through measurement of quasi-instantaneous vertical profiles.

The new instrument is intended to provide absolute acoustic backscatter at four frequencies (38, 125, 200 and 455 kHz) as it is lowered down the water column to a maximum of 6,000 m of water depth.

As part of the project, ASL designed a prototype instrument and tested it to evaluate multiple frequency technology for use as a standard instrument in oceanography. The instrument will provide acoustic data from the bathypelagic zone of the oceans



to complement other parameters for the study of deep water zooplankton, microneuston, and large particles.

The scientific collaboration includes the adaption of the existing AZFP manufactured by ASL. ASL plans to leverage small, reliable and affordable MF-AWCP instruments with up to four frequencies for use as a profiling instrument below a rosette sampling system. Further, ASL modified the instrument package to increase its maximum operating depth from 1,000 m to 6,000 m of water depth. The instrument will be powered from an internal battery for a period of at least 20 hours of continuous pinging and will include enough removable memory to store 3 days' worth of raw data.

The goal of the collaboration between ASL and Dr. Santiago Hernández-León, Institute of Oceanography and Global Change, is to evaluate factors that contribute to errors in the measurement of the absolute backscatter strength (Sv) and target strength (Ts) of ensonified targets. Dr. Santiago Hernández-León will field test the prototype instrument with respect to acoustic calibration at depth. Upon successful completion, the parties shall collaborate in the publication of a technical paper.

For more information, visit www.aslenv.com.

Oceaneering introduces PortVision 360™

Since 2007, Oceaneering's PortVision product line has enabled more than 3,000 users worldwide to enhance efficiency, reduce cost and increase safety and security by delivering valuable information and knowledge about vessel and terminal activities. The PortVision 360 service builds on this foundation, making it even easier to answer questions about vessel movements and events anywhere in the world. Service enhancements range

from more alerting options and flexibility to new playback, analytics and reporting options.

Feature highlights include:

- Patented technology delivers critical information when it's needed, with port- and terminal-level detail.
- Expanded reporting against a data warehouse of 100 billion vessel arrivals, departures, passings, and individual vessel movements, including detailed vessel and location snapshot reports and a vessel, point of interest or user-defined zone.
- Optional integration with satellite AIS and radar for the complete picture, even offshore and in open water.
- Full suite of tools to speed information access.
- Define powerful event-based alerts that can be delivered to the desktop or e-mail and create customized alert criteria down to the terminal, dock and buoy level.
- Use powerful group-based notification to share fleets, vessel and terminal notes, alerts, and other information.
- Dock Management System (DMS) for comprehensive marine terminal management and collaboration.
- Vessel Intelligence™ for gaining access to over 50 additional data attributes on 10,000 workboats and offshore support vessels.
- Offshore Asset Protection™ for protecting pipelines, rigs, platforms and bridges from collisions and unauthorized encroachment.

PortVision 360™ is available in professional and enterprise editions with tiered feature sets and can be accessed from PCs, tablets or mobile devices, with support for most modern web browsers.

For more information, visit www.portvision.com.

Eaton shell size 12, dry-mate connectors

Shell size 12 solutions are an extension of the Burton™ small-form-factor product line that also includes ultra-compact shell-size 9 solutions.



These connectors have the following characteristics:

- Provides 40% space savings when compared to shell size 20 connectors with the same number of contacts.
- 10,000 PSI open-faced pressure and 600V dielectric ratings.
- Available with 8 or 14 contacts for Ethernet, power, and mixed-mode applications.
- Plugs and cable assemblies available in in-line, right angle, and pressure balanced oil-filled configurations.
- Receptacles available for in-line cable and flange or threaded-mounting applications.

For more information, visit www.eaton.com/interconnect.

New ROS C460 low light camera

The ROS Monochrome C460 Camera offers outstanding performance in low light conditions as well as bright sunlight.



