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ESSENTIAL INTELLIGENCE

Defending Undersea Infrastructure pg. 18

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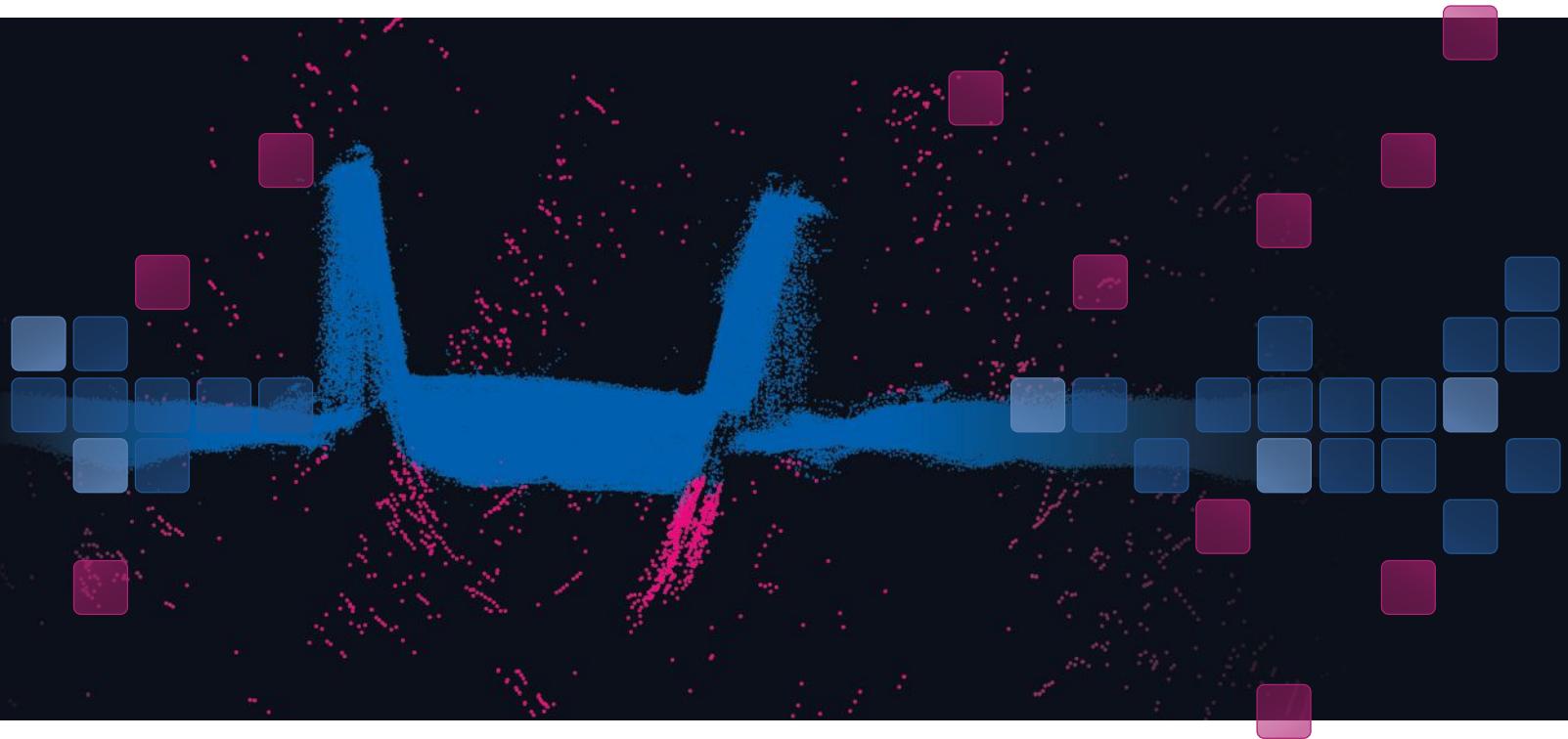
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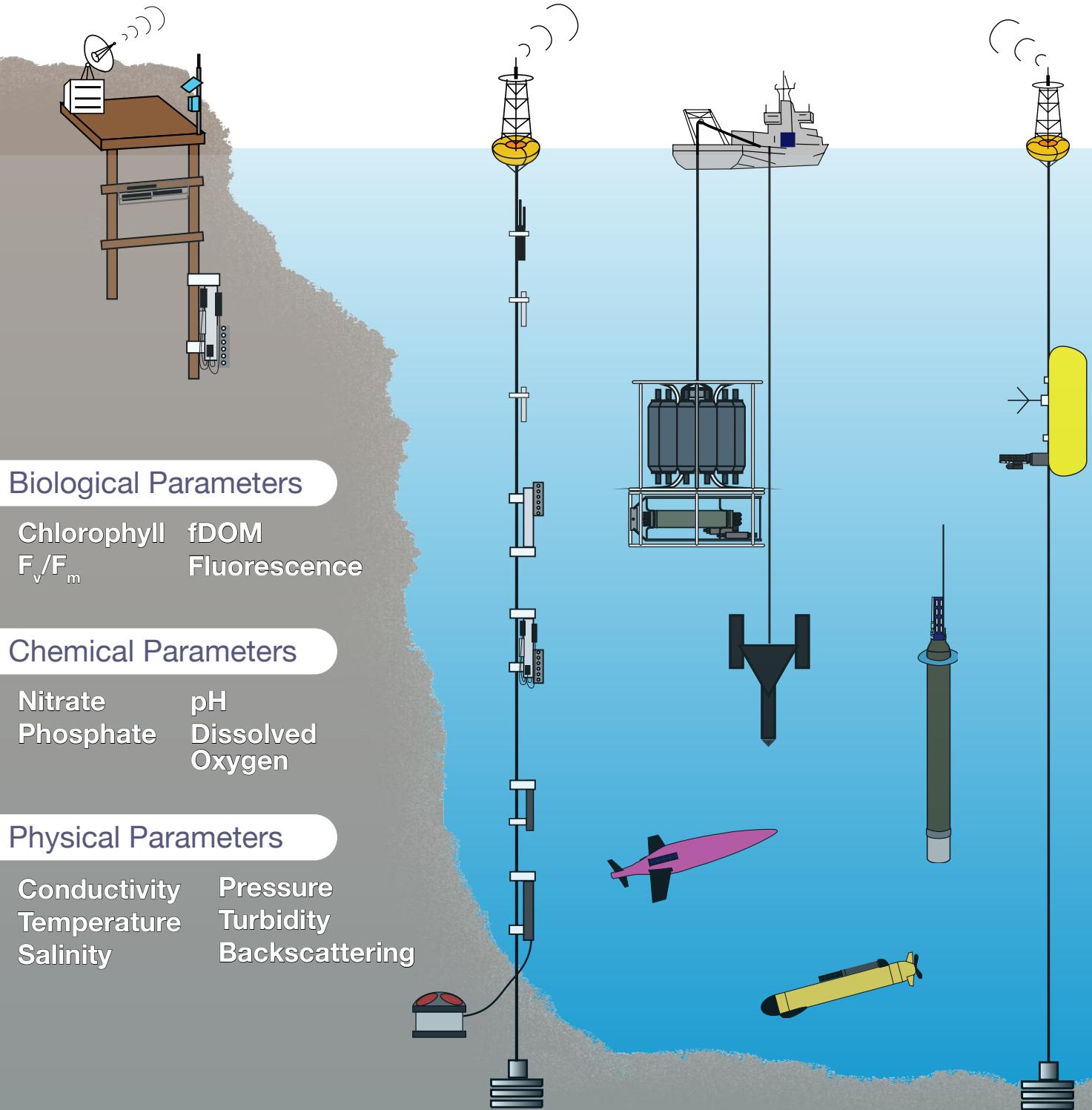
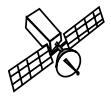


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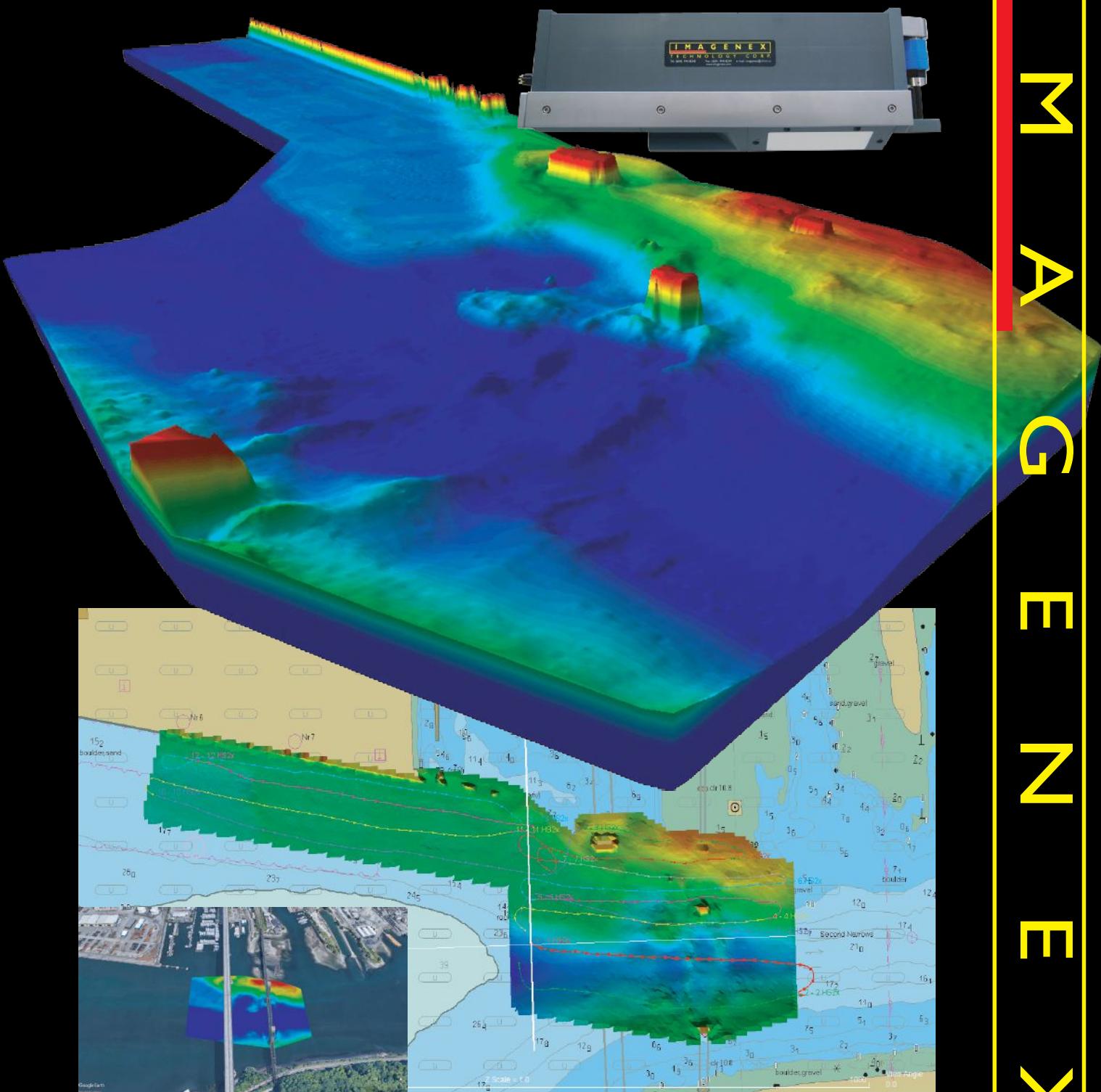
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DT102Xi Multibeam

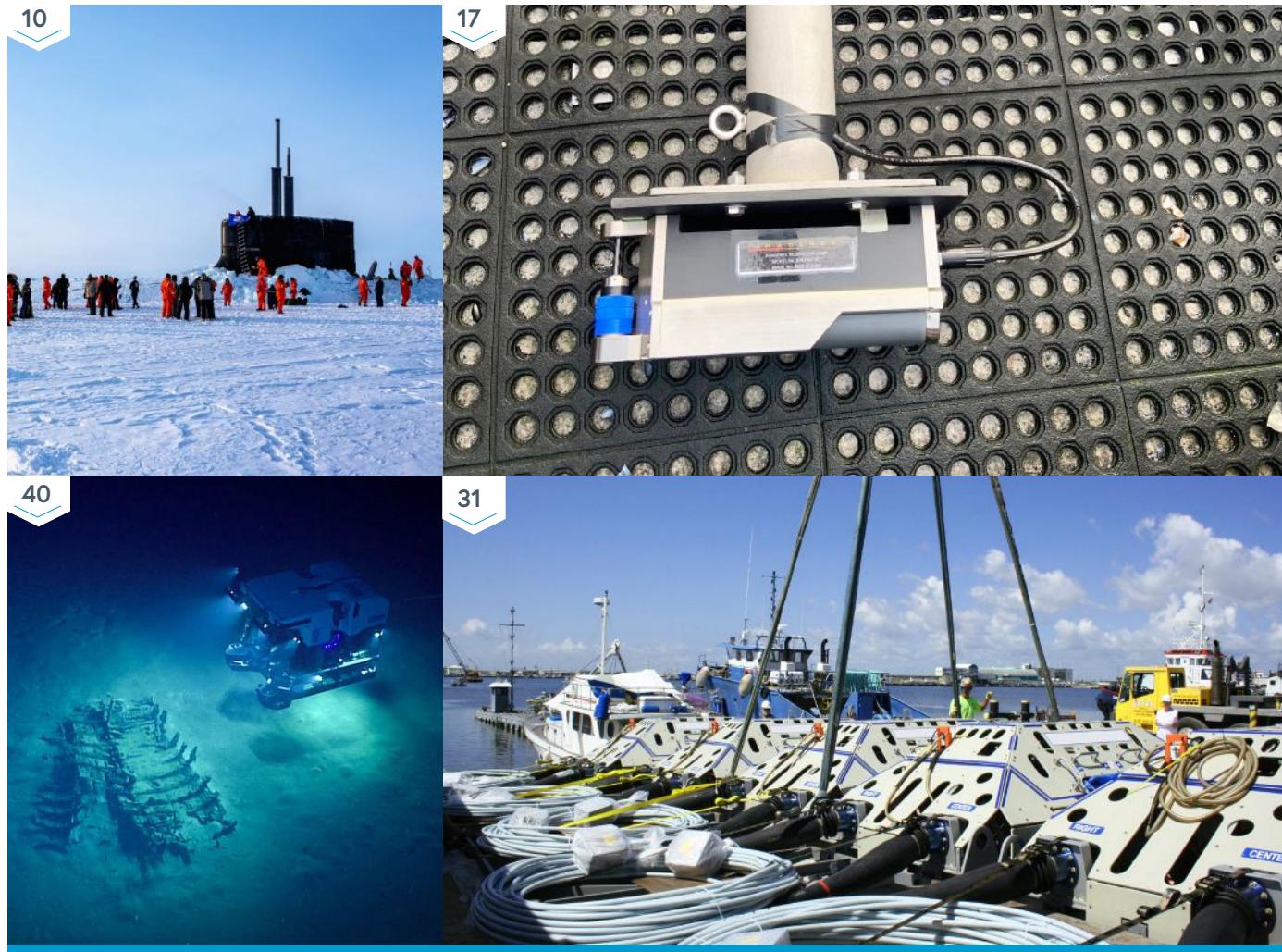
**Survey of Second Narrows in Vancouver Harbour,
including bridge footings and rock covered cables**



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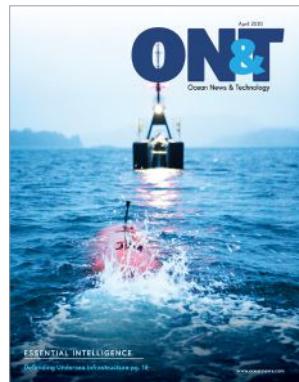
FEATURES

- 10** **Icex 2020** Strengthens Arctic Readiness of American Navy
- 17** **Looking Out For You:** Imagenex Multibeam Sonars
- 18** **The Deep Ocean:** Seabed Warfare And The Defense Of Undersea Infrastructure
- 29** **Fugro And Sea-Kit** To Develop New Range Of Inspection-Related Vehicles
- 31** **Deepwater Inspection Maintenance and Repair**
– Asset Integrity

DEPARTMENTS

- 14** OCEAN SCIENCE & TECHNOLOGY
- 30** OFFSHORE ENERGY
- 36** SUBSEA INTERVENTION & SURVEY
- 42** SUBSEA CABLES
- 44** DEFENSE
- 08** EDITORIAL
- 24** PRODUCT FOCUS
- 50** STATS & DATA
- 54** EVENTS
- 56** MILESTONES
- 59** OCEAN INDUSTRY DIRECTORY

IN EVERY ISSUE



ON THE COVER:

Autonomous underwater vessel (AUV) being recovered into a SEA-KIT uncrewed surface vessel (USV). See full story on page 29.



SEAMOR ROV

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SEAMOR STEELHEAD

This ROV is perfect for inspecting confined spaces. Quickly deploy the Steelhead to get the images you need & get the job done.

Actual Size (L x W x H)
19.8" x 15.1" x 14.7"



SEAMOR CHINOOK

Compact yet powerful, the Chinook ROV can dive to 600 metres & support a large range of navigational & searching aids.

Actual Size (L x W x H)
27" x 15.1" x 16"



SEAMOR MAKO

The Mako has a large open-frame design & capability to carry various accessories up to 22 kg & can run them all at once.

Actual Size (L x W x H)
33" x 25" x 26.5"

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With many conferences postponing flagship events, ON&T takes a look at what our readers can do to maintain professional relationships during the coming months—and offers two kinds of help. The first helps you build relationships. The second helps get your message out.

The best ocean-focused conferences provide quality content and intelligent conversations, all within the context of a shared community. From new ideas to networking, exhibitions to plenaries, conferences are an efficient way for us to stay informed and develop relationships.

How then can we keep those efforts afloat until the storm subsides? If possible, can we do it without overburdening our capital expenditures?

Let's look at two approaches that deserve increased emphasis during uncertain times.

Join a Professional Society

If there was ever a time to join a professional society, it's now. Already a member? Use this time to renew. Remember, many of these associations offer organizational memberships, so that multiple team members can benefit.

You may ask, why join now if they are postponing conferences? In short, conferences are only one tool in the box. Many professional associations have exclusive, members-only resources that can assist with networking, education, opportunities, and advocacy.

STRATEGIES FOR STORMY SEAS

BY GREG LEATHERMAN,
Editor in Chief, ON&T

To see a comprehensive, linked list of professional associations that are related to ocean industry occupations, visit our blog <https://tscstrategic.com/blog/join-a-professional-society>.

Send Us Your News

One of the most efficient ways to reach the right audience is through the pages of a trade publication. From large to small companies, staying visible in the ocean industries can be tough. Luckily, you know people who work for the top ocean industry magazine in the world. Take advantage. Send us your press releases.

But What If I Don't Fit In ON&T?

Our parent company, TSC Strategic, produces multiple publications including ECO, Offshore Source, and SubCableWorld. Match your desired audience to the proper channel and send us your news. If you have questions about the best fit, a browse through our publications will provide the answers.

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NEWSLETTER

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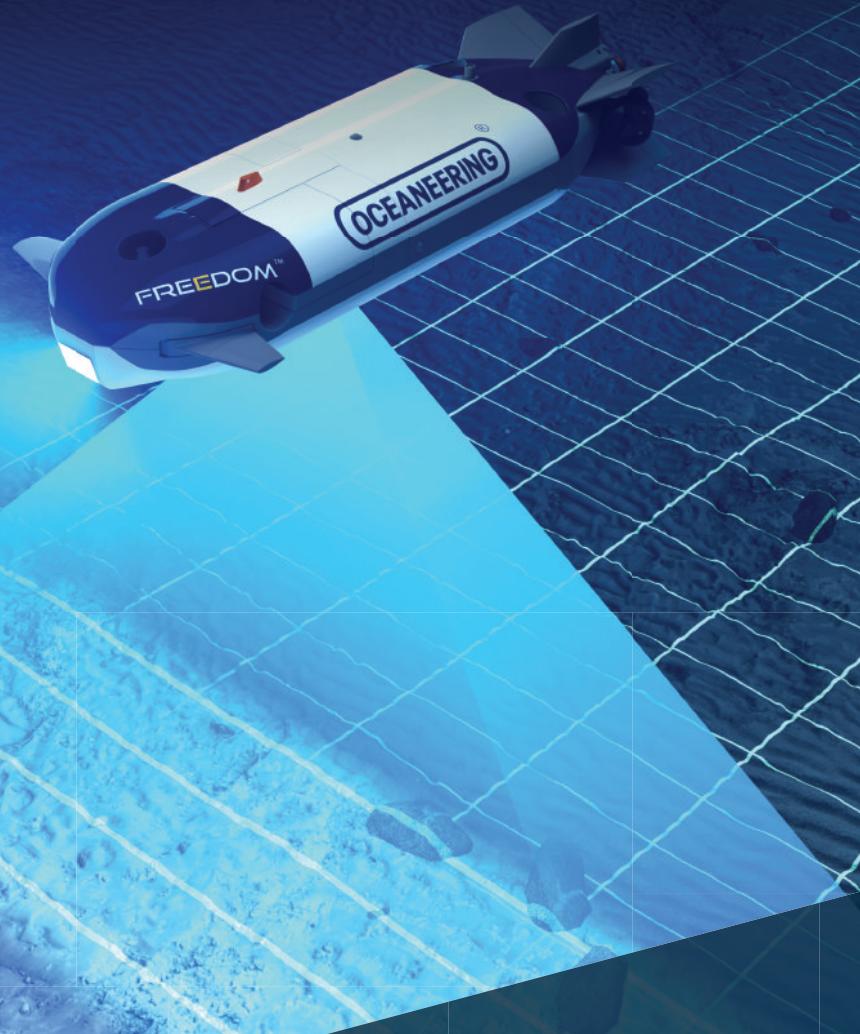
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ICEX 2020 STRENGTHENS ARCTIC READINESS OF AMERICAN NAVY

Commander, Submarine Forces (COMSUBFOR) officially commenced Ice Exercise (ICEX) 2020 in the Arctic Ocean with the construction of a temporary ice camp, Camp Seadragon, and the arrival of two U.S. Navy fast-attack submarines on March 4.