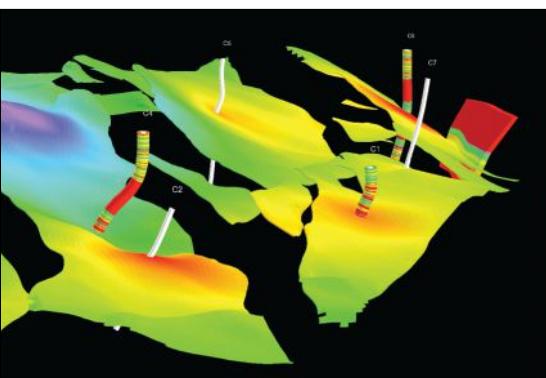
Features include 570 TVL resolution and a low light sensitivity of 0.000005 lux. The C460 also features a titanium housing, a 77° field of view and a depth rating to 6,000 m.

For more information, visit www.rosys.com.

CGG GeoSoftware releases EarthModel FT 9.5

CGG GeoSoftware has launched EarthModel FT 9.5, the latest version of its comprehensive geological modeling software that combines well and seismic data for a better understanding of the reservoir. Users can determine reservoir properties, such as lithofacies, porosity and permeability, for more accurate modeling results. EarthModel FT combines surface mapping, integrated structural modeling, reservoir property modeling and upscaling all in one package, with direct output to most flow simulators.

EarthModel FT 9.5 offers sandboxes where users can independently explore alternative interpretation scenarios and store them separately from the main project. Changes can be incorporated collaboratively into the central database in real



time, allowing for information sharing.

Additional enhancements for creating 3D geological grids include an enhanced algorithm for improved vertical layering that minimizes the number of layers needed to make a consistent grid model for use in inversion workflows, driving better model definition and faster inversion results. Users can access velocity data with the results from GeoSoftware's velocity modeling product, VelPro, which stores data in the shared wells database.

For more information, visit www.cgg.com.

IRM Systems introduces valve integrity management solution

IRM Systems, the independent authority in emergency pipeline repair, announced the introduction of the Valve Integrity Management Solution (VIMS®), an innovative method of maintaining critical pipeline valves to the highest performance standards and criteria that can save up to 70% in lost production, excluding the substantial cost of associated labor, equipment and specialists.

VIMS was developed in direct response to the distinct lack of analyzed data associated with valve integrity and maintenance in the industry. "Over time, we have seen a number of issues arise regarding valves, which could have been prevented had a methodical review of data about the valves installed on a pipeline system been carried out," said David Obatolu, general manager of IRMS UKWA. "The new VIMS, which combines trademarked VIMS software with a specially designed review process, provides pipeline operators with a novel, yet surprisingly simple way of looking after every aspect of their pipeline valves."

Following a comprehensive audit of the number and condition of all valves on a designated pipeline, IRMS logs and analyses the data, integrating it via the

VIMS into the operator's existing systems and processes. Data on individual valves and assets can then be immediately accessed in order to review a full range of benchmarked factors in, for example, design, construction, maintenance and reliability. By using this standardized approach to valve integrity maintenance—which relies upon solid risk and reliability engineering—operators can make informed decisions about inspection plans and repairs, saving time and money.

As a result of outreach by IRMS UKWA in the region, operators in West Africa are actively adopting the VIMS. Even those that previously managed valves with well-established, traditional processes have recognized that these systems were lacking, especially when it came to providing reliable valve integrity management.

The cost-savings implications of using VIMS to maintain valve integrity are far-reaching. "Regardless of pipeline location, the VIMS process brings about operational excellence," said Obatolu. "This means that operators can avoid costly repair operations and downtime, which can escalate into millions in lost production."

For more information, visit www.irm-sys.com.

Data verification for when it matters most

Maritime authorities are increasingly interested in identifying abnormal vessel behaviour and anomalies. As the world's leading provider of vessel movement information, exactEarth now begins the introduction of services that not only summarize vessel information but also determine the validity of vessel messages and analyzes behaviors and movements. exactEarth Knowledge Libraries are available both as stand-alone web services and an add-on to exactEarth ShipView™, allowing authorities to come to the aid of vessels in distress faster and deal with illicit activity sooner to protect borders and save lives. Using dozens of new vessel attributes not available from other AIS data providers and advanced analytics, authorities are able to define vessels of interest based on unique mandates, area of responsibility, vessel population and operational requirements.

The first Knowledge Library (KL) released, Data Quality (DQ) focuses on validating the information being transmitted by the vessel through the detec-



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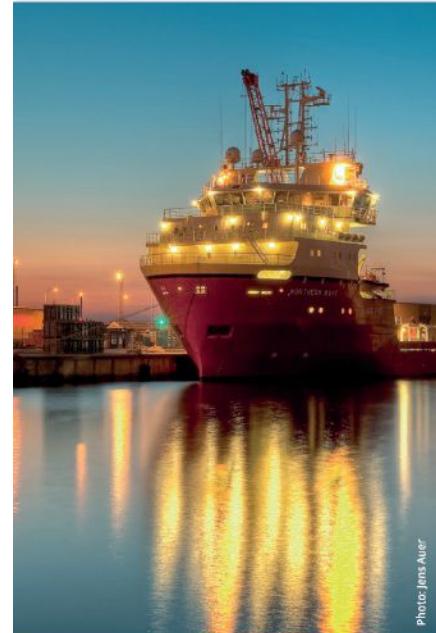


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tion of data-entry errors, possible GPS issues and probable vessel safety issues. The DQ KL uses advanced algorithms to detect false vessel information allowing users to know immediately when something does not add up. This saves valuable time to react faster to a vessel in trouble and provides authorities with insight into vessels that may be deliberately transmitting false information.

Data is crosschecked with our extensive AIS archive, new analytics engine as well as the new exactEarth Ship Database (DB) to ensure users are equipped with the most accurate vessel information possible. The new exactShipDB is also available for purchase as an add-on to exactEarth ShipView and encompasses extended vessel stats, vessel capabilities, ownership information as well as name and insurance history. This provides users an extra level of information needed to make knowledgeable decisions whether it is at port looking for blacklist vessels that have changed their name or out at sea tracking down the owners and responsible parties when a vessel is involved in an accident.

With the new Knowledge Libraries coming online along with the extended exactShipDB, authorities can be confident they are receiving the best in terms of data quality as all false information is automatically highlighted. exactEarth is defining, and ushering in the next generation of vessel monitoring solutions that allow analysis into position, time, and knowledge. Vessel behavior analysis can be completed with ease to investigate suspicious behavior and better contribute to overall maritime security in your waters.

For more information, visit www.exactearth.com.

Rotech Subsea confident in Tritech Gemini NBI

Tritech International Ltd announces that Rotech Subsea Ltd has purchased Gemini Narrow Beam Imager (NBI) systems.



The sonars are to be installed in single head or dual head configuration for use on Rotech's RS range of excavation tools and will support the increased volume of work they are securing worldwide in the oil and gas and renewables sectors. The Gemini NBI can communicate over Ethernet or VDSL and for this installation the systems will run in VDSL mode. The Gemini NBI systems will run on the newly introduced Tritech Gemini 72VDC VDSL Interface Unit, which will supply the sonars with sufficient power to operate over a 300-m cable. The unit connects to an Ethernet port on a standard PC running the Gemini software.

The Gemini NBI operates at 620 kHz and has a 1° narrow vertical beam to enable users to accurately identify acoustic target positions. Offering high-speed multibeam imaging, the Gemini NBI is ideally suited for trenching and excavation operations in poor visibility conditions as it features a 130° swath and 0.5° horizontal angular resolution providing 10-mm range resolution. Control of the Gemini NBI is via the standalone Gemini software package on a Tritech Surface Control Unit (SCU) or on a desktop PC or laptop.