ICEX 2020 is a three week biennial exercise that offers the Navy the opportunity to assess its operational readiness in the Arctic and train with other services, partner nations and Allies to increase experience in the region, and maintain regional stability while improving capabilities to operate in the Arctic environment.



The Seawolf-class fast-attack submarine USS Connecticut (SSN-22) from Bremerton, Wash., and the Los Angeles-class fast-attack submarine USS Toledo (SSN-769) from Groton, Conn., will conduct multiple Arctic transits, a North Pole surfacing and other training evolutions during their time in the region.

"The Arctic is a potential strategic corridor — between Indo-Pacific, Europe, and the U.S. homeland — for expanded competition. The Submarine Force must maintain readiness by exercising in Arctic conditions to ensure they can protect national security interests and maintain favorable balances of power in the Indo-Pacific and Europe if called upon," said Vice Adm. Daryl Caudle, Commander, Submarine Forces. "ICEX 2020 provides the opportunity for the Submarine Force to demonstrate combat and tactical readiness for sustained Arctic operations in the unique and challenging Arctic environment."

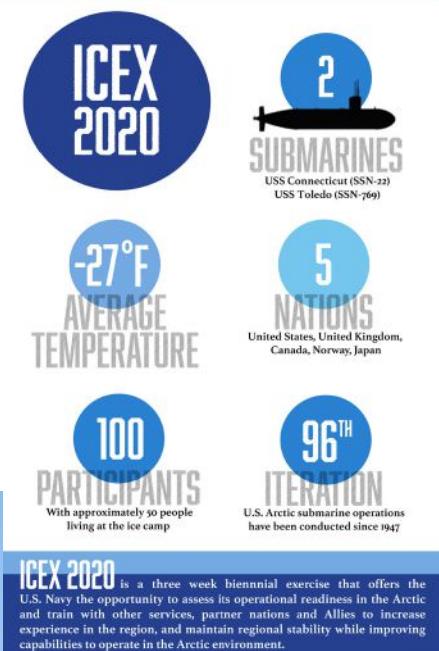
Russia Spies on Exercise

One nation with interests in the Arctic region decided they need to see what the U.S. Navy was doing during ICEX. Air Force General Terrence J. O'Shaughnessy of U.S. Northern Command told lawmakers on Capitol Hill that a pair of Russian reconnaissance aircraft intercepted by U.S. and Canadian jets on March 9 were "loitering" about 2,500 feet above Camp Seadragon.

North American Aerospace Defense Command (NORAD) said two Russian Tu-142 maritime reconnaissance aircraft were intercepted near Alaska on March 9. The Russian aircraft remained within the Alaskan Air Defense Identification Zone (ADIZ) over international airspace for roughly four hours, during which time they were spotted by NORAD F-22s and CF-18s, supported by a KC-135 Stratotanker and E-3 Sentry aircraft. NORAD added that the Russian aircraft

never entered U.S. or Canadian airspace but remained over the Beaufort Sea.

General O'Shaughnessy told lawmakers that the incident highlighted the critical role ICEX plays in maintaining domain awareness, as well as a preparing a persistent defense capable of reacting appropriately to threats.



» The crew of the Seawolf-class fast-attack submarine, USS Connecticut (SSN 22), enjoys ice liberty after surfacing in the Arctic Circle during Ice Exercise (ICEX) 2020. Photo credit: Mass Communication Specialist 1st Class Michael B. Zingaro, U.S. Navy.

ASL Takes the Lead

The Navy's Arctic Submarine Laboratory (ASL), based in San Diego, serves as the lead organization for coordinating, planning and executing the exercise involving five nations, two submarines and more than 100 participants over the three weeks of operations.

"The United States Submarine Force has been operating in the Arctic for decades, as our Navy is called upon to protect United States sovereign rights, the Submarine Force is expected to play a large role in our Arctic defense. Exercises like ICEX 2020 provide us with the opportunity to train and integrate the undersea domain into our Arctic defense," said Caudle.

Ice Camp Seadragon is a temporary ice camp that was established on a sheet of ice in the Arctic Ocean, known as an ice floe. Seadragon will serve as a temporary command center for conducting submarine operations and under-ice navigation exercises. The camp consists of shelters, a command center and infrastructure to safely house and support more than 45 personnel at any one time.

"ASL serves as the focal point for submarine Arctic operations by planning, embarking experienced Arctic operations specialists, maintaining the Navy's corporate knowledge on submarine Arctic matters, and developing/installing special equipment used to enhance the safety and efficiency of submarine Arctic operations," said Howard Reese, Director, Arctic Submarine Lab.

A History of Chill

The camp gets its namesake from USS Seadragon (SSN-584), the first submarine to transit the Northwest Passage. During the transit, Seadragon conducted the first hydrographic survey of the Northwest Passage and became the first vessel to navigate under an iceberg.



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Since the success of Seadragon's Arctic navigation initiatives, Arctic operations have been a crucial part of the missions conducted by nuclear submarines.

For more than 70 years, submarines have conducted under-ice operations in the Arctic region in support of inter-fleet transit, training, cooperative allied engagements and routine operations.

The U.S. Submarine Force has completed approximately 100 Arctic exercises.

For more information about ICEX 2020, visit www.dvidshub.net/feature/ICEX2020.

1. The Seawolf-class fast-attack submarine USS Connecticut (SSN 22) surfaces in the Arctic Circle during Ice Exercise (ICEX) 2020. Photo credit Mike Demello, U.S. Navy.

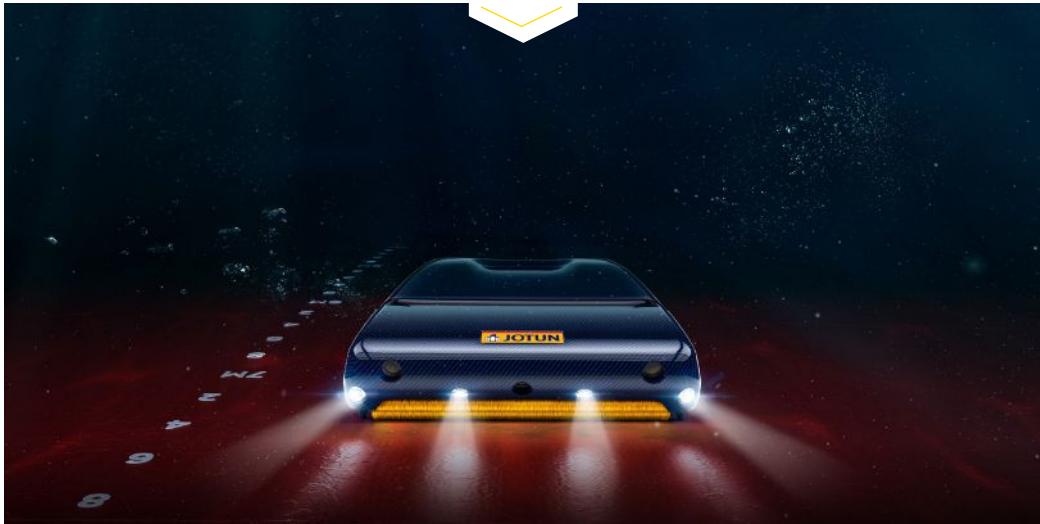
2. Partner nations flags fly over Ice Camp Seadragon during Ice Exercise (ICEX) 2020. Photo credit: Mass Communication Specialist 1st Class Michael B. Zingaro, U.S. Navy.

3. A helicopter travels between the Seawolf-class fast-attack submarine, USS Connecticut (SSN 22), and the Los Angeles-class fast-attack submarine, USS Toledo (SSN 769) after the submarines surfaced in the Arctic Circle during Ice Exercise (ICEX) 2020. Photo credit: Mass Communication Specialist 1st Class Michael B. Zingaro, U.S. Navy.

4. Mike Demello, logistics specialist, Arctic Submarine Laboratory, poses for a photo at Ice Camp Seadragon during Ice Exercise (ICEX) 2020. Photo credit: Mass Communication Specialist 1st Class Michael B. Zingaro, U.S. Navy.

5. The aurora borealis over Ice Camp Seadragon during Ice Exercise (ICEX) 2020. Photo credit: Mass Communication Specialist 1st Class Michael B. Zingaro, U.S. Navy.

JOTUN LAUNCHES REVOLUTIONARY HULL SKATING SOLUTIONS (HSS)



» HullSkater. Photo credit: Jotun.

Jotun recently launched Hull Skating Solutions (HSS), a revolutionary proactive cleaning system designed to guarantee shipowners an 'always clean' hull in the most challenging operations. The system offers high performance antifouling, proactive condition monitoring, inspection and proactive cleaning, high end technical service, and performance and service level guarantees. HSS provides individual proactive condition monitoring services tailored for each vessel, using a proprietary algorithm and big data to accurately predict fouling development and cleaning schedules.

With a comprehensive range of guarantees and service level agreements available, HSS solves the problem of biofouling once and for all, helping shipowners steer a more profitable and sustainable path into the future. If all ships in challenging operations converted to HSS, this would result in a CO₂ emissions reduction of at least 40 million tons per year.

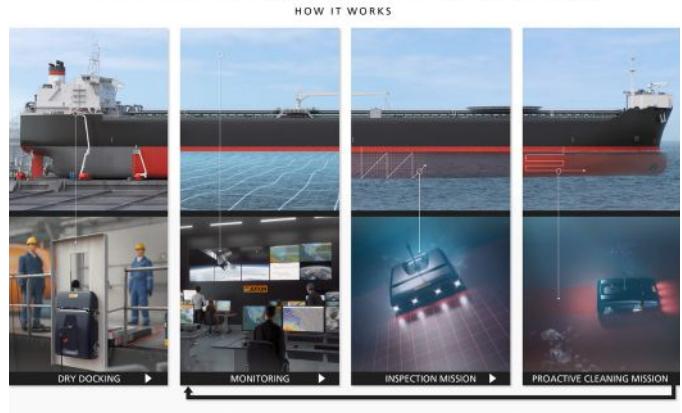
A primary component of HSS is the onboard Jotun HullSkater, a robotic technology purposely designed for proactive cleaning. In combination with the premium SeaQuantum Skate antifouling and a set of services, the Jotun Hull Skating Solutions will help ship operators combat early stages of fouling, significantly

reduce fuel costs, CO₂ emissions and the spread of invasive species.

The HullSkater

The HullSkater removes individual bacteria and biofilm before macro-fouling takes hold. This not only delivers peak performance, and unlimited idle days for shipowners, but

JOTUN HULL SKATING SOLUTIONS



» How it works. Photo credit: Jotun.

minimizes the need for reactive cleaning, cutting costs, environmental risk and optimizing fleet flexibility. The HullSkater stays on the hull by the force of its magnetic wheels, each equipped with electric motors for propulsion and steering. The vehicle has several cameras and sensors, supporting the operator with data for navigation and documenting fouling on the ship hull. The specially designed motorized brush keeps the hull free from fouling without causing erosion or damage to the hull coating. The vehicle is connected to the operator's control center through an umbilical and can be operated remotely for vessels anywhere in the world with 4G coverage. Inspection and proactive cleaning of a hull will normally take around 2 to 8 hours depending on size and condition.

Proactive Prevention

"Bio-fouling is a big challenge for the shipping industry," comments Geir Axel Oftedahl, Business Development Director at Jotun. "It increases frictional resistance leading to speed loss and greater fuel consumption, while at the same time increasing the risk of the transfer of aquatic invasive species. It is a burden to the industry, and our planet, and demands decisive action."

Business Critical

"Vessels are often faced with unpredictable operations," Oftedahl adds, "with erratic idling periods and varied operational profiles that make the selection of antifouling problematic, even for the best coatings. And once fouling grows the impacts are immediate, and damaging, with poor hull and propeller performance accounting for around one tenth of the world fleet's energy consumption. This can make a massive impact on any owner's bottom line. So, make no mistake, proactive inspections, hull cleaning and management isn't just an operational matter, it's a business-critical decision. As such, HSS is an essential business investment."

The technology has been developed over several years, with comprehensive testing taking place on vessels and at selected ports. Jotun is now in the final verification stage and is currently recruiting new selected owners to be the first to benefit from this "game-changing" solution. The shipping partners' dedicated involvement and their input to requirements, design as well as providing vessels for piloting, have been key in the development and testing of the solution.

PARTNERS AND THEIR INVOLVEMENT

KONGSBERG

KONGSBERG has many roles in the development of the HullSkater; technology development, robotics industrialization and manufacturing, in addition to service and support of the HullSkater in operation. The offering benefits strongly from KONGSBERG's 70 years of expertise in underwater technology



» Morten Fon, President & CEO, Jotun (Left) and Geir Haaoy President & CEO, Kongsberg (Right). Photo credit: Jotun.

and multiple autonomous underwater vehicles with advanced maneuvering and navigation systems.

Semcon

Semcon have been part of the development of the HullSkater from the start, contributing on design, analysis, software- and hardware development. With the long experience in developing innovative solutions together with their customers, Semcon's expertise in both robotics and digital solutions has been an important part of the cross-functional team.

DNV GL

The main focus for DNV GL – Maritime Advisory has been on the risk management of the solution, covering equipment, installation and integration of the HullSkater into the vessel and operational aspects related to safety, environment and security.

Telenor

Telenor, Norway's largest telecommunications provider, has provided an Internet of Things (IoT) solution over its mobile network for vessels using the HullSkater. Telenor's global footprint enables solutions for protected and secure flow of data across borders.

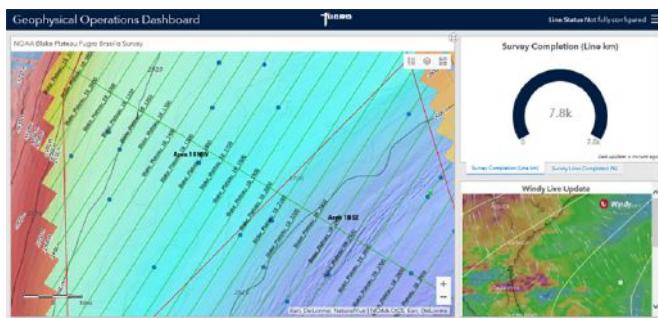
Shipping Partners

The shipping partners includes Wallenius Wilhelmsen, Berge Bulk and Maersk – strong, reputed companies with a high level of expertise within shipping. Their input to requirements and design as well as providing vessels for piloting, have been key in the development and testing of the solution.

For more information, visit

[HTTPS://WWW.JOTUN.COM/NO/EN/CORPORATE](https://www.jotun.com/no/en/corporate)

FUGRO AND NOAA PARTNERS ON 'OPPORTUNISTIC' APPROACH TO EEZ MAPPING



Fugro has partnered with the National Oceanic and Atmospheric Administration Office of Ocean Exploration and Research (NOAA OER) to establish a new 'opportunistic' approach for mapping deepwater areas of the U.S. Exclusive Economic Zone (EEZ). As Fugro's survey vessels transit to project sites through NOAA-identified areas of interest, remote command and control technologies are used to acquire high-resolution mapping data with minimal crew onboard.

A first test of the approach took place last autumn in the Blake Plateau region off the coasts of Georgia and Florida, resulting in 28 000 km² of new EEZ mapping data delivered to NOAA in February. With only about 40 % of the US EEZ mapped and significantly less of the area characterised, the new Blake Plateau mapping data will contribute to the goals and objectives outlined in a November 2019 Presidential Memorandum on Ocean Mapping of the United States Exclusive Economic Zone and Shoreline and Nearshore of Alaska, which calls for bold action to map, explore, and characterise the ocean. Additionally, Fugro will contribute mapping data collected while transiting to and from the Blake Plateau project site as part of its ongoing crowdsourced bathymetry programme related to Seabed 2030.

"Over the past several years, we've developed and refined our remote service technology to streamline project schedules, reduce costs, continuously improve health and safety of our staff, and lower our carbon footprint," said David Millar, Government Accounts Director for Fugro in the Americas. "This same technology is utilized in the opportunistic mapping model. By leveraging the location and movements of suitable survey platforms, we can acquire high-accuracy, high-resolution bathymetry data with limited staff onboard. The approach is both efficient and cost-effective, and we believe it has tremendous potential in helping close bathymetry data gaps, not only in the US but all over the world."

WWW.FUGRO.COM

NEW RBRquartz³ BPR|ZERO ENABLES CLIMATE, OCEAN AND GEOPHYSICAL STUDIES

Deepwater pressure measurements with the highest level of stability are critical for climate, global ocean circulation, and geophysical process studies. The RBRquartz³ BPR|zero is a special version of the RBRquartz³ BPR (bottom pressure recorder) implementing an internal barometer and switching valve. The novel AzeroA technique is used to provide in-situ reference measurements to correct for long term drift in the Paroscientific Digiquartz® pressure gauge.

The AzeroA technique is used to assess drift in the quartz pressure gauge. This is done by periodically switching the applied pressure that the gauge measures from seawater to the atmospheric conditions inside the housing. The drift in quartz sensors is proportional to the full-scale rating, so a reference barometer – with hundreds of times less drift than the marine gauge – is used to determine the behaviour of the marine pressure measurements. Employing the AzeroA correction will typically reduce the bottom pressure drift to less than 1cm/year at 7000dbar. The RBRquartz³ BPR|zero comes with a high-accuracy temperature sensor and may be supplied with a second (redundant) quartz pressure gauge and, optionally, a triaxial quartz accelerometer.



This instrument is intended for deepwater, long-term deployments where high stability and resolution of absolute pressure measurements are critical. Combined with the RBRfermata external battery canister, the RBRquartz³ BPR|zero can sample continuously at 1Hz for 600 days or every 10s for more than eight years. Despite being located on the seafloor, the high resolution (10ppb) quartz pressure sensor is able to detect 700μm changes in surface water level from 7,000m below the surface.

Researchers at the University of Washington Applied Physics Lab have been using RBRquartz³ BPR|zero control and logging components for bottom pressure measurements on a real-time cabled array for geophysical studies. Scientists at the French National Centre for Scientific Research (CNRS) will start using the RBRquartz³ BPR|zero to detect small and slow vertical submarine movements associated with the Mayotte volcano activity.

WWW.RBR-GLOBAL.COM

LOOKING OUT FOR YOU: IMAGENEX MULTIBEAM SONARS

Imagenex Technology Corp. was founded in 1988 by pioneers in the development of high-resolution sonar. Three decades later, Imagenex continues to push the performance boundaries of their high-resolution sonar units.

As Imagenex brings new products to market, they add variations and improvements to existing equipment. Their new Xi hardware platform is the backbone of this latest state-of-the-art technology designed into the most compact, lightweight, low power and fully integrated multibeam sonars the market has to offer.

Xi is the heartbeat in the stand-alone 837BXi and 837AXi Delta T multibeam profiling and imaging sonars. Designed with lightweight, subsea housings to operate near the surface or alloys including Titanium to withstand full ocean depth deployment, there is a solution engineered for your platform.



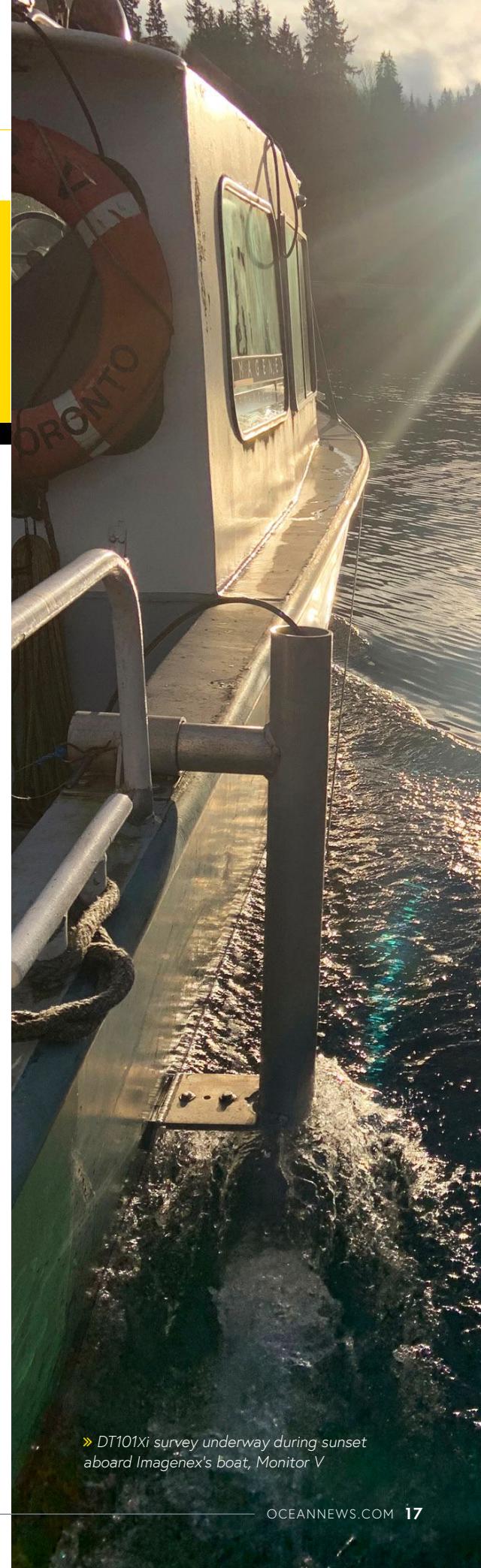
» The DT101Xi, ready and waiting for deployment on the boat deck.

With a working frequency of 120 kHz up to 2.25 MHz and up to 480 beams across a wide swath, certainly there is a model in their vast product offering to suit your application, whether you are surveying from the surface, at depth on an AUV/ROV, or looking forward for navigation and obstacle avoidance. Operating at less than 10 Watts and as light as just over 1 lb in water makes the 837BXi Delta T the ideal fit for any battery driven platform.

The DT101xi and DT102xi are fully integrated IHO Special Order multibeam solutions designed for bathymetry. Both models feature a built-in MRU and sound velocity sensor integrated into one sleek and compact working unit. Only one cable is required to power and communicate with all three combined sensors, making both the DT101xi and DT102xi sonars very attractive survey solutions for portability and quick mobilization on vessels of opportunity. With power consumption at less than 20 Watts and robust Titanium/Delrin housings they are both very well suited for autonomous battery powered designs. Imagenex's standard built designs feature the DT101xi as a 120° x 3° system, while the DT102xi is a 180° x 3° system.

With continuous technological advancements, software and hardware compatibility, portability and overall ease of use, Imagenex sonar systems set the industry standard as the most specified sonar systems worldwide. Please contact Imagenex for more specific information and to discuss your application in more detail. Imagenex sonars looking out for you!

For more information, visit
WWW.IMAGENEX.COM



» DT101xi survey underway during sunset aboard Imagenex's boat, Monitor V

THE DEEP OCEAN: SEABED WARFARE AND THE DEFENSE OF UNDERSEA INFRASTRUCTURE

By William G. "Bill" Glenney, via CIMSEC

INTRODUCTION

Given recent activities by the PLA(N) and the Russian Navy, the matters of seabed warfare and the defense of undersea infrastructure have emerged as topics of interest to the U. S. Navy. This article presents several significant considerations, arguably contrary to common thinking, that highlight the challenges of bringing the deep sea and benthic realm into cross-domain warfighting in the maritime environment.

THE DEEP OCEAN ENVIRONMENT

For clarity the term "deep ocean" will be used to cover the ocean bottom, beneath the ocean bottom to some unspecified depth, and the ocean water column deeper than about 3,000 feet. The deep ocean is where the U.S. Navy and the submarine force are *not*. Undersea infrastructures are in the deep ocean and on or under the seabed for various purposes.

How does the maritime fight on the ocean surface change when there must be a comparable fight for the deep ocean? In the maritime environment, it is long past time for the U.S. Navy to be mindful of and develop capabilities that account for

effects in, from, and into the deep ocean, including effects on the ocean floor. Cross-domain warfighting demands this kind of completeness and specificity. As the Army had to learn about and embrace the air domain for its Air-Land battle in the 1980s, the Navy must do the same with the deep ocean for maritime warfare today and for the future.

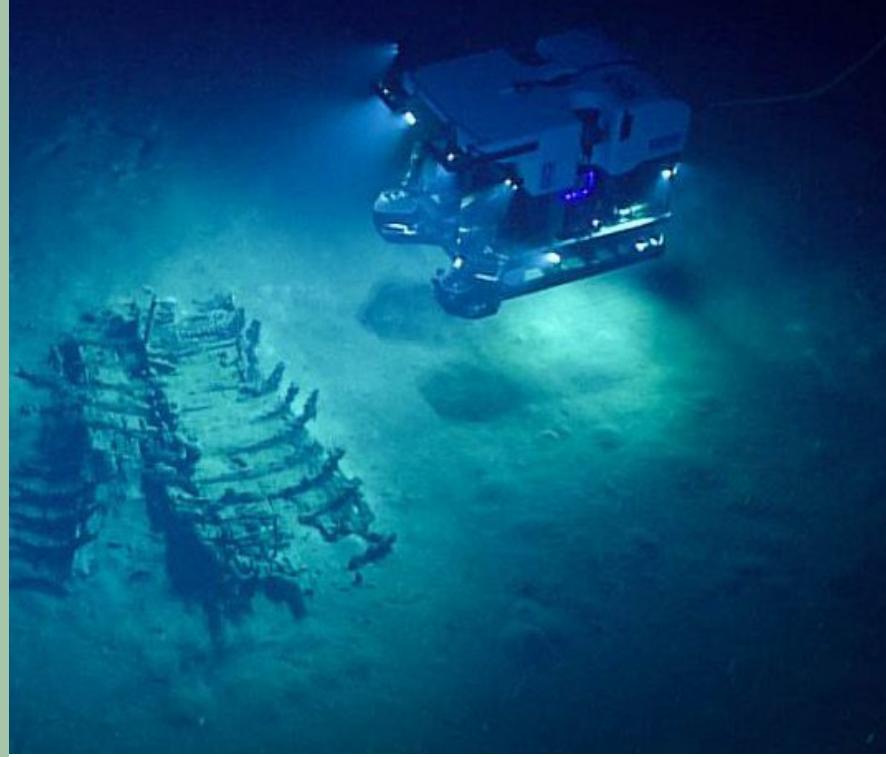
However, the current frameworks of mine warfare, undersea warfare, and anti-submarine warfare as practiced by the Navy today are by no means sufficient to even deny the deep ocean to an adversary let alone control the deep ocean. To "own" a domain, a force must have the capability to sense and understand what is in and what is happening in that domain. The force must also have the capability to act in a timely manner throughout that domain.

Today, the Navy and many nations around the world have radars and other sensors that can detect, track, and classify most of anything and everything that exists and happens in the atmosphere from the surface of the ocean and land up to an altitude of 90,000 feet altitude or higher, even into outer space. The Navy and

many nations also have weapons – on the surface and on land, and in the air – that can act anywhere within the atmosphere.

Some nations even have weapons that can act in the atmosphere from below the ocean surface. In short, with regard to the air domain, relevant maritime capabilities abound, including fixed or mobile, unmanned or manned, precise or area. Naval forces can readily affect the air domain with capabilities that can cover the entire atmosphere.

But the same cannot be said for the deep ocean. Figure 1 below is based on information drawn from unclassified sources. Consider this depiction of the undersea in comparison with the air domain. Notice that there is a lot of light blue space – space where the Navy apparently does not have any capability to sense, understand, and act. The Navy's capability to effect in, from, and into the deep ocean is at best extremely limited, but for the most part non-existent. Capabilities specifically relative to the seabed are even less, and with the Navy's mine countermeasures capabilities also being very limited. What systems does the Navy have to detect unmanned



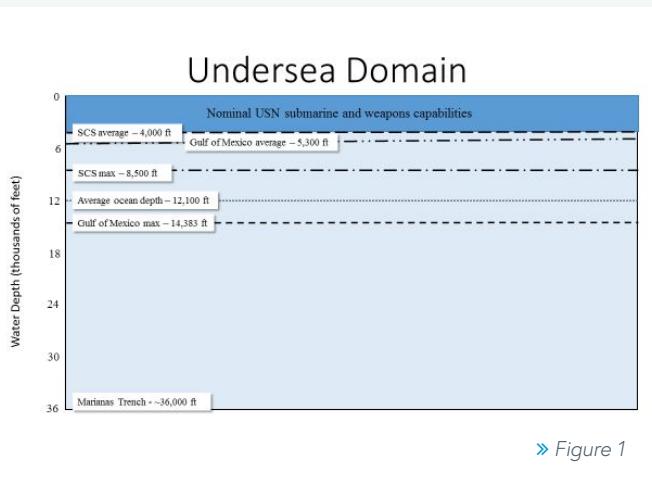
underwater vehicles at very deep depths? What systems does the Navy have to surveil large ocean areas and the resident seabed infrastructure? What systems does the Navy have to act, defend, or attack, in the deep ocean?

Arguably, the Navy has built an approach to maritime warfighting that dismisses the deep ocean, and done so based on the assumption that dominating the top 3,000 feet of the waterspace is sufficient to dominating the entire waterspace – ocean floor to ocean surface. Undersea infrastructure is presumably safe and protected because the ceiling over it is locked up.

However, the force must have the capabilities to sense, understand, and act in the deep ocean.

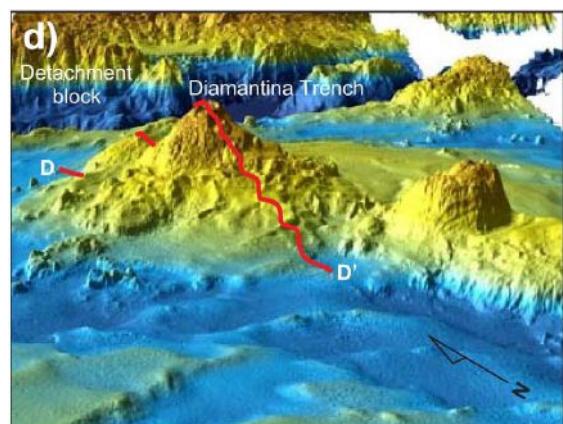
While the assumption for dominating the deep ocean by dominating the ceiling may have been useful in the past, it clearly is no longer valid. In the past, it was very expensive to do anything in the deep ocean. The technology was not readily available, residing only in the hands of two or three nations or big oil companies. This no longer holds true. The cost of undersea technology for even the deepest known parts of the ocean has dropped dramatically, and also widely proliferated. If one has a couple hundred million dollars or maybe a billion dollars, they can sense, understand, and act in the deep ocean without any help from a nation or military. Unlike the U.S. government-funded search for the SS *Titanic* by Robert Ballard, Microsoft co-founder Paul Allen independently found USS *Indianapolis* in over 15,000 feet of water in the Philippine Sea. The capabilities to sense, understand, and act in the deep ocean are available to anyone with a reasonable amount of money to buy them.

Figure 1 is misleading in one perspective. At the level of scale in figure 1, the ocean floor looks flat and smooth. If something is placed on the ocean bottom, such as a towed payload module, a logistics cache, sensors, or a weapon system, could it be easily found?

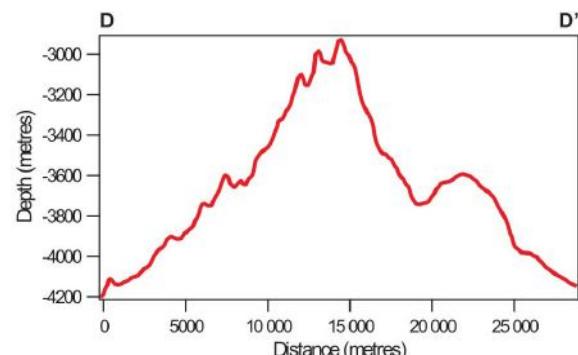


» Figure 1

Figure 2 is a picture of survey results from the vicinity of the Diamantina Trench approximately 700 miles west of Perth, Australia in the Indian Ocean. The red line over the undersea mountain is about 17 miles in length. The water depth on the red line varies from 13,800 feet to 9,500 feet as shown on the right.



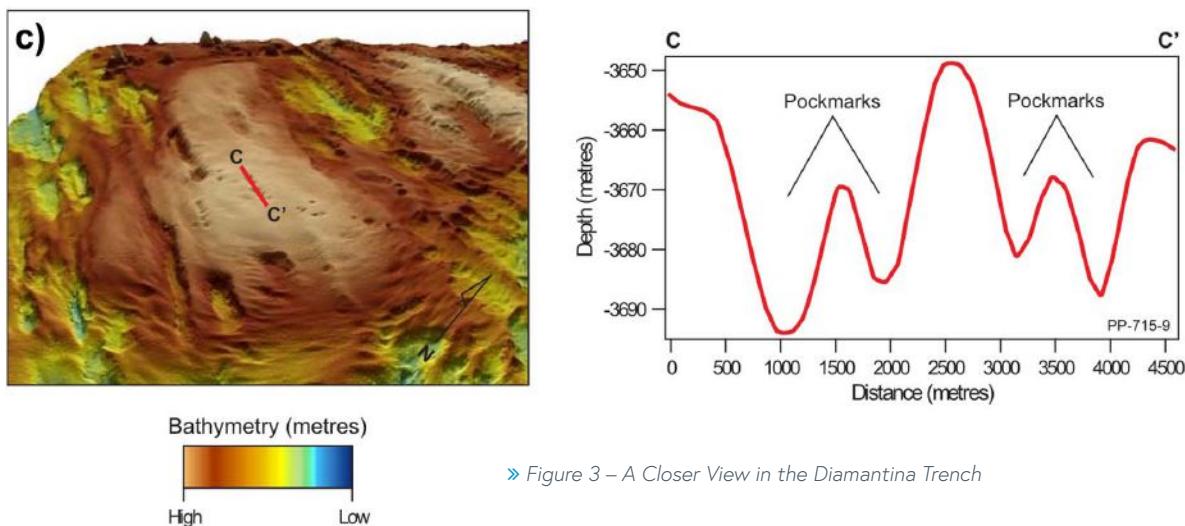
» Figure 2 – Diamantina Trench



Consider figure 3. The red line is just under three miles in length. The depth variation ranges from 12,100 feet to 11,900 feet.⁵ These figures provide examples of evidence that the abyssal is not featureless. The assumption of a flat and smooth ocean floor is simply wrong, and severely understates the challenge of sensing and acting in the deep sea.

How hard would it be to find a standard-sized shipping container (8ft x 8ft x 20ft or even 40ft) on this floor? It could be incredibly difficult, requiring days or weeks or even months with many survey vehicles, especially if the area had not been previously surveyed. This is a lesson the U. S. Navy learned in the Cold War and has long since forgotten from its "Q routes" for port access. And it would be harder still if one were purposefully trying to hide whatever they placed on the ocean floor, such as in the pockmarks of figure 3.

Based on reported results from a two-year search for Malaysian Airlines flight MH-370, approximately 1.8 million square miles of the ocean floor were searched and mapped to a horizontal resolution on the order of 100 meters and vertical



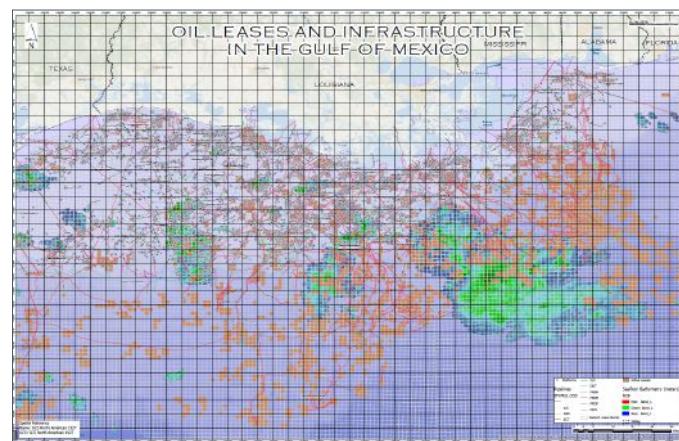
» Figure 3 – A Closer View in the Diamantina Trench

resolution of less than one meter.⁶ Yet, the plane remains unlocated.

Hiding things on the seabed is fairly easy, while finding things on the seabed is incredibly difficult. Unless one is looking all the time, and has an accurate baseline from which to start the search and compare the results, sensing in the deep sea is significant challenge. The next consideration is that of the matter of scale of the geographic area and what resides within it. This is what makes numbers matter.

Figure 4 provides a view of the Gulf of Mexico, which includes about 600,000 square miles and waters as deep as 14,000 feet. There are about 3,500 platforms and rigs, and approximately 43,000 miles of pipeline spread across the Gulf.

Of note, the global economy and worldwide demands for energy have caused the emergence of a strategic asymmetry exemplified by this figure. China gets most of its energy imports by surface shipping which is vulnerable to traditional anti-shipping campaigns. The U.S. gets much of its energy from undersea systems in the Gulf of Mexico. While immune from anti-shipping, this infrastructure is vulnerable to seabed attack. In late 2017, the



» Figure 4 – The Gulf of Mexico. Courtesy of BOEM

Mexican government leased part of their Gulf of Mexico Exclusive Economic Zone seafloor to the Chinese for oil exploration.

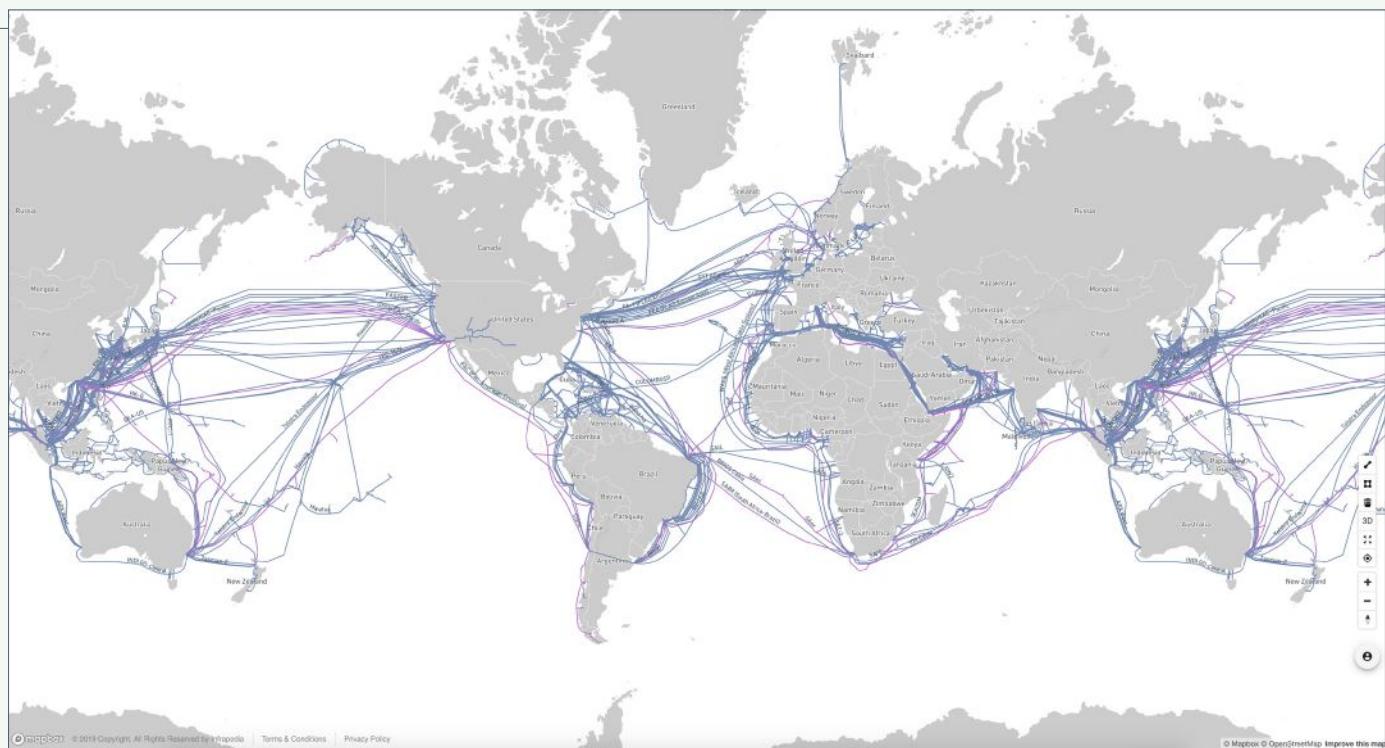
Figure 5 provides a depiction of global undersea communication cables with some 300 cables and about 550,000 miles of cabling.

Figure 6 provides a view of the South China Sea near Natuna Besar. This area is about 1.35 million square miles with waters as deep as 8,500 feet. Recall that in the two-year search for Malaysian Air flight MH 370 they surveyed only 1.8 million square miles, and did so in a militarily-benign environment.

The deep ocean demands that a maritime force be capable of surveilling and acting in and over large geographic areas just like the ocean surface above it. Undersea infrastructure is already dispersed throughout those large areas. In addition, because the components of undersea infrastructure are finite in size, the deep ocean also demands that a maritime force be capable of surveilling and acting in discrete places. While it is arguable that defense in the deep ocean is a wide-area challenge and offense is a discrete challenge, the deep ocean demands that a maritime force be capable of doing both as part of the maritime battle. Therefore, the deep ocean presents an "area" challenge and a "point" challenge simultaneously, and both must be addressed by maritime forces.