For more information, visit www.tritech.co.uk.

University of New South Wales invests in Sonardyne Scout

One of Australia's leading academic institutes, the University of New South Wales (UNSW), is using underwater positioning technology from Sonardyne Asia Pte. Ltd. in Singapore to support pioneering research into human impact on marine and estuarine habitats.

The Scout-Pro Ultra-Short BaseLine (USBL) system tracks the position of divers while they collect sediment samples, underwater video transects and biota—activities that are often difficult, sometimes dangerous, and rarely precise.

UNSW began survey operations in 2015 to assess how the underwater environment changes in response to leisure activities, particularly around boat moorings. Much like on land, habitat degradation in seascapes can act to create a mosaic of habitats, each with varying suitability for the resident fauna and flora. Physical disturbance of the seafloor, nutrient and heavy metal contamination, and recreational fishing are naturally irregular and can lead to a "hidden" layer of diversity in the ecosystem.



Quantifying these impacts and uncovering this diversity calls for precise, geo-located sampling data—a requirement that is now being met following UNSW's acquisition of the Scout-Pro acoustic positioning technology.

At the start of a survey, each member of the dive team is equipped with a small tracking beacon, the exact position of which is continuously monitored by an acoustic transceiver deployed from the side of a surface vessel. The university's vessel fleet is made up of small cabin cruisers, RIBs and even shoreline infrastructure such as wharves and jetties. Scout's small size, portability and speed of setup matches these operational requirements perfectly, to the extent that the UNSW scientists only needed an hour of training to become familiar with using the system.

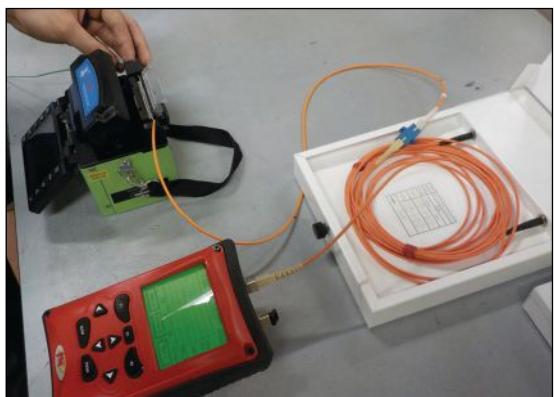
For more information, visit www.sonardyne.com.

Novacavi engineers a new hybrid cable in a multi-protocol fiber optic configuration

Novacavi has just engineered a special hybrid cable for the latest electro optical transmission systems in marine application.

It is specifically designed with single mode and multi mode fiber optics in several different protocols all together within one metal tube in combination with other electrical components. This customized hybrid cable is conceived as a perfect functional solution with a reliable pressure and temperature resistance in optimized shape.

Novacavi offers technical expertise and manufacturing efficiency focusing on continuous improvement in applica-



tions of fiber optic technology. They supply hybrid cables with glass and/or plastic F.O. (single mode 9/125 or multi mode 50/125; 62, 5/125) and tubes and hoses in almost any conceivable configuration with optical fiber testing report.

For more information, visit www.novacavi.it.

New Tritex multigauge 5650 Surveyor thickness gauge

Dorchester based, Tritex NDT have launched their new Multigauge 5650 Surveyor thickness gauge. The new gauge, based on the already very popular original Multigauge 5600, has new features specifically designed for marine surveyors. The gauge can be used with existing standard soft-faced probes for measuring metal thickness through coatings, up to 20 mm thick, to give the same high standard of performance as the Multigauge 5600. However, by simply exchanging the probe, the gauge automatically switches to GRP measurement mode which uses single echo. This can be used to assess the condition of GRP when checking for

osmosis and delaminations. Either probe can also be used in echo – echo mode, if required, by easily selecting the option from the keypad during measurement. No special probes are needed for echo – echo mode.