In addition, the size of the area and the number of points of interest means that a dozen UUVs or a couple of nuclear submarines are not in any way sufficient to address the maritime warfighting challenge of defending the deep ocean and undersea infrastructure of this scale. Furthermore, the situation is exacerbated by systems and vehicles in the deep ocean above the seabed. The threat is not a few, large, manned platforms, but many small unmanned vehicles and weapons.

The historical demarcation among torpedoes, mines, and vehicles is no longer productive except maybe for purposes of international law and OPNAV programmatic. Operationally and tactically, the differentiation is arbitrary and a distraction



» Figure 5 – Global Undersea Telecommunications Cables

from operational thinking. The Navy should be talking in terms of unmanned systems – some armed or weaponized, and some not; some mobile and some not; some intelligent and some not. Torpedoes can easily become mobile, armed UUVs with limited intelligence. Mines can also become mobile or fixed UUVs with very limited intelligence.

In the course of the author's research and in research conducted by the CNO Strategic Studies Group (SSG), there were no situations or considerations where reclassifying mines and torpedoes as UUVs was problematic with regard to envisioning war at sea. Doing so eliminated a significant tactical and operational seam and opened up operational thinking. The systems for the

detection and neutralization of UUVs are the same as those needed to detect and neutralize torpedoes and mines, and the same for surveilling or attacking undersea infrastructure.

CONCLUSIONS

Ultimately, understanding the deep ocean and warfare in the deep ocean is a matter of numbers and time – requiring plenty of sensors, and plenty of time.

About the Author: Professor William G. Glenney, IV, is a researcher in the Institute for Future Warfare Studies at the U.S. Naval War College. The views presented here are personal and do not reflect official positions of the Naval War College, DON or DOD.

Editor's Note: Ocean News & Technology is partnering with the Center for International Maritime Security (CIMSEC) to increase awareness of defense technology topics. ON&T reprints this article, which first appeared on the CIMSEC website, with permission. CIMSEC is a 501(c)3 non-partisan think tank with over 800 members in more than 30 countries. CIMSEC does not take organizational positions and encourages a diversity of views in the belief that a broad range of perspectives strengthens our understanding of the challenges and opportunities in the maritime domain. To learn more, visit cimsec.org.

The author has contributed a second installment on this topic which can be read at <http://cimsec.org/the-deep-ocean-seabed-warfare-and-the-defense-of-undersea-infrastructure-pt-1/39593>. That second article looks at concepts from the CNO SSG.

Full references for this story are available online at <http://cimsec.org/the-deep-ocean-seabed-warfare-and-the-defense-of-undersea-infrastructure-pt-1/39593>.



» Figure 6 – The South China Sea



» WaterProof used ADCPs from Nortek to help measure existing sedimentation levels and water currents in and around ferry channels going to the island of Ameland in the Netherlands. Photo credit: Nortek.

NORTEK'S SIGNATURE VM INSTRUMENTATION KEEPING DUTCH WATERWAYS NAVIGABLE

Maintaining the narrow navigational channels through the shallow tidal flats of the Wadden Sea in the Netherlands is a constant battle, due to the high rate of sediment deposition. Nortek's Signature VM instrumentation has proved to be a valuable weapon in this fight, providing vital information on particle density and current flows through the water layers.

The Dutch jokingly say that God created Earth, but the Dutch created the Netherlands, given the extensive measures taken through the centuries to reclaim and protect the country's low-lying land from the sea, largely through the construction of dikes. However, this activity does not come without side effects.

The construction of the Afsluitdijk, a 32 km dike through the IJsselmeer and Wadden Sea, has resulted in a major morphological shift in the Dutch section of the Wadden Sea, one of the world's largest tidal flats systems, which stretches from the Netherlands to Denmark.

Off the northern Dutch coast, the sea bottom is rising and the maritime navigation channels for ferries are rapidly

clogging up with sediments. The navigation channel for the ferry crossing between Holwerd and the island of Ameland has to be dredged around the clock to keep it accessible. Near the village of Holwerd,



» The easy-to-use vessel-mounted Signature VM played a significant role in determining the spatial distribution of velocities, sediment concentrations and tidal prisms across the navigation channels. Photo credit: Nortek.

sedimentation rates of up to 6 m a year are frequently reached. Total dredging volumes exceeded 1.5 million m³ in 2018.

WaterProof Marine Consultancy & Services was asked by the Dutch Ministry of Public Works to monitor and assess the possible impact of dredging a shortcut in the meandering navigation channel. Due to its constant erosion

and sedimentation process, the route to Ameland is becoming longer, costing time, fuel and extra CO₂ emissions. Dredging the shortcut of the ferry channel would change the hydromorphological conditions and therefore needed to be monitored to assess the efficiency of the measure and any long-term impact in the area.

Acoustic Instrumentation Point Way To Solution

As part of its analyses, WaterProof needed to measure existing sedimentation levels and water currents in and around the channels. The specialized consultancy firm selected Nortek's Signature acoustic Doppler current profilers (ADCPs) to do the job, including the vessel-mounted Signature VM.

Data gathered by the Signature VM provided accurate insight into the flow velocities over the water column at the channel transects and also showed the continuously depth-varying sediment concentrations in the water over the tidal cycle. This knowledge aids understanding of the morphological system and gives direction in the efficiency of future mitigation measures to keep the navigation channel open.

WaterProof's Luitze Perk reports: "Nortek advised us on suitable equipment for our

extensive field campaign and delivered the right acoustic instrumentation for the job. Our bottom frames were equipped with Signature ADCP instrumentation to gain information about water flow, water level and (in combination with an optical sensor) suspended sediment concentrations over a two-month period."

WaterProof took measurements using stationary Nortek Signature1000 ADCPs, as well as the easy-to-use vessel-mounted



» Nortek's vessel-mounted ADCP current survey package – called Signature VM – opens up new and unprecedented opportunities to ocean researchers, while offering operational convenience and reduced complexity. Photo credit: Nortek.

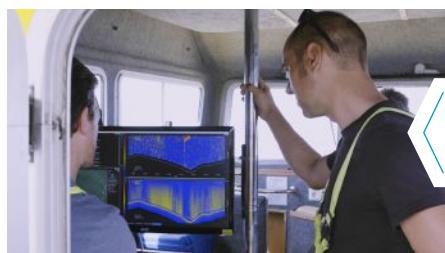
Signature VM, which played a significant role in determining the spatial distribution of velocities, sediment concentrations and tidal prisms (the volume of water moved between low and high tide) across the navigation channels.

"The vertical beam of this vessel-mounted system provides us with a high-resolution echograph, encompassing the entire water column from the water surface to the bottom of the sea, where the highest concentration of sediments can be expected," he adds.

Lab Analysis With Velocimeter In Flow Flume

Sediment samples taken in the field were taken back to WaterProof's lab for additional flow flume measurements. Here, Nortek's Vectrino velocimeter was used to determine local, near-bed flow velocities.

"We're pleased how Nortek supported us throughout the campaign, making it



» Data gathered by the Signature VM provided accurate insight into the flow velocities over the water column at the ferry channels near Ameland in the Netherlands. Photo credit: Nortek.

possible to gather extensive and useful data," Perk says.

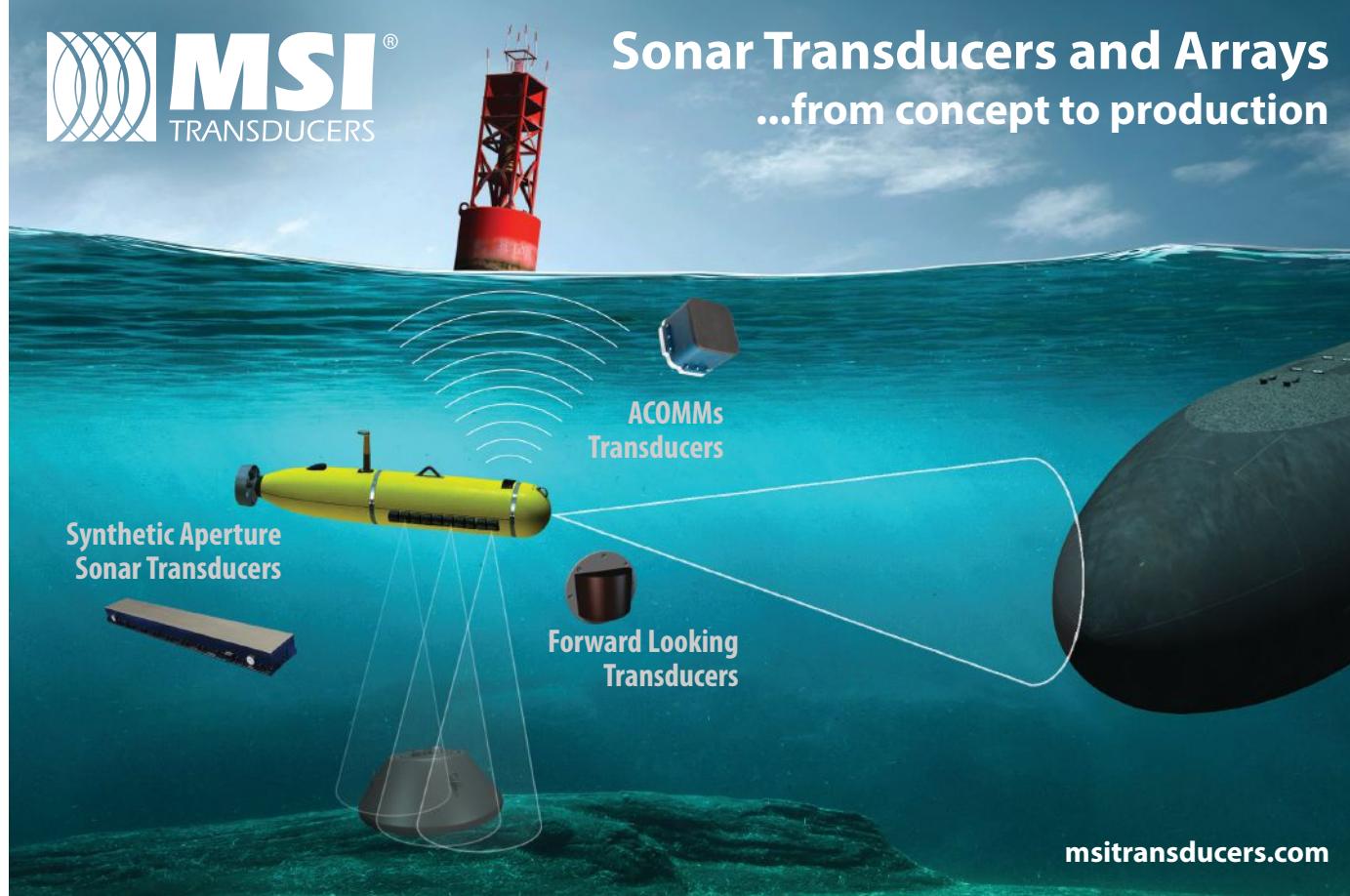
The results of these field and lab studies enable WaterProof to provide well-founded advice to the authorities on possible measures to keep the navigation channel towards the island of Ameland open for ferries.

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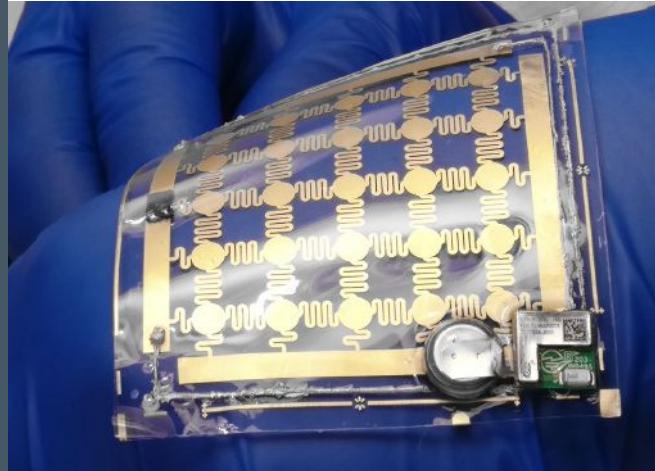
BLUEFIN: AN AFFORDABLE BIO-LOGGING SKIN MADE FROM COMMON MATERIALS

Living creatures are loaded with sensors. We see, here, taste, and smell using devices loaded onto an ambulatory vessel capable of traversing land or water: our bodies. But that is far from the only sensory organ providing information about the world around us. The largest sense organ for most creatures is skin, but unlike our eyes and ears, which have been recreated with common technology, skin has proven difficult to duplicate in a lab. For one thing, skin stretches and flexes while it senses the environment, a quality that has limited the materials suitable for biomimicry.

However, one pioneering lab led by scientist Muhammad Mustafa Hussain recently made a breakthrough that not only mimics skin, it does so on the cheap. It's a technology so innovative that it even won a Consumer Technology Association (CES) 2020 Best of Innovation Award honoring outstanding design and engineering in consumer technology products. Bluefin took the top spot in the category of Tech for a Better World.

Bluefin Capabilities

Bluefin is a tagging technology that sticks to the fish, or a fish wearable, that can measure water temperature, pressure, depth and pH levels in parts of the ocean humans can't reach. Only 2.4 grams, the Bluefin functions continuously for a whole year at a proven depth of two kilometers in the ocean, and it is simply attached to the outer shell or skin of an animal. The tagging technology has been tested on several marine species including blue crabs, turtles, stingrays, beluga whales, sharks and blue fin tuna.



» Photo credit: All photos courtesy of KAUST.

"The gathered data will be analyzed to preserve and to enhance the marine ecology anywhere in the world," said Muhammad Mustafa Hussain, professor of electrical engineering at the King Abdullah University of Science and Technology (KAUST), who worked on developing Bluefin.

The Tech Behind the Skin

The product has two specific designs: an attachable tag for smaller marine species, and a larger stretchable polymeric belt to tie around larger marine species. Bluefin is the first tagging tech that does not restrict the animal's movements and does not cause harm to the animals.

Using iridium-based chips, the system provides seamless data transmission from the tags, and the power supply is ensured by non-toxic physically flexible batteries. The current prototype relies on Bluetooth technology to transmit data stored on the chip to smartphones. The gathered data provides KAUST with the information useful for effective policy implementation to reduce society's environmental impact on marine ecology.

Initially available only for oceanographic research institutions, Bluefin will be available in 2020 for scuba divers, naval forces, and fisheries that are interested in marine life tagging for ecological data.

"I realized we could help marine species by developing comfortable and convenient wearables for them," Hussain said.



STORMGEO AND DNV GL SIGN MoU TO ACCELERATE MARITIME DATA SHARING

StormGeo and DNV GL have signed a Memorandum of Understanding (MoU) to drive digitalization and data standardization in the maritime industry.

In the MoU, both parties aim to strengthen the presence and integration of StormGeo's fleet performance management and weather intelligence solutions on DNV GL's independent data platform, Veracity. This will give StormGeo's customers an enhanced service offering, helping them to further optimize the operations of their fleet. Veracity users will benefit from easy integration of StormGeo's weather intelligence services that can be accessed on the Veracity Marketplace.

"Today StormGeo offers an integrated solution to span navigation and voyage planning, weather routing and fleet performance management. We believe this partnership signals the industry that we intend to further enhance our service portfolio to help clients improve safety and fuel efficiency of their vessels," says Thilo Dückert, StormGeo VP, Fleet Performance Management.

"With Veracity, we have built an independent network of industry relevant companies, where the members of the network can buy, combine, share and collaborate on data to optimize their operation



– all while knowing their data is safe and secure throughout the process," says Mikkel Skou, Director of Veracity at DNV GL. "StormGeo is an important supplier to many of Veracity's customers and we have received interest from our clients for stronger integration with StormGeo in our platform products. We now look forward to closely examine how we can do this in a manner where both companies' customers can gain from our united strengths."

The MoU builds on an agreement from March 2019 when DNV GL and StormGeo announced that they would consolidate their fleet performance solutions under the StormGeo banner. The agreement combined DNV GL's ECO Insight and Navigator Insight solutions with StormGeo's FleetDSS and ship reporting solutions. StormGeo is now servicing a fleet of more than 12,000 vessels that receive route advisory, weather intelligence, navigation and planning, or fleet performance.

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FRENCH HYDROGRAPHIC AND OCEANOGRAPHIC OFFICE SELECTS SBG SYSTEMS

Shom, the French national hydrographic and oceanographic office selected SBG Systems' inertial navigation systems to renew their whole fleet of INS. They chose the cost-effective and easy-to-use Navsight Apogee INS for their speedboats and survey vessels for both shallow and deep-water real-time bathymetric surveys and Qinertia PPK software for post-processing tasks.



» Survey Vessel. Photo courtesy of SBG Systems.

The fleet used by Shom is based in Brest and is composed of eleven boats, including seven speedboats, and three 59-meter long BH2 survey vessels. They operate on shallow and deep water. Shom also uses a fleet based in New Caledonia composed of two boats, one speedboat and a buoy-laying Vessel used part of the time for hydrographic surveys.

When it came to renewing the fleet of inertial navigation systems (INS), the

Shom looked at INS complying with IHO standards for bathymetric surveys, with a focus on roll and heave that have the biggest impact on the multibeam echo sounder data compensation. After conducting tests in their official test zone where each element's location is strictly and precisely known, Shom selected SBG Systems for the replacement of inertial navigation systems. At first, they acquired a Navsight Ekinox grade (0.02° roll) for shallow water survey in New Caledonia, they then decided to move the fleet in Brest with Apogee grade INS solutions (0.008° roll).

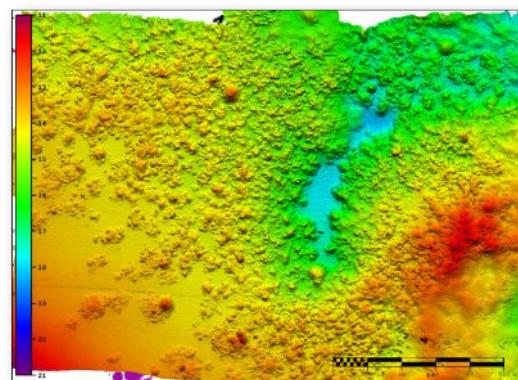
Designed for hydrographers, Navsight Apogee grade is composed of a GNSS receiver and a processing unit enabling the real-time fusion of inertial and navigation data. Navsight provides connections to several external equipment such as echo sounders, computers, etc. With its titanium enclosure, the Apogee sensor could be installed in the floodable engine compartment, close to the multibeam echo sounder.

Navsight Apogee is a high-performance inertial navigation system based on MEMS technology. It requires no annual maintenance. The SBG solution includes free unlimited firmware updates and technical support. Once connected

through Ethernet, the Navsight inner web interface guides the user during the installation phase. For example, a 3D view of the boat shows the entered parameters so that the user can check the installation in real-time. The embedded filter also controls and validates lever arms and antenna alignment during this procedure, which can be a plus if the Shom needs to calibrate a new system abroad.

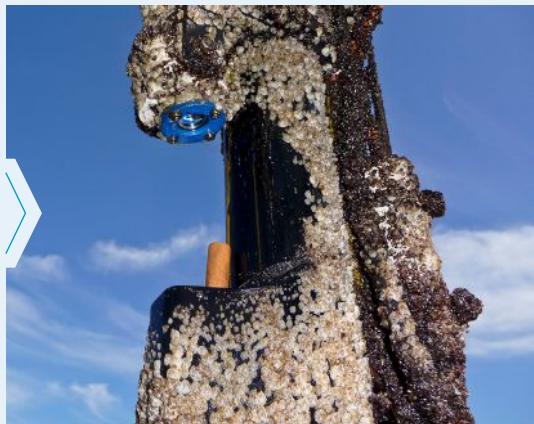
Navsight Apogee INS accepts real-time corrections from Real Time Kinematic (RTK) or Precise Point Positioning (PPP). In their daily surveys, the Shom uses PPP positioning for its big advantage of not requiring any installation compared to RTK. It also allows surveying offshore, or even near shore when no RTK correction is available. If most of their data is collected in real-time, Shom hydrographers employ SBG Systems' in-house post-processing software called Qinertia to understand and fix data issues due to communication cuts. At the end of the day, the onboard team checks the data and corrects them with Qinertia if needed.

For more information, visit
WWW.SHOM.FR



» Seafloor test. Photo courtesy of SBG Systems.

NEW ANTIFOULING UV SPOTLIGHT AGAINST UNDESIRABLE UNDERWATER GROWTH



» IOW UV
Antifouling

After about three years of development, an antifouling device designed at the Leibniz Institute for Baltic Sea Research (IOW) has now been licensed for commercial production. The new system uses lens optics to focus the UV light of energy-efficient LEDs and thus keeps irradiated surfaces free of fouling.

The new antifouling UV spotlight was developed for the continuous deployment on the three autonomous MARNET measuring stations, which the IOW operates in the Baltic Sea on behalf of the Federal Maritime and Hydrographic Agency (BSH) for monitoring the marine environment. Underwater sensors continuously register temperature, salt and oxygen content, currents and the development of phytoplankton by means of chlorophyll-a-fluorescence measurement.

"Organisms that colonise probes have a considerable effect on the sensory equipment, for example by hindering the oncoming flow of water, altering the measuring environment in the close vicinity of the probes, weakening their sensitivity and much more," says Robert Mars, the IOW instrumentation expert in charge of technical support of the Baltic Sea MARNET stations and inventor of the antifouling UV spotlight. "For example, without antifouling, it takes only two to four weeks – depending on the season – until algae growth massively falsifies the measurement of chlorophyll-a-fluorescence," Mars explains.

Since the measuring stations can be serviced by ship only five or six times a year, chemical antifouling or ineffective mechanical aids have been necessary.

"Especially since the tributyltin compounds (TBT), a highly toxic antifouling agent, were banned EU-wide in 2008, fouling has become a chronic problem in underwater measurement technology," says the IOW engineer. A non-toxic alternative is UV-C light with a wavelength of 200 – 280 nanometers.

"The UV-C LEDs are compact and robust, have a very long life and

a narrow emission wavelength band exactly in the desired range, so that no energy is unnecessarily wasted on other wavelengths. On the whole, the LEDs are incredibly energy efficient, which is essential for long-term operation that depends on battery power," says Mars.

Beginning in 2017, Mars, together with colleagues from the IOW instrumentation team and fine mechanics workshop, developed and tested prototypes of a LED-based UV antifouling system. The result was a handy device with a robust titanium casing and a plastic mount from the 3D printer, which can be adapted to different installation conditions. For the first time, quartz glass lenses focus UV light to counteract underwater light scattering and efficiently direct the radiation exactly to the target area where it is needed. Both, point and area emitters, can be realised. The new antifouling UV spotlight of the IOW has been in use at all three MARNET stations since June 2019.

"It has passed the intensive testing with distinction," Mars is pleased to report. "All target areas could be kept completely and permanently free of fouling by irradiation from a distance of up to 1 meter. The UV exposed sensors, in particular the interference-prone chlorophyll fluorometer, now consistently deliver very good data and the casing successfully defies the harsh field conditions in the middle of the Baltic Sea."

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SUPPORTING A SUSTAINABLE FUTURE FOR ARCTIC SHIPPING

High in the Arctic Circle lies the Northern Sea Route, one of the planet's vital shipping arteries. It cuts a journey by almost a third compared to the southern route but it passes through waters which are mostly frozen.

The northern route connects east and west, allowing cargo to be transferred from northern Europe to north-east Asia, via the Bering Strait. It's a 30-percent faster passage than the southern Europe-Asia alternative via the Suez Canal and is attractive to shipping companies, thanks to considerable fuel and emission savings. The increased vessel traffic through the northern route needs to take into consideration the delicate Arctic ecosystem that surrounds it.

This is why it is paramount that vessels

operating in the Northern Sea Route are fitted with the most sustainable technologies. Sovcomflot, a leader in energy shipping, operates the world's largest ice-class fleet powered by ABB's Azipod® electric propulsion, which cuts fuel consumption while negating the need for separate ice-breaking ships in Arctic seas frozen with up to 2.1 m of ice.

And to assist vessels on their extreme voyages, ABB has opened a dedicated Marine Service Center in the northerly Russian port town of Murmansk, offering 24/7 support. Sovcomflot's vessels are among over 1,000 ships supported by the ABB Ability™ Collaborative Operation Centers worldwide, from where ABB experts monitor operational shipboard systems, coordinate equipment diagnostics and offer predictive maintenance services.



Speaking about digitally connected ships operating in remote areas, Jyri Jusslin, Global Head of Service, ABB Marine & Ports, said: "We can support them. We can spot problems even before the crew, so we can say: 'Have a look at this and let's fix it before it stops your operation!'"

Vessels equipped with ABB's electric, digital and connected solutions are helping to ensure that one of the world's most precious – though arduous – supply routes can continue to operate sustainably.

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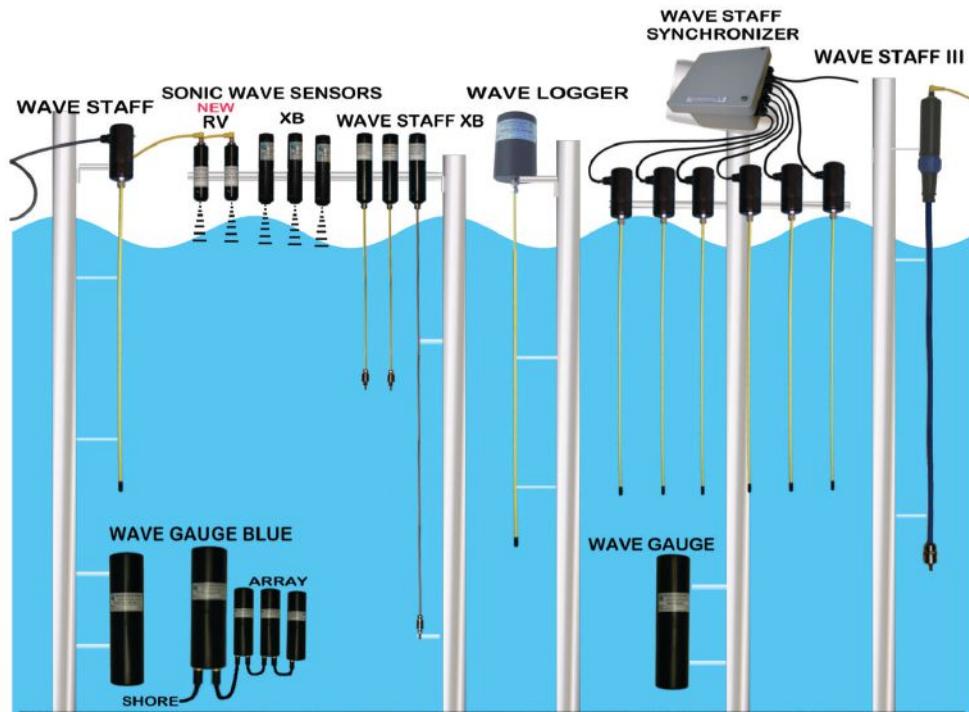
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Fugro, a world's leading Geo-data specialist, has announced a strategic partnership with SEA-KIT International, winner of the Shell Ocean Discovery XPRIZE.

SEA-KIT, a global provider of hi-tech solutions to maritime and research industries, will work with Fugro to develop a new range of agile and compact uncrewed surface vessels (USVs) which can deploy remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) for marine asset inspections. The first USVs will be launched before the end of this year, and a larger USV model is being designed for delivery in 2021. These inspection-related USVs are being developed alongside Fugro's range of USVs for hydrographic data acquisition.

Mark Heine, Chief Executive Officer at Fugro, said:

"We are excited to be partnering with SEA-KIT International to develop a range of USVs that will transform the marine industry. Together with other strategic alliances, this partnership represents a major acceleration to our strategy of leading the development of remote and autonomous solutions, which is key to delivering a safer and more sustainable approach to constructing and maintaining marine assets."

Ben Simpson, Managing Director of SEA-KIT International, commented: "We're delighted to announce our partnership with Fugro, which will combine our design and build expertise with Fugro's track record in the marine inspection market. Together we can push for better sustainability in the marine industry and lead the way for others to follow."

An Offshore Subsea Inspections First from Fugro

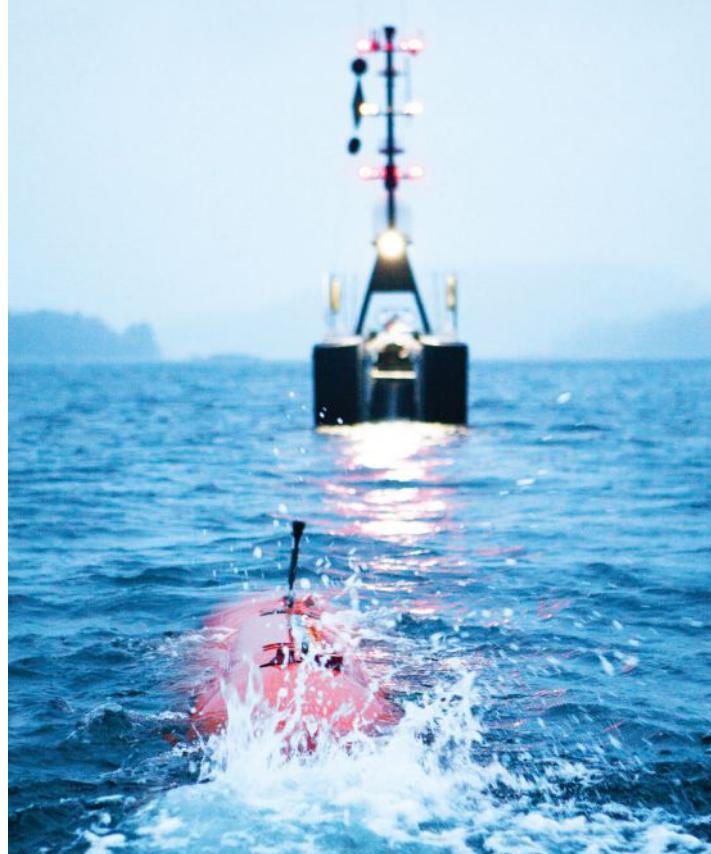
In addition to investing in USVs and ROVs, Fugro has built a global network of seven remote operations centers (ROCs) to deliver fast, safe and efficient inspection and positioning services, including two new ROCs in Aberdeen, Scotland, and Leidschendam, the Netherlands, both opened in 2019. By the end of 2020, Fugro will be the first company in the world to provide offshore subsea inspections via USVs and ROVs that are operated from onshore ROCs.

Fugro and SEA-KIT International will accelerate the development and use of uncrewed vessels, remotely operated from Fugro's ROCs, to improve safety, efficiency, and reduce the environmental impact on marine activities. The new range of USVs will consume up to 95% less fuel than traditional vessels, supporting international ambitions for zero global emissions in the marine industry.

ECO Award

SEA-KIT has a history of innovation. In fact, they were recognized in ON&T's sister publication, Environment Coastal & Offshore (ECO) for their Unmanned Survey Vehicle—USV Maxlimer—developed for the Shell Ocean Discovery XPRIZE by Hushcraft Ltd. The vessel contributed to advancing both exploration and a healthier ocean. Its unmanned capabilities allow a large area of the seafloor to be mapped at a high resolution. It's also emissions friendly and highly efficient. The vehicle uses diesel-electric propulsion which results in an approximate 95% reduction in fuel consumption. To read more about this award, see the Nov/Dec 2019 issue of ECO Magazine.

FUGRO AND SEA-KIT TO DEVELOP NEW RANGE OF INSPECTION-RELATED VEHICLES



For more information, visit
WWW.FUGRO.COM • WWW.SEA-KIT.COM

CORONAVIRUS AND THE ENERGY SECTOR



By Professor Phil Hart,
Director of Energy and Power
at Cranfield University



ON&T asked our resident energy expert how the coronavirus outbreak could impact the energy sector. Here are his answers.

Can the grid cope if everyone starts working from home and schools shut?

"The grid should have no challenges meeting the needs of remote working or school closure. Our power transmission and distribution systems are extremely robust and over recent years energy efficiency measures mean our overall power consumption as a country has reduced.

"Wholesale relocation of computers and additional household loads due to people being there have an extremely small chance of upsetting the grid systems in any way. Offices closing offer the opportunity to reduce overall loading significantly, if things like air conditioning are turned off/down, and/or lighting and ancillary systems are turned off.

"Avoidance and reduction of these electrical loads

coupled with reduced fuel use for commuting should have a positive impact on the environment with no meaningful negative impacts on our national electrical infrastructure."

Is there a risk to power supply at all?

"The risk to power supply is very minimal, unless all the work force in our power stations are off sick or basic fuel supply is interrupted. We obviously have maintenance regimes which have to be kept up at all of our power stations. If those are not met then there is a risk that some may have to be withdrawn from service if the crisis goes on for a long time.

"The advent and scale of renewables in our supply system is helpful here as the size of renewable plants is generally much smaller, and the national power system

will be better able to handle withdrawal of multiple smaller sites. I feel sure that major producers such as DRAX have contingency plans in place to ensure maintenance of their base load plant is kept up to date, so the overall risk of any issues with power supply is really quite small currently.

"We'll need to keep an eye on the international gas and biomass supply chains over coming weeks to see if there are any interruptions, but certainly for oil and gas the pricing wars currently underway seem to indicate a glut of supply not an interruption is most likely short term."

Are smaller power supply companies at risk?

"Electrical power is a staple of modern life, almost as basic to how we behave as water and food. Whilst there may be variations in daily

use profile, changes in power flows through the grid (more distributed than centralized towards big buildings), or modest reductions in power use potentially, none of these should be meaningful to the overall commercial supply and demand outcome.

"The only exception to this is if we see major users like industrial, manufacturing or chemical works shutting down, reducing the demand significantly. We're a long way off that but it might happen as if the economy grinds to a halt and production of goods slows / closes down – that could hurt some generating companies' profits short term. In an ever-changing picture, this might be worth keeping an eye on over coming weeks."

Editor's Note: Phil Hart serves on the Editorial Advisory Board for ON&T Magazine.



DEEPWATER INSPECTION MAINTENANCE AND REPAIR – ASSET INTEGRITY

Ocean Specialists, Inc (OSI) provides integrated technical services and specialized marine project management and operations to the global ocean and subsea markets. We deliver reliable, discrete and innovative solutions drawing upon a wide range of in-house resources and expertise. These solutions are expanded through the skill set of our group of companies (CSA Inc), which encompass environmental services and marine and subsea engineering and fabrication, including autonomous vehicle design and manufacture. Our ocean engineering and technology competence, combined with extensive operational experience allow us to offer integrated solutions to customers across the ocean industry.

OSI's staff have been involved in a variety of subsea projects, developing technology and installation capabilities that support deepwater inspection maintenance and repair. OSI has installed a series of communications nodes scalable to provide a connection point for AUV docking systems with available power and communications at the node interface.

Deepwater Asset Integrity (AI) has been led by the oil industry due to the high volume and many years of experience of managing and maintaining offshore and seafloor infrastructure. The lessons learned and skills set developed for the Offshore Oil & Gas Industry is equally applicable to the Defense, Oceanographic and developing Seafloor Mining Industries.

The focus of AI will typically be periodic inspection and monitoring.

In deep water, inspection has traditionally been limited to periodic inspection by Remotely Operated Vehicles (ROV), requiring ROV operations with costly manned surface support vessels are used for the surveys. More recently Autonomous Underwater Vehicles (AUV) have begun to perform some survey functions, particularly for linear features like pipelines, or large area surveys where the AUV can perform a survey faster and more cost effectively than a traditional survey vessel with a towed array.

In 2015, SeaRobotics, a CSA Holdings company, was selected by Lockheed Martin RMS (NYSE: LMT) as the Original Equipment Manufacturer (OEM) for the Marlin® Mk3 AUV. The 4000m depth-rated system features an interchangeable payload module and dual AUV/ROV propulsion modes allowing the system to be fully autonomous or remotely piloted. The Marlin Mk3 offers 24-hour continuous operation between recharges and 100 km range.

In the latest iteration, the AUV is transitioning to a resident capability allowing seafloor deployment for months or years without the need for a manned support vessel. The resident AUV uses a docking station that provides bi-directional communications and re-charging facility.

Irrespective of the industry, AUVs can provide structural surveys for seafloor support structures like jacket platforms, and linear feature surveys for pipeline and cables, pre and post installation and seabed surveys for wellheads, manifolds, trees and other seafloor hardware. The inspections are performed using video, sidescan, sub-bottom profiler, and multibeam echosounder tooling packages with 3D sonar survey allowing the creation of 3D models that can then be used for time varying change detection. These capabilities will, in the future, offer significant savings on maintenance operations that would otherwise require manned vessels and ROVs.

In addition to the inspection and monitoring role, current AUV's can perform long-term environmental monitoring, while future AUV development will also include vehicles capable of performing light intervention work.

Regardless of the application, OSI and its sister companies have the experience, resources, and facilities to provide a turnkey solution. We expect many challenges ahead for long-term resident AUV developments, which in turn will bring opportunities to develop innovative solutions, including integrated system of components for energy management, communications and navigation, as well as self-diagnostics and advanced autonomy functions.

WWW.OCEANSPECIALISTS.COM





EXCALIBUR SUPPORTS BLYTH'S FULL PROJECT LIFE CYCLE

Jack-up platform Excalibur played a crucial role in the construction of the UK's first offshore wind farm in 1998. Two decades years later it returned as the wind farm's main decommissioning vessel.

Despite only having two turbines, the Blyth Offshore Wind Farm had a big impact on the renewable energy industry. As the first offshore development in the UK, it demonstrated that wind power provided a robust, feasible, alternative energy source and heralded a new era of renewable technology.

According to E.ON, now RWE Renewables, which owned and operated the wind farm, the turbines at Blyth generated enough energy to supply over 2,000 homes, preventing 4,520 tonnes of carbon dioxide from entering the atmosphere each year.

FULL LIFE CYCLE SUPPORT

Back in 1998, Fugro conducted the overwater site investigation to inform the design of the monopile foundations for the pair of 2-megawatt wind turbine generators at Blyth. They returned two years later to drill and grout both the foundation piles, using their Excalibur jack-up platform.

After successfully generating electricity for nearly 20 years, by April 2019 the asset at Blyth had reached the end of its life cycle. Having helped bring the project to fruition, it's fitting that Excalibur was again deployed to support the decommissioning. Returning to the site with Excalibur was a proud and memorable moment for the Fugro team.

A COMPLEX OPERATION

Each of Blyth's two generators was 95 metres high and mounted on a 3.5-metre diameter monopile fixed in a pre-drilled grouted socket. E.ON's challenge was to remove the turbines safely and with minimal impact on the environment; the turbines would then be recycled. It was clear from the outset that this removal would be a complex operation, and the irregular seabed and ravines of sandstone outcrop at the site required a specialist and low-impact approach.

Fugro's solution for minimising the environmental impact was based on Excalibur's cruciform capped jacking legs, which ensure a highly mobile, light-footprint approach for work on wind turbines and cable arrays in nearshore areas and shallow transition zones.

Excalibur's 230-tonne crane was deployed to decommission the two turbines and foundation structures. A robust technical solution was required to overcome not only the weight of the monopile foundations but also any embedment friction accumulated during the construction phase.

A load-bearing platform located on Excalibur's existing aft moon pool reaction beams was central to Fugro's solution. Jacking stools equipped with hydraulic cylinders exerting 600 tonnes of hydraulic lift were in position, poised to remove the monopile in a safe and controlled way, with minimal impact on the marine environment.

Fugro used a water-jetting tool to cut the structure 0.5 metres below the seafloor. The jack-up's integral reaction beams were then used to lift the monopile free before transferring it to Excalibur's deck and onward to recycling. The remaining socket was then filled to seafloor level with 250 tonnes of ballast stone to return the installation site to a natural condition.

CABLE RECOVERY

The next step was to disconnect and terminate a 1.4-kilometre length of heavy-duty electrical cable. Once it had been safely earthed and any residual current discharged, Fugro used a multicat vessel to winch the now-redundant cable onboard for eventual disposal.

Fugro deployed specialist equipment to recover the cable and varied their methods according to the topography: a mass-flow excavation tool was used to expose the cable where it ran through an offshore submerged sand bank; two 15-tonne 360° excavators were used where the cable lay in an intertidal location.

The operation went according to plan and Fugro's flexible approach resulted in safe, efficient operations and full cable recovery.

SOLUTION SETS THE BENCHMARK

Fugro's innovative offshore wind farm foundation jacking solution uses a safety-first approach, based on robust engineering and efficient operation, that mitigates the cost and deployment challenges of using bigger cranes and jack-up barges. It's a ground-breaking solution that won the Innovation

Showcase Award in the Renewable Energy category at the 2019 European Commercial Marine Awards.

Patrick Rainey, E.ON, now RWE Renewables Offshore Logistics Manager, was impressed: "The Blyth decommissioning brought its own set of unique challenges, just as it did when the turbines were constructed almost 20 years ago. The site's proximity to shore and the fact that it was the UK's first [offshore wind] decommissioning project generated a lot of interest, which added additional pressure for positive completion."



"I would like to thank Fugro: their expertise, professionalism and knowledge were key factors that enabled the successful on-time decommissioning of the UK's first offshore wind farm without incident. As a result of Fugro's work on this project, the benchmark has now been set for future decommissioning activities."

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OIL & GAS DIGITAL PLATFORM PROTEUS SECURES ADDITIONAL INVESTMENT

A digital platform which could revolutionize the way in which the upstream oil and gas industry resources projects has secured £1.8 million of private investment.

The brainchild of new start-up technology firm, Xergy, Proteus is a cloud-based work management system that allows companies to find the right people for projects as and when they are needed and by enabling remote-working allows a genuine freelance culture in the industry to flourish. Xergy claims Proteus will transform the way in which the industry sources and uses talent to resource and deliver projects. Led by industry stalwarts, James McCallum and Colin Manson, Xergy has already benefited from £1 million of private investment.

Mr. Manson said: "We have now secured almost £3 million from private investors, which has allowed us to develop and beta test Proteus with amazing feedback from users, including Emerson and Xodus. This investment underlines our confidence in the product and the value and efficiencies it can bring but it also demonstrates that there is appetite for disruption within the sector."

A software platform, with an ERP system at its heart, Proteus facilitates working remotely within a working environment. This, in turn, will greatly increase efficiency by removing fixed overheads and needless cost and improving utilisation rates and project management, while reducing the carbon emission from commuting and travelling.