The gauge has a large modern color display and an easy-to-use clear graphic menu. It has been designed in line with Tritex's concept of simple, accurate and robust. Intuitive menus allow for easy navigation while the gauge has added features to improve performance.

For metal measurement, the gauge utilizes the Multiple Echo technique to ignore coatings up to 20 mm thick and just measures the metal substrate. No grinding or removal of the coatings is required, significantly reducing preparation time and ultimately saving both time and money when carrying out inspections. All probes have Intelligent Probe Recognition (IPR), which automatically adjusts settings in the gauge when connected, resulting in a perfectly matched probe and gauge for enhanced performance. Also, the Automatic Measurement Verification System



(AMVS) used with multiple echo ensures only true measurements are displayed, even on the most heavily corroded metals. An optional leather case protects the gauge in even the most harsh environments.

Only single crystal probes are used, which have a number of advantages when measuring on curved and corroded surfaces. The new Multigauge 5650 is supplied as a complete kit, ready to use, with a 3-year warranty and free calibration for the life of the gauge.

For more information, visit www.tritexndt.com.

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69

Ocean News & Technology

Decom North Sea (DNS) has announced the appointment of a new chief executive, **Roger Esson**. He brings over 20 years' highly relevant experience as DNS continues to play a critical part in the development of the UK decommissioning sector, having held a variety of leadership positions within companies ranging from SMEs to tier 1 contractors, his previous roles have included time with Stork Technical Services and Amec Foster Wheeler's decommissioning division.

WFS Technology Ltd. has appointed **Graeme Slater** as sales manager for the UK, Australia and SE Asia. He is based in Aberdeen. Since joining in March, Slater has been supporting WFS's UK and international customers in their use of Seatooth-enabled products to increase production and reduce costs. These leading-edge systems provide effective, reliable and affordable subsea wireless instrumentation, control products, sensor systems, networks and communication solutions for use in underwater environments.

Global Marine Systems Limited announces two key promotions within the senior management team. **Mikkel Gleerup** will assume the role of director, sales & commercial at Global Marine and **Darren Lam** will join SBSS as managing director. Gleerup will take up his role in mid-May and will be based in the UK with global responsibility for sales. He joined Global Marine as managing director at SBSS in 2014, and has been instrumental in SBSS' strong performance delivery during his time at the helm. Lam will join SBSS in Shanghai from the beginning of May. He has worked at Global Marine for a number of years, most recently in the role of senior project manager, and has been responsible for implementing a host of high-profile projects in both telecom and power for the business.

Specialist maritime communications consultancy Seaborne Communications has appointed **Simon Gutteridge** to the role of business development director. With more than 30 years experience in maritime sales and conferencing activi-



Esson



Slater



Gleerup



Lam

ties, Gutteridge will be the driving force behind the continued expansion of the media relations and communications company.

ValvTechnologies, Inc. has named **David Garcia** director of manufacturing. Based in Houston, Garcia will have senior management responsibility for ValvTechnologies' manufacturing groups, leading the achievement of production, productivity, quality, safety and customer satisfaction goals, as well as spearheading manufacturing process continuous improvements.

Seatrionics, an Acteon company, is delighted to announce the renewal of their global sales and distribution partnership with **2G Robotics**, specialists in high precision underwater laser scanning and imaging technology.

Rowe Technologies Inc. has announced the appointment of **Ransone Technology Associates** (RTA) as an exclusive agent for distribution in the following states of the Mid-Atlantic region—Maryland, Delaware, Virginia, North and South Carolina, Washington DC, and GSA contracting. RTA will be selling and supporting their equipment across the region. Rowe designs, develops, and manufactures ADCPs for applications in oceans, lakes and rivers.

An ambition to provide even better service to **MacArtney**'s customers in the Asian Pacific market has resulted in a relocation of MacArtney Singapore to bigger and more spacious environments and in the set-up of a new local office in China. The new premises of MacArtney Singapore include in addition to their dedicated sales office, various warehouse and workshop facilities, viz. a fibre optic workshop as well as a dedicated slip-ring repair workshop and a moulding workshop.

Trelleborg's offshore operation has received a certificate for material verification for Uraduct® and bend restrictors under the American Petroleum Institute's specification for flexible pipe ancillary equipment (API 17L1 Ed. 1 2013). In addition, the operation's manufacturing facilities in Brazil and the UK have been awarded the highly demanding ISO 9001:2008 certification.

Damen Shipyards Group has announced the opening of a new branch office in Houston, Texas. This expansion, under the name of Damen North America, meets the increasing demand for Damen's unique shipbuilding concepts and repair and conversion services. The branch office—representing the Damen Shipyards Newbuild, and Damen Shiprepair & Conversion businesses across North America and

Canada—has decided to open offices in the heart of the energy corridor of Houston, to ensure it can accommodate customers in the best possible way.

Ocean Floor Geophysics (OFG) is pleased to announce the appointment of **Salcon Petroleum Services** (SPS) as its agent in Malaysia. SPS will provide marketing support in Malaysia for all of the services provided by OFG. SPS's personnel have extensive technical and sales experience in the oil & gas industry, including marine electromagnetics.

Guidance Marine Ltd has established a memorandum of understanding (MOU) with subsea technology company, **Sonardyne Brazil Ltda**, to provide support for its Artemis® product in Brazil. Under the terms of the MOU, Sonardyne is available to carry out on Guidance Marine's behalf, equipment servicing and repair for the Artemis system, a microwave position reference sensor for use in long range marine DP applications.

Subsea technology company, **Sonardyne International Ltd**, has become the newest associate member of the National Oceanography Centre's (NOC) Marine Robotics Innovation Centre. Sonardyne and NOC have a long history of working together, with Sonardyne acoustic positioning equipment currently installed on the NOC's deep-diving ROV and fleet of Autosub autonomous underwater vehicles, and an Innovate UK funded project currently underway.

Aberdeen-headquartered subsea cable and connector specialist **Hydro Group plc** announces five new business partner agreements with Uni-One in Taiwan, ISL in China, Oceanpixel in the Philippines, PT Indonesia in Indonesia and DKHG in Vietnam. They will aid Hydro Group's cabling interconnect solutions presence in these important markets.

Klein Marine Systems, Inc., a wholly owned subsidiary of Mitcham Industries, Inc., is pleased to announce the addition of **Saté lites y Telecommunicaciones, C.A.** as an international representative for Klein Marine Systems Maritime Security and Surveillance systems in Venezuela and Panama.

3sun Group opened a new base in Hull that aims to provide up to 50 jobs locally. The expansion strengthens the Group's strategy to become a leading supplier of installation, inspection and maintenance services for the offshore wind industry in the UK and Europe.

Leading specialist in well diagnosis, **EV**, has announced the acquisition of Aberdeenshire-based well integrity software supplier, **Epidote Ltd**, to enable a world-class well diagnosis service.

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nmsfocean.org/capitol-hill-ocean-week

June 12-15, 2016
PORTS 2016
 New Orleans, LA
www.portsconference.org

June 14-16, 2016
Seawork International
 Southampton, UK
www.seawork.com

June 21-23, 2016
Clean Pacific
 Seattle, WA
www.cleanpacific.org

June 21-23, 2016
MAST
 Amsterdam, The Netherlands
www.mastconfex.com

July 18-20, 2016
Oceanography & Marine Biology
 Brisbane, Australia
www.oceanographyconference.com

July 30 - Agust 3, 2016
IMCC
 St. Johns, Newfoundland
conbio.org/mini-sites/imcc-2016

August 9-11, 2016
Deepwater Intervention Forum
 Galveston, TX
www.deepwaterintervention.com