Mr. Manson added: "Proteus can help the upstream oil and gas industry transform itself to suit the needs of today's and tomorrow's workforce. Today's bright minds are looking for greater flexibility with the ability to work when they want and where they want and Proteus enables them to do that, at the same time ensuring that the industry can tap into this talent pool."

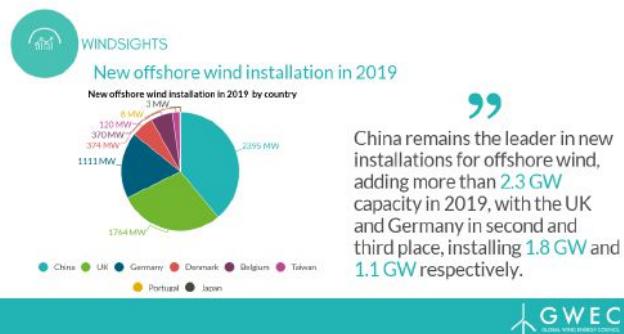
Proteus has the potential to capture a large share of the oil and gas gig economy, worth £9.6 billion, and a portion of the £3.9 billion oil and gas ERP (enterprise and resource planning) market. The ERP system within Proteus connects all the key workflows used by most oil and gas companies. The systems integrate seamlessly and are accessed through an interface designed to simplify every workflow, but the added dimension is the talent pool within it which connects companies with the best suited freelance contractors for the job.

For more information about Proteus: www.proteus-work.com

For more information about Xergy: www.xergy.com

RECORD 6.1GW OFFSHORE WIND CAPACITY INSTALLED IN 2019

The latest data released by the Global Wind Energy Council (GWEC) shows that the global offshore wind industry added 6.1GW of offshore wind capacity in 2019, a record year for the industry and an impressive 35.5 percent increase on the previous year, which saw 4.5GW installed. This growth is set to accelerate, with GWEC Market Intelligence's preliminary forecasts finding that an additional 50 GW of new offshore wind capacity could be installed by 2024 globally. This would mean that total installed offshore wind capacity could reach nearly 80 GW globally over the next five years, an increase of almost 172 percent from today's capacity.



Eight markets reported new offshore wind installations in 2019: China – 2395 MW; United Kingdom – 1764 MW; Germany – 1111 MW; Denmark – 374 MW; Belgium – 370 MW; Taiwan – 239 MW; and Portugal – 8 MW (floating).

BUSINESS NETWORK ANNOUNCES SCHEDULE FOR IPF VIRTUAL



The Business Network for Offshore Wind has announced its schedule for IPF Virtual, taking place online April 21-22 in advance of this year's in-person conference, now scheduled for August 18-21 in Providence, Rhode Island.

Free to all IPF registrants, IPF Virtual was created to provide a critical platform for federal agencies to solicit industry feedback on pending policy and regulation formulation. It also ensures attendees receive the time-sensitive information they need to make strategic business decisions for the future, particularly during this unprecedented time of economic uncertainty.

The schedule kicks off at 9 a.m. EST on Tuesday, April 21, with an hourlong look at "Offshore Wind: The Challenges Ahead." Immediately afterwards, members of the media may join a separate press conference call at 10 a.m. EST to pose questions to Liz Burdock, CEO of the Business Network; Jaime Steve, senior vice president for Policy & Programs; and selected speakers to be announced from the rest of the program.

Other sessions cover the West Coast opportunity and floating wind turbines; developments in wind resource assessment, maintenance inspections, hiring practices, and worksite safety; and job opportunities for engineers and surveyors. The program concludes with an in-depth look at the offshore wind industry developing in New Jersey, on Wednesday, April 22.

SCHEDULE:

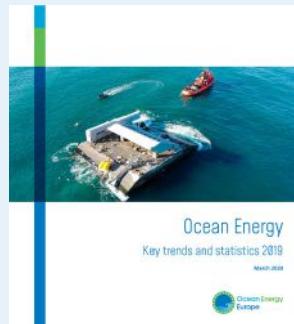
Tuesday, April 21, 2020, at 9:00 a.m. – 2:00 p.m. EST

Press conference call, 10:00 to 10:30 a.m. EST

Wednesday, April 22, 2020, at 9:00 a.m. – 2:00 p.m. EST

To learn more, visit
WWW.OFFSHOREWINDUS.ORG

EUROPEAN TIDAL POWER GENERATION JUMPS BY 50% IN 2019



Europe still leads the world in tidal energy installations, and European tidal stream projects generated 50% more electricity in 2019 than the year before, according to statistics released by Ocean Energy Europe.

European tidal stream capacity continued to climb in 2019, reaching 27.7 MW cumulatively - almost four times as much as the rest of the world. Electricity produced by tidal energy shifted up a gear in 2019, adding 15 gigawatt-hours to Europe's running total - which hit 49 gigawatt-hours at the end of the year. In the wave energy sector, installed capacity in Europe grew by 25%. Several projects hit the water along the Atlantic and North Sea coasts, taking Europe's cumulative installations to 11.8 MW.

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COPENHAGEN SUBSEA LAUNCHES THE GORILLA ROV



Copenhagen Subsea has launched a new powerful Remotely Operated Vehicle (ROV), specifically developed for the tough conditions in the offshore industry. The ROV is based on Copenhagen Subsea's rim-driven thruster technology and is robust and reliable in challenging environments – qualities which inspired the company to name it the Gorilla.

Reliability has been first and foremost throughout the design and development of the Gorilla. Basing the ROV on industrial components ensure the utmost operational reliability, allowing customers to execute their tasks on time, to budget and safely, with no need for divers in the water.

The Gorilla is equipped with an intelligent Dynamic Positioning (DP) system, enabling automatic control of position, depth, altitude, heading, pitch and roll. A lack of thrusters is a common problem in conventional ROV design, which makes it impossible to control the pitch and roll of the vehicle and thus hard for the operator to keep it stable during operations. Even

weak currents can cause these ROVs to tilt and the operator to lose control of the vehicle, potentially leading even to the abandonment of the mission and recovery of the ROV. By contrast, the Gorilla's state-of-the-art DP system makes it easy to operate the vehicle even in low visibility and strong currents. This is based on an advanced sensor system, which delivers input to the DP system to constantly adjust output of the ROV's eight thrusters in a fly-by-wire system to keep it stable in the water. The Gorilla can sense the seafloor from up to 70 meters above, enabling the DP system to keep it in the required position, even should the operator take hands off the controls.

This solves another common problem during launch of conventional ROVs, when the current can quickly push it away from the vessel, leaving the operator disoriented and without knowledge of its exact location or where to steer to reach its destination. This can often lead to an abandoned mission, necessitating a second attempt or a wait for conditions to improve. Instead, the Gorilla will use

its DP system to instantly adjust the output of its eight thrusters to maintain position relative to the seabed, meaning the operator can easily steer to the designated destination.

Like its namesake, the Gorilla is strong – it can carry up to 70 kg and has an easy to understand payload interface with a power supply and separate fiber cable connection, dedicated to the customer-specific requirement. The electrical system is based on industrial hardware from the leading Japanese industrial electronics company OMRON, unlike conventional ROV systems which are often based on proprietary electronic components developed inhouse. This is a critical differentiating factor in the reliability of the Gorilla: hardware developed and produced inhouse, in series of only 20-50 items, is simply not of sufficient scale to achieve the required level of endurance and reliability for offshore use.

For more details, visit
WWW.COPENHAGENSUBSEA.COM/GORILLA-ROV



Fifty Years of Ocean Science

CSA opened its doors in 1970 with a mission to advance ocean science. For 50 years, from coastal waters to the deep sea, we've proudly partnered with industrial, academic and government organizations to design and implement scientifically robust and progressive environmental programs, all in accordance with the strictest quality assurance and HSSE requirements.

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Find out how CSA can help you manage the environmental impact of your marine activities as we embark on the next 50 Years of Ocean Science.

Sea the Difference.



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SMD TO REVEAL ITS FIELD TEST READY ELECTRIC QUANTUM EV ROV

The release of the next generation of Work Class ROV came significantly closer, as subsea technology specialists SMD prepare to reveal its field test ready electric Quantum EV ROV.

The high capability Quantum EV is part of SMD's environmentally responsible solution to next generation subsea robotics. It is designed around five key principles covering performance, reliability, flexibility, ease of use and cost.

The first phase in a robust series of stress-tests on the full range of components that make up the innovative modular EV ROV design is now complete. Data released by SMD reveals that all components are now certified to perform at depths of 6,000 meters and have passed grueling environmental testing. The development of the propulsion system allows for optimum performance as well as longevity, stability and consistency. Quantum EV can reliably run for longer, without the need for manual intervention.

The vehicle is equipped with a range of cutting-edge technologies including the completely new 200kW high power electric thrust system, a new long-distance DC transmission solution and locally managed DC power system. Quantum EV has a 15% increase in performance while using half the energy of a current Work Class ROV. The new platform also features advanced flight processing for high quality survey, battery compatibility for tetherless operations and is future proofed to accept AI command technology.

The next phase of development has started. Dynamic tests will take place during a series of wet trials, many in open water over the coming months. First deliveries are expected to begin in 9-12 months.

The SMD EV program forms part of SMDs long-term strategy to engineer a series of adaptable technologies based on an open-electric framework for whatever shape vehicle is required and that can be adapted for a variety of operations. Quantum



EV will be joined by other models in the range. As well as being used to maintain traditional subsea infrastructure, this new generation ROV technology is being developed for use with robotic Unmanned Surface Vessels (USVs). Its ability to interface with autonomous onboard decision making makes the Quantum EV the ideal partner for the new breed of over-the-horizon technologies, without compromise on the ability to do high quality work.

Mark Collins, SMD's Director for Remote and Autonomous Technologies has been involved throughout the development process. He said, "Over the past four years our engineering and innovation teams have been on a journey to develop a high performing, stable vehicle that gives our customers ultimate control across a range of sectors and tasks. The development of the EV-ROV has taken place very much in collaboration with our customers and our partners – their needs continue to be at the heart of this ground-breaking technology. Since September we have put a large amount of effort into testing components in a range of real-world scenarios. We are confident it will significantly outperform the current models, even in the most challenging of subsea situations.

For more information, visit
WWW.SMD.CO.UK

continuous availability of versatile intervention tools.

This contract confirms Stinger's position as a forefront company as supplier of solutions for autonomous and onshore supported underwater drones in the energy sector.

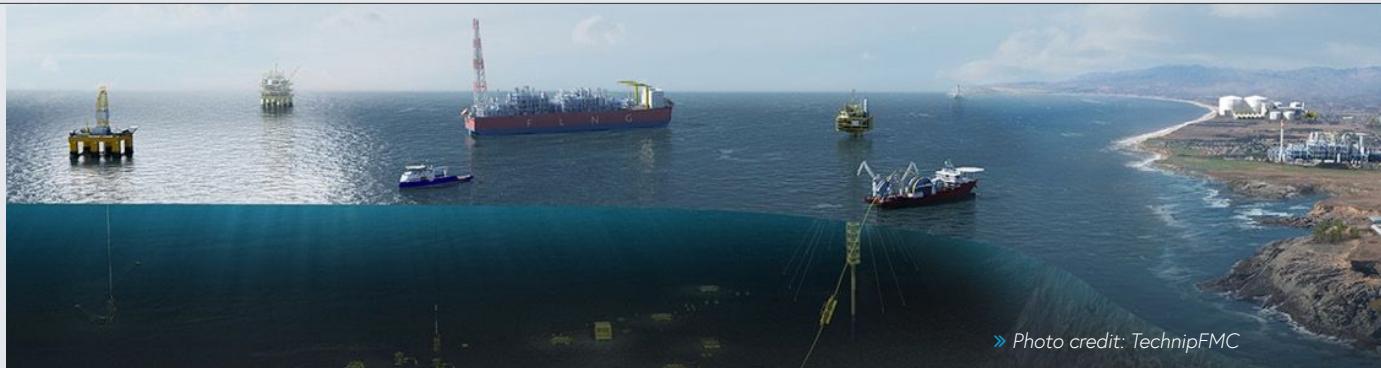


WWW.STINGER.NO

STINGER TECHNOLOGY AWARDED R&D CONTRACT WITH NEPTUNE ENERGY

Stinger Technology, the next generation subsea marine robotics company, has been awarded a R&D contract with Neptune Energy, for the development, qualification and field trials of autonomous inspection/intervention subsea drones.

The solutions that will be developed for Neptune Energy aim to save costly vessel operations and reduce risk through



» Photo credit: TechnipFMC

TECHNIPFMC AWARDED MAJOR CONTRACT FOR BP PLATINA FIELD OFFSHORE ANGOLA

TechnipFMC has been awarded a significant integrated Engineering, Procurement, Construction and Installation

(iEPCI™) contract from BP Angola for the Platina field development, located offshore Angola in Block 18 at water depths ranging from 1,200 to 1,500 meters. For TechnipFMC, a "significant" contract is between \$75 million and \$250 million.

The contract covers the manufacture, delivery and installation of the subsea equipment including subsea trees, a production manifold with associated subsea control and connection systems, as well as rigid pipelines, umbilicals and flexible jumpers.

Arnaud Pleton, President Subsea at TechnipFMC, commented, "We are very pleased to have been selected by BP for this important deepwater development offshore Angola. We are committed to BP and to supporting the Angolan oil and gas industry. This iEPCI™ follows iFEED™ work and will utilize our local assets such as our service base in Luanda and our umbilical factory in Lobito."

For more information, visit
WWW.TECHNIPFMC.COM



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COLLABORATION ON GROUNDBREAKING CARBON-FREE AUV RESIDENCY SOLUTION

Ocean Power Technologies, Inc. is working on a groundbreaking solution for carbon-free subsea autonomous underwater vehicle (AUV) residency – long-term, persistent deployment without support from manned vessels – with joint development partners Modus Seabed Intervention and Saab Seaeye.

"We believe a self-contained system powered by an OPT PowerBuoy® and exempt from existing ocean infrastructure has the potential to revolutionize the industrial use of AUVs and make long-term residency a cost-effective reality," said George Kirby, OPT President and Chief Executive Officer. "Modus Seabed Intervention's experience with advanced technology development efforts in subsea docking with Saab Seaeye's

market-leading hybrid AUV (HAUV) enables autonomous offshore operations and we believe it is a natural fit for our environmentally sound PowerBuoy® ocean power and communications technology," Kirby added. "We're looking forward to working together to further support the growing offshore electrification market."

Remote operation without the need for surface vessel support or complex power and data umbilical cable systems to offshore platforms or land has the potential to offer tremendous savings over operations that would otherwise require manned vessels – including long-term environmental monitoring, frequent subsea equipment integrity inspections, and interaction with seafloor assets.

This novel system is designed for carbon-free autonomous offshore operations with the OPT PowerBuoy® power and communications platform at its core. Via an innovative integrated mooring and subsea power/data transmission cable, a PowerBuoy® can provide carbon-free power to a seabed docking station to recharge an autonomous underwater vehicle while enabling secure data transmission to and from shore-based operations located anywhere in the world.

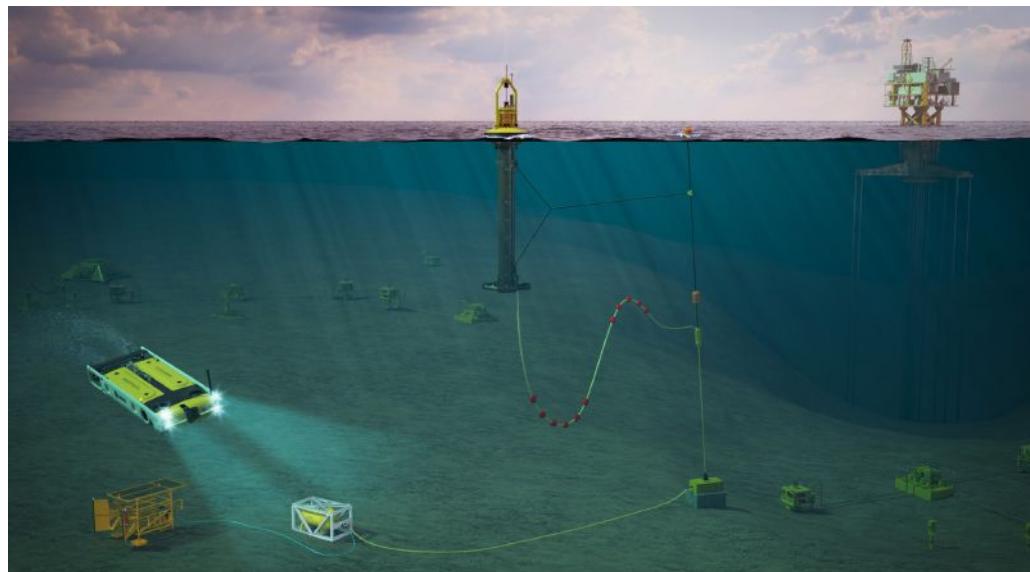
The autonomous resident AUV system concept has been jointly submitted for U.S. government development and demonstration project funding consideration.

The ongoing electrification of offshore applications finds underwater vehicles increasingly utilized for defense and security surveillance, as well as for seafloor mapping and asset maintenance in oil and gas, as well as science and research. Increasing the length and variety of missions an AUV can undertake can

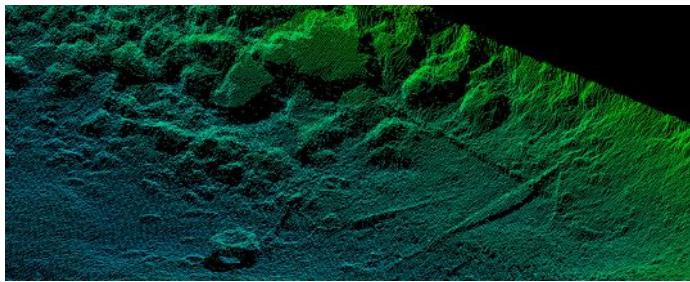
drive down costs and risks, and true autonomous control with access to data in real time is a goal for operators. An autonomously powered interactive docking station independent of traditional infrastructure offers efficiency in routine operations and facilitates timely response to ad hoc events (extreme weather, subsea equipment failure) more rapidly than possible with surface-based vessels.

It is believed that the OPT/Modus/Saab AUV residency system will boast substantial environmental, risk, safety, and cost benefits over incumbent fossil-fuel powered solutions. This system is novel because it's truly autonomous. Removing vessels and umbilical links to fossil fuel generation drops carbon emissions and relocates personnel onshore, cutting risk and costs while increasing safety.

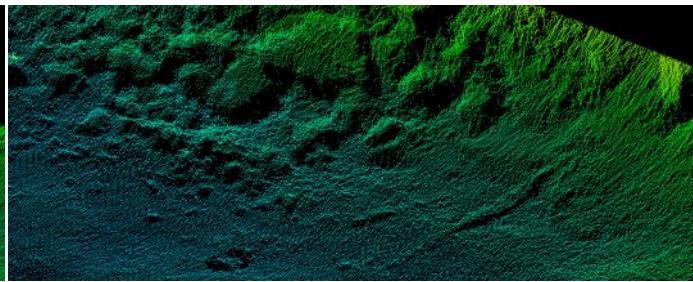
www.oceanpowertechnologies.com



» Ocean Power Technologies' PB3 PowerBuoy® wave energy converter is pictured with innovative single point mooring integrating power and data transmission connected to a subsea battery solution and autonomous underwater vehicle (AUV) charging station. Developed with Modus Seabed Intervention utilizing a Saab Seaeye Sabertooth AUV, the concept has been submitted for U.S. government development and demonstration project funding consideration.



» A 600kHz, 100-degree scan from the EM2040



» A 300kHz, 100-degree scan from the EM2040.

NEW FEATURES RELEASED ON KONGSBERG EM 2040 MKII MULTIBEAM ECHOSOUNDER

Kongsberg Maritime has released two new state-of-the-art features on its market-leading EM 2040 MKII multibeam echosounder. The first enables the use of dual high frequencies to survey wide swaths of the seabed at much higher resolutions than before, while the second facilitates simultaneous collection of backscatter data using multiple frequencies. These cutting-edge functionalities constitute a significant upgrade to the current system, which already offers outstanding range and resolution.

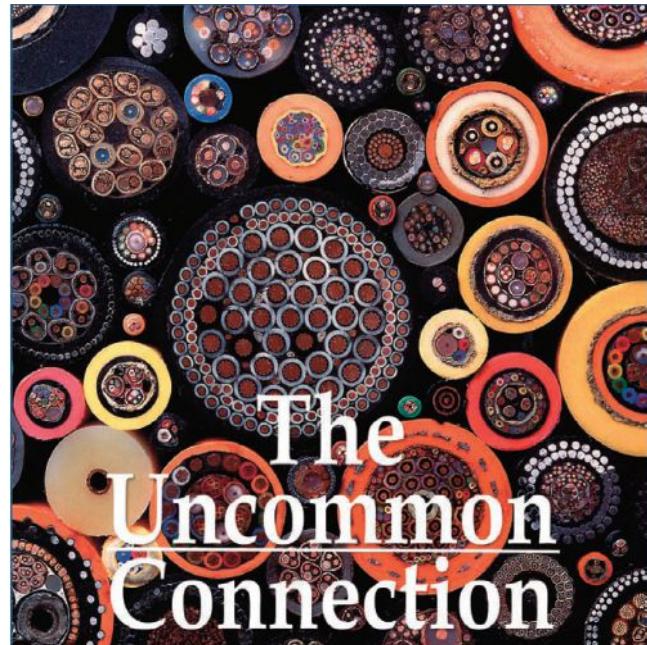
The EM 2040 MKII is a broadband multibeam echosounder system, which uses frequencies from 200kHz to 400kHz to yield a wide swath of up to 170 degrees. With the new high frequency feature, the EM 2040 MK II will additionally employ 600kHz and 700kHz frequencies to give enhanced detail over a swath of up to 120 degrees. This will enable the user to carry out bathymetric survey, inspection and wreck mapping at the highest resolution possible today. Seabed classification will also be more accurate due to the added ability to simultaneously collect backscatter data at multiple frequencies – an enhancement of the single-frequency facility standard to all EM systems.

As part of a new EM technology platform designed for future challenges, the EM 2040 is compatible with a new KONGSBERG-developed datagram format, which supports several new features such as extended backscatter calibration, with more features already in development. The new format is supported by Kognifai, KONGSBERG's open digital ecosystem which brings opportunities to transform survey operations through digitalization.

"The EM 2040 provides state-of-the-art survey vessel operators with the highest performance, most accurate mapping capability available on the market today. For existing EM 2040 MKI systems an upgrade path will be offered, while for EM 2040 MKII users the new features will be offered just as a software upgrade," says Helge Uhlen, Vice President Kongsberg Maritime Sales.

The EM 2040 mapping system takes advantage of features and benefits achieved in the development of the EM family of multibeam echosounders: EM 712, EM 304 and EM 124. It joins Kongsberg Maritime's unmatched range of leading Multibeam Echo Sounder Systems, from very shallow water to full ocean depth, all with proven superior performance and reliability.

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GLOBAL OFFSHORE AWARDED CONTRACT FOR KINCARDINE OFFSHORE WIND FARM



Global Offshore, a leading provider of cable installation, repair and trenching services to the offshore renewables, utilities and oil & gas markets and part of the Global Marine Group, has announced the contract award for cable installation and burial at the Kincardine Floating Offshore Wind Farm for Spanish developer and construction company Grupo Cobra.

Utilizing specialist cable installation vessel, the Normand Clipper, the latest addition to their fleet, Global Offshore will install one export and five inter array cables at the site, totaling 30.3 km. The project will commence in the spring with boulder clearance and route preparation

work utilizing a pre-lay plough, ideally suited to the varying seabed conditions expected in and around the wind farm location. Installation works will include the use of a dynamic riser to allow for movement of the platform, an engineering solution unique to this emerging floating sub-sector of offshore wind. Following the cable installation, remedial burial will be completed on parts of the route by a jet trencher to ensure the long-term safety of the cable.

Mr. Mike Daniel, Managing Director of Global Offshore commented, "We're pleased to be working with Grupo Cobra on this project, located just on the

doorstep of our Head Office in Aberdeen. We are taking our extensive experience in installing dynamic umbilicals and flexibles in offshore oil and gas, and applying it to cable installation in the emerging floating wind farm sector, a growth area of offshore renewables. Utilizing multiple assets from across the Group to deliver this project showcases the complete cable installation solution that we're able to offer to our customers."

For more information, visit
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NAVY SETS COURSE FOR INSTALLATION RESILIENCE WITH NEW ENERGY STRATEGY



» Assistant Secretary of the Navy for Energy, Installations and Environment Lucian Niemeyer, far right, discusses the "Installation Energy Resilience Strategy" document with his staff. The strategy directs the Department of the Navy (DON) to increase mission capability by integrating a higher degree of energy security through reliability, resilience, and efficiency consistent with the DON's energy security framework. Photo credit: Mass Communication Specialist 1st Class Paul L. Archer, U.S. Navy.

The Department of Navy (DON) has published their new installation energy strategy focused on the delivery of uninterrupted, reliable and high-quality power necessary to meet evolving mission requirements as defined in the National Defense Strategy. The strategy was signed by Acting Secretary of the Navy, The Honorable Thomas Modly on 28 February 2020 and reflects the DON's emphasis on addressing energy gaps impacting warfighter readiness using all methods of power generation.

The Installation Energy Resilience Strategy recognizes Navy and Marine Corps shore infrastructure as critical for generating, sustaining and deploying tactical assets. The strategy directs the DON to increase mission capability by integrating a higher degree of energy security through reliability, resilience, and efficiency consistent with the DON's Energy Security Framework.

"With the guidance, priorities, and metrics in this energy plan, we can focus command attention and scarce resources at every

level to deliver substantive results for the enhanced readiness and resilience of our forces," Modly said.

Naval readiness is threatened by aging energy infrastructure: generation, distribution, and back-up systems are degrading the ability of shipyards, piers, maintenance facilities, armories, magazines, training ranges, simulators, weapons systems, and shore-based communications to meet mission readiness.

"This strategy is a major step forward for the Department as we acknowledge the reality that future combat systems will need more power of higher quality and greater resiliency," said Acting Assistant Secretary of the Navy for Energy, Installations, and Environment, The Honorable Lucian Niemeyer. He went on to say "It starts with individual efforts to identify mission essential shore assets that must continue to operate in the event of a power outage. Then, we must develop installation energy plans to provide a long-term strategy for investments and

projects to meet our resilience goals."

The strategy provides resources for Navy commanders and energy managers at all levels within the DON. The document includes case studies of successful energy resilience projects at Marine Corps Air Station Miramar and Naval Support Activity Guantanamo Bay, Cuba; a guidebook on Congressional authorities enabling industry and community partnerships on energy projects; as well as a compilation of Department of Defense (DOD) and Federal resources and references.

"This strategy is a call to action to urgently implement resiliency and protections for our critical systems needed to defend our nation, if we are successful in strengthening our energy infrastructure, our adversaries will not find success in deterring our resolve" said Niemeyer.

The Installation Energy Resilience Strategy can be downloaded at: www.secnav.navy.mil/eie/Documents/DON-Installation-Energy-Resilience-Strategy.pdf

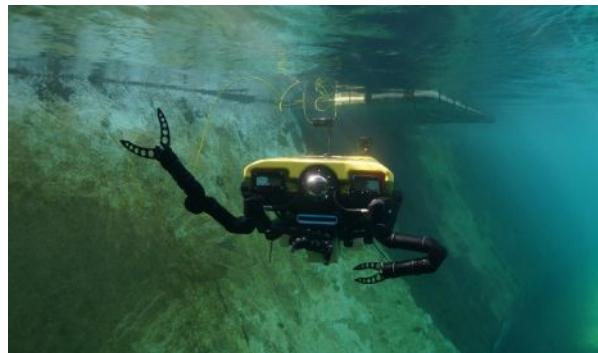
BLUEPRINT LAB AND VIDEORAY IN PARTNERSHIP FOR NEW EOD TOOL FOR US NAVY

Blueprint Lab and VideoRay LLC have jointly announced a new partnership to further integrate and field Blueprint Lab's Reach Alpha, the world's smallest, lightest, subsea manipulator system. A key application of this technology is rendering safe underwater mines on ships, shipping lanes, ports, and offshore infrastructure.

Blueprint Lab, with headquarters in Sydney, Australia, specializes in lightweight robotic arms for remotely operated vehicles (ROVs). The company develops systems for the military, oil and gas, and scientific communities. The Reach Alpha is a field-proven manipulator. Since it is highly modular and configurable, with 3-, 4- and 5-function versions available, it is well suited to the difficult and challenging tasks involved in underwater mine countermeasures.

VideoRay LLC, with headquarters in Pottstown, Pa., is a global leader in the field of ROVs used for observation and inspection. VideoRay has been awarded a contract by the Defense Innovation Unit to develop the Navy's next generation EOD response vehicle. Since 1999, VideoRay has been designing, manufacturing, and marketing ROVs to transform the way people work underwater.

The partnership between VideoRay and Blueprint Lab will further their close



collaboration with the U.S. and other allied navies in the iterative process of refining tools, techniques, and mission planning to keep our forces safe and effective in the evolving technology of undersea warfare.

VideoRay and Blueprint Lab are working under the VideoRay Integrator program, which empowers partners to develop and customize Mission Specialist technology to meet specific customer missions.

Anders Ridley-Smith, Business Development Manager of Blueprint Lab, is excited about the opportunity. "Blueprint Lab has worked incredibly hard to develop robotic arms that are robust, dexterous, and intuitive to use. We're excited to bring these to the Navy through collaboration with VideoRay. Their ROV platform provides an advanced, powerful delivery system to bring our manipulators to bear on the threat environment and we look forward to pushing the boundaries of what's possible underwater."

"We're very excited about this collaboration, and what it means in extending the state of the art in EOD response underwater," said Scott Bentley, CEO of VideoRay. "The combination of the best underwater vehicle technology – our power, flexibility, and precise underwater navigation, and Blueprint Lab manipulator capabilities in dexterity, durability, and operator interface – are providing the best tool for our warfighters by far."

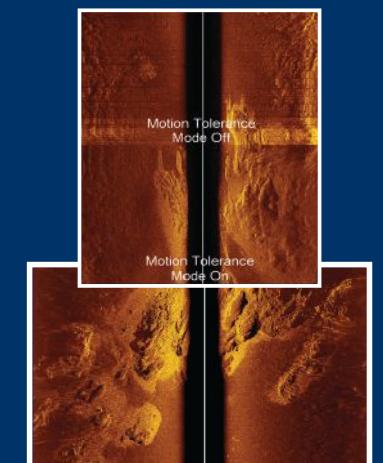
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DAMEN COMPLETES COMBAT SYSTEMS INSTALLATION ON GUIDED MISSILE FRIGATE

Damen Shipyards Group and its partner PT PAL recently completed installation and testing of combat systems to the second of the Indonesian Ministry of Defense's SIGMA 10514 Perusak Kawal Rudal (PKR) guided missile frigates, the KRI Gusti Ngurah Rai (332).

The PKR frigates are constructed via a modular process operating simultaneously at Damen Schelde Naval Shipbuilding (DSNS) in the Netherlands and the PT PAL shipyard in Indonesia. In this manner, Damen is able to build high quality vessels anywhere in the world. This method also enables Damen to fulfil its commitment to the Indonesian Ministry of Defence to deliver an extensive knowledge and transfer of technology (ToT) program. A significant part of this transfer program is the installation of combat systems along with provision of training to the crew in their usage and maintenance.

Hein van Ameijden, managing director of DSNS, said, "From the outset of this project DSNS and our partner Thales Netherlands have been fully committed to the development of the Indonesian defense industry and its supporting sectors. This commitment is demonstrated with a series of ToT and local content programmes starting in 2013 when project execution commenced.

"For example, DSNS has trained and educated more than 328-yard personnel, including welders, planners and engineers, during the project. Thales Netherlands has contributed by subcontracting local industry for software development, providing support, ultimately, for Indonesia to develop an indigenous combat management system."

The combat systems installed and tested include:

- VL MICA for defense from airborne threats
- Exocet for defense from offensive targets at greater distance
- Torpedo system for protection against submarine threat
- 35 mm rapid-fire cannon to respond to threats from both air and sea
- Electronic detection system to divert enemy attacks with electromagnetic redirection
- Modification of the computer operated operational system in order to operate the above



The final phase prior to handover was successfully completed on February 21st with sea-going trials – the sea acceptance test (SAT). The purpose of this was to demonstrate that installations throughout the entire chain of weapons systems meet desired efficiency and accuracy.

"All our prior efforts paid off. Already at the start of the tests it was clear that installation had been carried out with great precision during construction and that preparatory alignment activities and agreements had been carefully followed. The second PKR vessel achieved similar results to the first one. This demonstrates that the complete concept implemented in the SIGMA PKR Class can be considered reliable and robust", concluded Mr. Van Ameijden.

For more information, visit
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N-SEA AWARDED DEFENSE CONTRACT BY ROYAL NETHERLANDS NAVY

Leading subsea solutions integrator, N-Sea, has announced the commencement of a five-year contract with the Royal Netherlands Navy. The contract, which includes two year-long extension options, will see N-Sea operate the multipurpose support vessel, Geosea, which arrived at the naval base at Den Helder (Netherlands) on 4 March 2020.

The Geosea is a modern DP2 Multipurpose Support Vessel designed for safe and efficient offshore operations. N-Sea's workscope throughout the charter will utilize the vessel as a facilitating platform for mine countermeasure activity, development and training in advance of the Navy's implementation of new-build, minehunter class vessels.

Arno van Poppel, N-Sea CEO commented, "Signed only three weeks ago, implementation of the contract began with immediate effect. During this short time frame, we have transported the Geosea from the Gulf of Mexico, performed a full inspection and maintenance, as well as assigning the vessel to the Dutch flag and adding the home port of Den Helder to the stern.



» Geosea coming into Port of Den Helder. Image courtesy of N-Sea.

"N-Sea is exceptionally proud to play such a significant part in this pioneering journey for the Royal Netherlands Navy, and our commitment to the campaign has been clearly reflected by the impressive start made by our team."

The N-Sea Group consists of the entities N-Sea Offshore and N-Sea Survey. N-Sea headquarters is located in The Netherlands.

WWW.N-SEA.COM



The Republic of Korea (ROK) Navy has renewed its annual contract with eMARINE to maintain the electronic charts display and information systems (ECDIS) onboard 225 naval ships. The contract is valued at \$1.9 million (2.4 billion Won).

"We have a remarkable record of providing excellent and professional service to our customers, and this latest renewal from the ROK Navy further strengthens that record," stated Ung Gyu Kim, Chairman and CEO of eMARINE Global. "We were also recently awarded a contract renewal for the annual maintenance of the ROK

eMARINE GLOBAL AWARDED \$1.9 MILLION ECDIS MAINTENANCE CONTRACT FROM KOREAN NAVY

Navy's anti-submarine warfare team trainer (ASWTT), a project we helped to install and have maintained over the last three years."

Overall, eMarine has been providing maintenance work on an annual contract basis for the ROK Navy since 2007, when the company's navigation technology was first installed. Since then, the volume or work and budget have increased each year. Today, eMarine's ECDIS technology is the primary navigation solution used by the ROK Navy fleet.

The ROK Navy increased the budget and number of ships serviced under the maintenance contract over the prior year's contract.

Founded in 2001 and based in South Korea, eMARINE Global is working with a growing base of marquee customers to

achieve maritime ICT convergence through fully integrated products and services, offering state-of-the-art e-navigation, marine Internet of Things (IoT), and marine big data solutions, primarily in Korea with near-term expansion into U.S. and Chinese markets.

For more information, visit
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USNS COMFORT ARRIVES IN NYC, USNS MERCY ACCEPTS PATIENTS IN LA



» Military Sealift Command hospital ship USNS Mercy (T-AH 19) arrives in Los Angeles, March 27. The hospital ship USNS Mercy (T-AH 19) deployed in support of the nation's COVID-19 response efforts, and will serve as a referral hospital for non-COVID-19 patients currently admitted to shore-based hospitals. This allows shore base hospitals to focus their efforts on COVID-19 cases. One of the Department of Defense's missions is Defense Support of Civil Authorities. DoD is supporting the Federal Emergency Management Agency, the lead federal agency, as well as state, local and public health authorities in helping protect the health and safety of the American people. Photo credit: Mass Communication Specialist 1st Class David Mora Jr., U.S. Navy.

The Military Sealift Command hospital ship USNS Comfort (T-AH 20) arrived in New York on March 30, 2020 in support of the nation's COVID-19 response efforts.

While in New York, the ship will serve as a referral hospital for non-COVID-19 patients currently admitted to shore-based hospitals, and will provide a full spectrum of medical care to include general surgeries, critical care and ward care for adults. This will allow local health professionals to focus on treating COVID-19 patients and for shore-based hospitals to use their Intensive Care Units and ventilators for those patients.

Comfort is a seagoing medical treatment facility that currently has more than 1,200

personnel embarked for the New York mission including Navy medical and support staff assembled from 22 commands, as well as over 70 civil service mariners.

"The USNS Comfort arrives in New York City this morning with more than 1,100 medical personnel who are ready to provide safe, high-quality health care to non-COVID patients," said Capt. Patrick Amersbach, commanding officer of the USNS Comfort Military Treatment Facility. "We are ready and grateful to serve the needs of our nation."

Comfort's primary mission is to provide an afloat, mobile, acute surgical medical facility to the U.S. military that is flexible, capable and uniquely adaptable to

support expeditionary warfare. Comfort's secondary mission is to provide full hospital services to support U.S. disaster relief and humanitarian operations worldwide.

"Like her sister ship, USNS Mercy (T-AH 19), which recently moored in Los Angeles, this great ship will support civil authorities by increasing medical capacity and collaboration for medical assistance," said Rear Adm. John Mustin, vice commander, U.S. Fleet Forces Command. "Not treating COVID-19 patients... but by acting as a relief valve for other urgent needs, freeing New York's hospitals and medical professionals to focus on the pandemic."

"This USNS *Comfort* team of Sailors, Marines and Civilian Mariners came together during the transit to New York City and our medical professionals are ready to begin receiving patients from local hospitals tomorrow," said Capt. Joseph O'Brien, mission commander of Task Force New York City. "Our personnel are our strength—the men and women of our military services accomplish incredible things every day, and I am confident in their abilities as we start the next phase of this mission."

The ship expects to begin receiving patients 24 hours after arriving in New York City. All patient transfers will be coordinated with local hospitals, thus ensuring a consistent handoff of care between medical providers. Patients will not be accepted on a walk-on basis, and should not come to the pier with any expectation that they can receive care.

"The last time that this great hospital ship was here was in the wake of 9-11, where she served as respite and comfort for our first responders working around the clock," said Mustin. "Our message to New Yorkers —now your Navy has returned, and we are with you, committed in this fight."

The U.S. Coast Guard is providing a security escort of USNS *Comfort* into New York Harbor, comprised of crews and assets from around the region to include the Coast Guard Cutter *Shrike*, Coast

Guard Cutter *Sitkinak*, Maritime Safety and Security Team New York, Coast Guard Station New York, and Coast Guard Air Station Cape Cod.

U.S. 2nd Fleet exercises operational authorities over assigned ships, aircraft, and landing forces on the East Coast and the Atlantic.

USNS Mercy Accepts its First Patients in Los Angeles

The hospital ship USNS *Mercy* (T-AH 19) accepted its first patients in Los Angeles on March 29 during its support of the nation's COVID-19 response efforts.

"I couldn't be more proud of our crew for all the hard work they did to get us here and ready in such a short time," said Capt. John Rotruck, *Mercy*'s Military Treatment Facility commanding officer. "Being able to accept our first patients is a true testament of the teamwork between *Mercy*, the Navy, the State of California, the county of Los Angeles, and the City and Port of L.A."

While in Los Angeles, the ship will serve as a referral hospital for non-COVID-19 patients currently admitted to shore-based hospitals, and will provide a full spectrum of medical care to include

general surgeries, critical care and ward care for adults. This will allow local health professionals to focus on treating COVID-19 patients and for shore-based hospitals to use their Intensive Care Units and ventilators for those patients.

"The men and women embarked on board *Mercy* are energized, eager, and ready to provide relief to those in need," said Rotruck.

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Mercy's primary mission is to provide an afloat, mobile, acute surgical medical facility to the U.S. military that is flexible, capable, and uniquely adaptable to support expeditionary warfare. *Mercy*'s secondary mission is to provide full hospital services to support U.S. disaster relief and humanitarian operations worldwide.

U.S. 3rd Fleet is operating as the Maritime Command Element, West, for U.S. Naval Forces Northern Command (NAVNORTH), under U.S. Northern Command for Defense Support of Civil Authorities in support of the Federal Emergency Management Agency, the lead agency.



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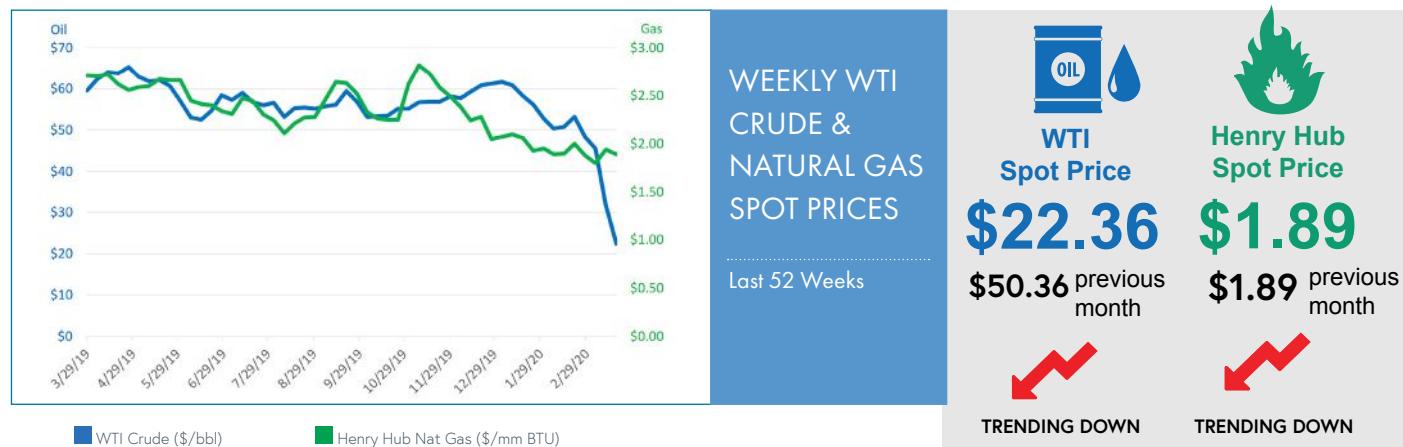
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CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF MARCH 13, 2020

Oil prices continued to take a hit, dropping below the \$23-per-barrel mark. The U.S. Energy Information Administration (EIA) attributed the drop to Coronavirus concerns and the failure of the Organization of the Petroleum Exporting Countries (OPEC) and partners to reach an agreement to continue crude oil production cuts. The WTI Spot Price per barrel was at \$22.36 on March 20, 2020. To put that in perspective, the WTI was above \$61.00 per barrel at the start of the year.