August 29 - September 1, 2016
Offshore Northern Seas
 Stavanger, Norway
www.ons.no

September 19-23, 2016
Oceans '16 MTS/IEEE
 Monterey, CA
www.oceans16mtsieeemonterey.org

October 10-12, 2016
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 Houston, TX
www.dynamic-positioning.com

October 11-13, 2016
Oil Comm
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www.oilcomm.com

October 17-18, 2016
Submarine Networks World
 Singapore
www.terrapinn.com

October 19-20, 2016
Offshore Well Intervention GoM
 Houston, TX
www.interventiongom.offsnetevents.com

October 25-26, 2016
AWEA Offshore Windpower
 Warwick, RI
www.awea.org

October 25-26, 2016
Offshore Energy '16
 Amsterdam, The Netherlands
www.offshore-energy.biz

November 1-3, 2016
Clean Gulf
 Tampa, FL
www.cleangulf.org

November 30 - December 2, 2016
International Workboat Show
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72

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| 3. ENGINEER/SCIENTIST | 6. OTHER (Specify) _____ |

3 Describe your organization (circle 1):

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- B. Offshore Oil and Gas/Mining
- C. Ocean Renewables
- D. Education
- E. Government, Military
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- G. Marine Science/Environmental/Fisheries (Science; Environmental; Fishing and Aquaculture; Survey; Observation; Exploration)
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Product & Services Focus: Acoustic Modems, Releases & Transponders; Marine Communications; Survey & Exploration Services

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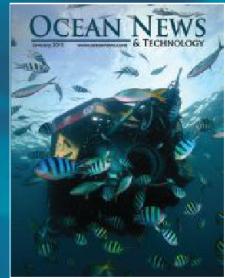
Editorial: Offshore Support, Supply & Emergency Vessels; Deep Sea Mining
Distribution: International Workboat
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DECEMBER

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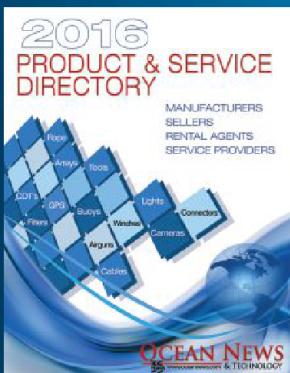
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Email: tdavis@hydraoc.com
Website: www.hydraoc.com
Contact: Trevor Davis



Hydra Offshore Construction, Inc. specializes in subsea fabrication and construction, heavy lift, maintenance, repair, and decommissioning. The Hydra 23 acre dockside facility in Port Arthur, Texas is also equipped for SIT (System Integrated Testing), and the fabrication of jumpers, PLETS, PLEM's, manifolds, custom drilling templates, spool pieces, trash caps, and equipment skid packages.

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Website: www.newindustries.com
Contact: Bill New



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80

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Subsea Americas

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Website: www.iver-auv.com
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June 2016

82

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Radar Screen Report	56	www.subcableworld.com/radar-screen-report
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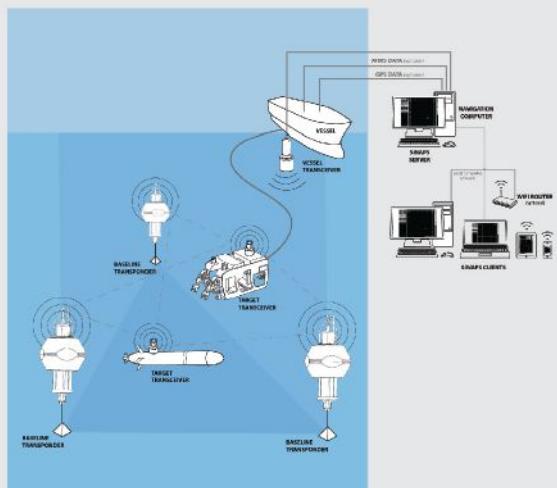
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