KEY EQUITY Indexes

PRICES IN US DOLLARS AS OF MARCH 30, 2020

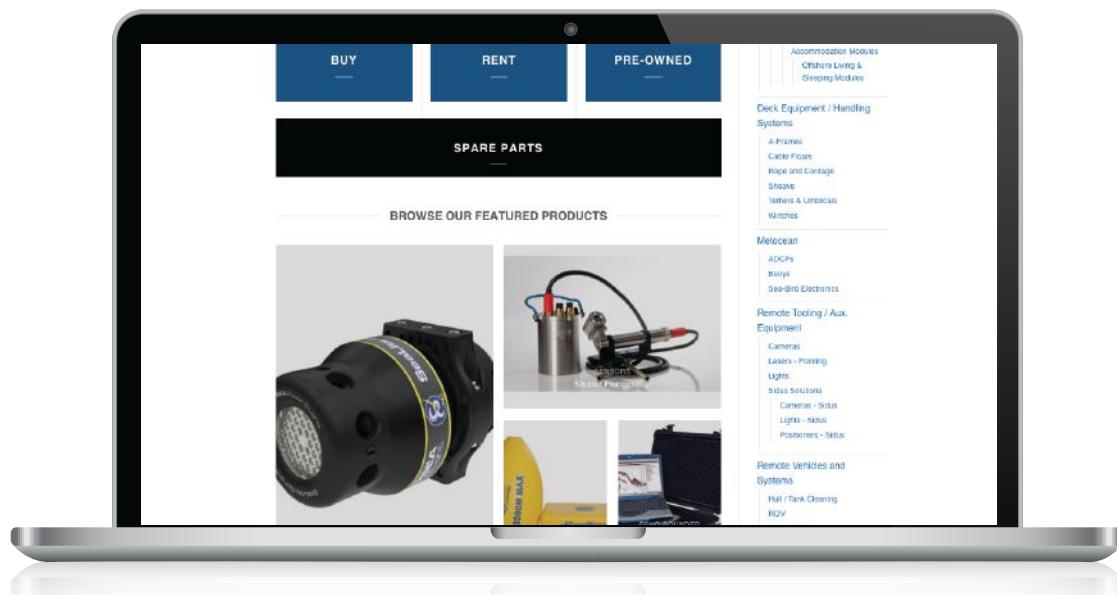
EQUITY INDEXES CONTINUED to show volatility in the past month

As is widely known, equity indexes suffered some of the biggest drops in history in the past month. The Dow Jones Industrial Average (DJIA) closed at 29,348.03 on February 17. It then dropped more than 9,000 points and closed at just below 20,000 points on March 16. It has since rallied and closed above 22,300 points on March 30. The S&P500 saw a similar pattern, peaking from nearly 3,400 points on February 17 to below 2,400 points on March 16, finally rebounding to above the 2,600-point mark on March 30. The losses were driven by concerns over the Coronavirus and ongoing uncertainty about its impact on the global economy, while the \$2 trillion relief bill passed by Congress on March 25 helped fuel the rally.

After a period of relative stability, the Philadelphia Oil Services Index (OSX) suffered greatly in the past month from a combination of Coronavirus concerns and low oil prices. The OSX dropped by more than half between February 17 and March 16 from just over 64 points to less than 24 points, before rebounding slightly to close at 24.19 points on March 30.

SELECTED EQUITY INDEXES





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WILDCARDS CONTINUE DOMINATING COMMODITY MARKETS

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

Crude Oil:

The challenge of writing a commodity market column that won't be read for a few weeks means unforeseen events – even ones considered – can upset conclusions. Our March column touched on the Covid-19 virus and its impact on Chinese and global oil demand. We even previewed OPEC's recommendation for additional output cuts to help counter the drop in oil use. The recommended output cut was anticipated being embraced at the early March OPEC-plus meetings and would forestall an oil price collapse. Our assumptions proved wrong and oil prices fell 53 percent in the 10 trading days following the failed OPEC-plus meetings!

While a disagreement over the magnitude of the OPEC-plus output cut increase was a distinct possibility, no one envisioned the disagreement leading to an all-out oil war between Russia and Saudi Arabia, two of the world's largest oil producers. Saudi Arabia aggressively moved to cut export prices – especially for its Asian customers who Russia was targeting – and boost production to record levels. This appeared to be a "scorched earth" strategy, designed to teach everyone, especially Russia, to not "mess" with Saudi Arabia.

On April 1st, Russia will restore its 280,000 barrels a day output cut, but whether it can add an additional 500,000 b/d, as announced, remains questionable due to logistical challenges. In the meantime, Saudi Arabia instructed Aramco to ramp up production capacity to 13 million barrels a day, and immediately boost shipments by 2.5 mmb/d to 12.4 mmb/d. This incremental supply, combined with continued growth in U.S. shale oil output, guarantees the world will be over-supplied with oil at a time demand is collapsing, as the world deals with the economic impact of Covid-19.

Estimates call for oil demand to drop by 10-14 mmb/d in April, ensuring storage tanks around the world will be overflowing. Even with adding tankers, such as Saudi Arabia's recent contracting of 31 VLCCs, storage will be overwhelmed, pushing oil prices lower. With demand down and growing numbers of mandatory "shelter-in-place" orders shutting down not only cities but even countries such as Italy, Spain and India, refiners will take less oil despite sharply lower prices. The industry's low-oil price playbook, which calls for ramping up refining as consumers respond to lower pump prices by increasing fuel consumption, will not work this time.

The combination of a demand shock from the virus and a supply shock from an oil-war presents a unique challenge for oil companies. Can the oil-warring parties reach an agreement to cut output? Not likely, at least anytime soon. Will we see a peaking in the virus spread, and then be able to predict when economies will restart? Possibly, but the timing is uncertain. Therefore, market conditions will weigh on oil prices. They likely go lower before rallying. Don't expect a meaningful oil price recovery, however, until future supply/demand dynamics become clearer.

Natural Gas:

The one fuel seemingly benefiting from the market's response to Covid-19 virus and the outbreak of an oil war is natural gas. One wonders why? Especially when we focus on the calendar's transition from late winter into early spring. It means cold weather becomes less of a gas demand driver, although often there is one last winter blast before the trees and flowers fully bloom.

With oil demand collapsing and prices in freefall, U.S. shale producers are slashing capital spending. Drilling activity is dropping and high-cost shale wells are being postponed. Fewer new wells plus rapid declines in oil shale well output means less associated natural gas will soon be flowing. An offset is that Permian Basin shale wells see more gas flowing as oil output declines. Overall, though, natural gas output will slow and eventually decline.

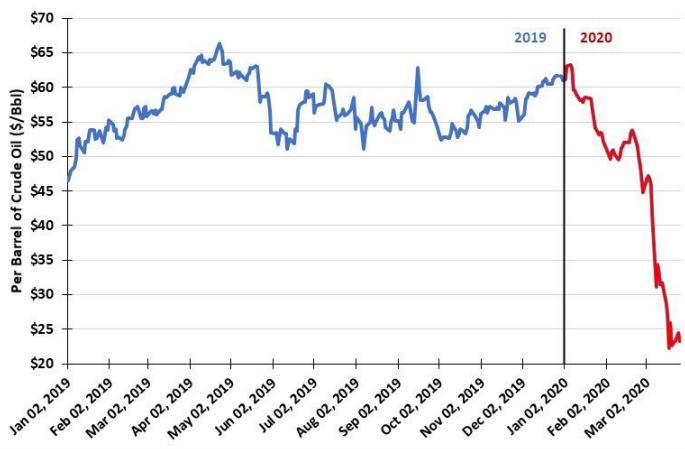
In the near-term, with gas supply growth slowing, natural gas prices will depend increasingly on demand factors – principally non-weather ones. That means natural gas for powering electricity generators, as well as for export either via pipelines to Mexico or as LNG to world markets. Low prices are boosting the global competitive position for U.S. natural gas.

Gas consumption for power generation was substantially above last year through the middle of March, and projections call for it to remain higher through the balance of the month. The reason for the elevated level is the increased shutdowns of nuclear power plants for maintenance. So far this year, nuclear plant shutdowns have been above the 5-year average and the shutdowns of last year. Natural gas generated power offsets that electricity loss.

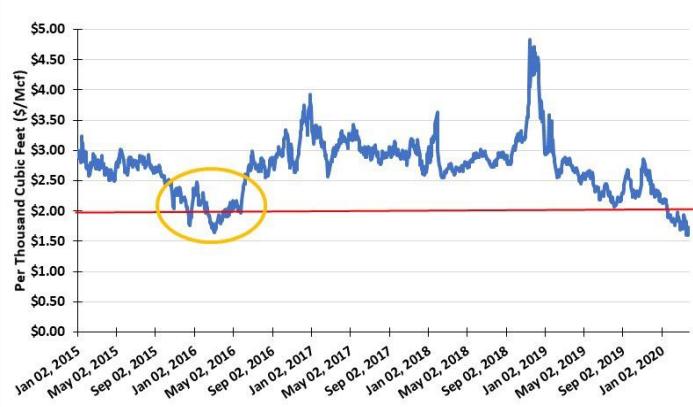
An important driver for gas demand is coming from the LNG business, as volumes shipped in March will substantially exceed those moved last year. That largely reflects the additional LNG export capacity that began operating during the past 12 months. Shipping data shows 14 LNG cargoes will move from Coast export terminals during March. That good news, however, is offset by the announcement of two cargoes from Chenier's Sabine Pass terminal being rejected by buyers. Cheniere's high financial leverage, the inability recently to secure a long-term LNG deal with India, and the current market turmoil has forced the company to lay off a substantial number of employees and reduce executive compensation. Is bankruptcy in its future?

The last time natural gas prices traded below \$2 per thousand cubic feet was in 2016, when oil prices were also diving. Market conditions eventually pushed the price back above \$3.50. Traders believe the current oil market debacle will restrict gas supply growth, and as demand picks up, gas prices will rise. We could be surprised how far they climb. If it happens, producers will smile, but not consumers.

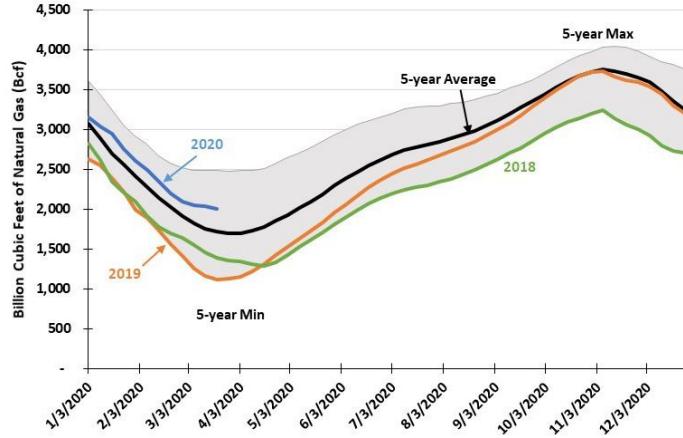
2020 Oil Price
Roller Coaster -
Poised for Lower?



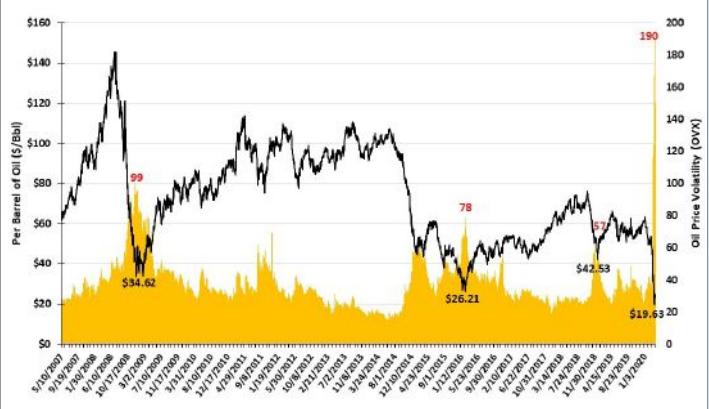
2016 Was Last Time
Gas Prices Below
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event.asme.org/OMAE

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Providence, RI » August 18-21
www.offshorewindus.org/2020ipf

Financing Wind North America

Boston, MA » September 2-3
northamerica.financingwind.com

Teledyne Marine Users' Conference Canada

Halifax, Canada » September 28-29
www.teledynemarine.com/events/Teledyne-Marine-Users-Conference-Canada/

OilComm

Houston, TX » October 14-15
www.oilcomm.com

OCEANS'20 Gulf Coast

Biloxi, MS » October 19-22
gulfcoast20.oceansconference.org

Clean Gulf

San Antonio, TX » October 20-22
www.cleangulf.org



EUROPE

MCE Deepwater Development

London, UK » June 15-17
www.mcedd.com

UTC

Bergen, Norway » June 16-18
www.utc.no

Seanergy

Nantes, Saint-Nazaire, France
 » June 30 - July 3
www.seanergy-forum.com

Deep Sea Mining Summit

London, UK » August 18-19
www.deepsea-mining-summit.com

Offshore Northern Seas

Stavanger, Norway » Aug 31 - Sept 3
www.ons.no

All-Energy

Glasgow, UK » September 14-15
www.all-energy.co.uk

WindEnergy Hamburg

Hamburg, Germany
 » September 22-25
www.windenergyhamburg.com/en

Int'l Naval Engineering Conference

Delft, The Netherlands » October 6-8
www.imarest.org/events/inec-2020

Offshore Energy

Amsterdam, The Netherlands
 » October 26-28
www.offshore-energy.biz

UDT

Rotterdam Ahoy, NL » December 8-10
www.udt-global.com



OTHER REGIONS

Offshore Well Intervention APAC

Kuala Lumpur, Malaysia » June 2-3
www.interventionasiapac.offsnetsevents.com

PHILMARINE

Manila, Philippines » June 16-18
www.philmarine.com

Telecoms World Asia

Bangkok, Thailand » July 21-22
www.terrapinn.com/conference/telecoms-world-asia

Oceanology Int'l Middle East

Abu Dhabi » September 7-9
oceanologyinternationalmiddleeast.com

Telecoms World Middle East

Dubai » September 7-8
www.terrapinn.com/conference/telecoms-world-middle-east

Submarine Networks World

Singapore » September 23-24
www.terrapinn.com/conference/submarine-networks-world

Mediterranean Offshore Conference

Alexandria, Egypt » October 13-15
www.moc-egypt.com

ADIPEC

Abu Dhabi » November 9-12
www.adippec.com

MAST Asia

Tokyo, Japan » November 9-11
www.mastconfex.com/asia2020

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SONARDYNE APPOINTS NEW MANAGING DIRECTOR



» Sonardyne has announced Graham Brown as its new Managing Director

Leading marine technology provider Sonardyne International Ltd. has announced Graham Brown as its new Managing Director. Graham, who takes over the role from John Ramsden on 1 April 2020, has served on Sonardyne International's board from 2008, most recently as Sales and Marketing Director and Deputy Managing Director.

John, who has been Sonardyne International's Managing Director since 2009, is staying within the Sonardyne family, taking the role of CEO of Sonardyne Group, the newly formed parent company of Sonardyne International and its sister companies; Chelsea Technologies, EIVA, Wavefront and 2G Robotics.

DAMEN SHIPYARDS GROUP APPOINTS MARC VAN HEYNINGEN AS NEW COO

As of 1 April 2020, Marc van Heyningen will become the new Chief Operations Officer (COO) of Damen Shipyards Group. This completes the Executive Board of the leading Dutch maritime solutions provider.

"We warmly welcome Marc on board," said CEO Arnout Damen. "With his experience and background, he is certainly able to take operational excellence within our company to an even higher level."

Marc is a MSc in Civil Structural Engineering at Delft University and has spent the vast majority of his career working for Fluor Corporation in various general and operations management positions in, for example, The Netherlands, The UK, India and the USA. His last role was Vice President of Operations based in Fluor Company Headquarters in Dallas, Texas. "I very much look forward to joining the Damen team and working to strengthen project execution and quality of delivery."

Mr. Van Heyningen is the successor to Jan-Wim Dekker, who started as Chief Commercial Officer on 1 January. In addition to Mr. Damen, Mr. Dekker and Mr. Van Heyningen, Andreas Fluhrer (Chief Transformation Officer), Tom Touber (Chief Financial Officer) complete the board. www.damen.com

"This is an exciting time for Sonardyne International," says Graham. "Looking beyond the current, uniquely challenging business climate, we'll continue to grow organically, in terms of our people, our technology offering and the global markets which we support - while upholding the service and support that we're renowned for. But we're now part of a wider group of companies, with access to a considerably enlarged portfolio of products and services that complement our own seabed-to-shore systems. We expect this to deliver significant operational benefits for our customers across the global energy, ocean science, civil and defense markets."

"Next year will be Sonardyne's 50th year in business and I'm proud to have played a significant role in the success of the company over the last two decades," says John. "As we look forward to celebrating that half century milestone with Graham at the helm, our collective sights are focussed on the direction we're headed in at the start of our second half century. As CEO of Sonardyne Group, I'm excited at the prospect of working with Graham and his counterparts across our business to support those who measure, navigate, communicate or explore the world's waters and oceans, safely, responsibly and more efficiently than ever before."

Mr. Brown is an Electromechanical Engineer by background with a first-class degree and Ph.D. He is also a Chartered Engineer, a Fellow of the Institute of Directors (IoD), a Fellow of the Institute of Marine Engineering Science and Technology (IMarEST), and a member of the Society for Underwater Technology (SUT). He contributes to a number of industry groups such as the Southern Region Council of the Energy Industries Council (EIC). www.sonardyne.com



» Marc van Heyningen, Chief Operations Officer (COO) of Damen Shipyards Group

FUGRO WINNER IN FLOATING WIND TECHNOLOGY ACCELERATION COMPETITION

Fugro, in a consortium with AS Mosley and the PeriDynamics Research Centre at University of Strathclyde, has been announced as one of eight winners of the Carbon Trust's Floating Wind Technology Acceleration Competition. The eight winning innovations will receive a share of £ 1 million prize fund from the Scottish Government, and the opportunity to consult on their innovations with the 14 leading offshore wind developers represented on the Floating Wind Joint Industry Project (JIP), which is managed by the Carbon Trust.

The competition was designed to address four key industry challenge areas identified in Phase One of the Carbon Trust's Floating Wind JIP: monitoring and inspection, mooring systems, heavy lift maintenance, and tow-to-port maintenance.

Fugro's objective, as with the objectives of all partners in the consortium, is to develop cost-effective condition monitoring software that characterizes the condition of mooring lines of floating wind turbine assets in respect of wear, corrosion and fatigue. Reducing and/or eliminating the requirement for visual

inspection by remotely operated vehicles and divers will reduce costs and offshore health and safety exposure.

Fugro project manager Dr. Stuart Killbourn said, "We are looking forward to developing a transformative condition monitoring software package for floating structure mooring lines, which will significantly reduce the need for personnel and vessel activities offshore. This is a key enabler towards the deployment of floating wind turbines in Scottish waters and the generation of clean renewable energy to meet the nation's needs." www.fugro.com



» Fugro and partners' winning innovation will develop cost-effective condition monitoring software to characterize wear, corrosion and fatigue on mooring lines of floating wind turbine assets such as this one in the Atlantic Ocean.

ASL WINS 2019 US NATIONAL OCEANOGRAPHIC PARTNERSHIP PROGRAM AWARD



ASL was part of a team of organizations called the Marine Arctic Ecosystem Study (MARES) that won the 2019 US National Oceanographic Partnership Program (NOOPP) Excellence in Partnering Award. The award was presented at the 2020 Ocean Sciences Meeting in San Diego, California on 20 February 2020.

The Excellence in Partnering Award is presented annually to a NOOPP project that demonstrates strong partnerships with objectives to advance our understanding of the ocean sciences. The MARES project integrates several organizations

that include academic, private, tribal and state government with a focus on understanding the dynamics of the Arctic marine ecosystem in the eastern Beaufort Sea. This coordination of effort produced new insights from a broad range of sensors yielding a more complete understanding of the structure and function of this remote marine ecosystem.

MARES was initiated by senior scientist Dr. Guillermo Auad of the Bureau of Ocean Energy Management (BOEM). It was led by Dr. Francis Wiese of Stantec Consulting Services.

ASL's role in this collaboration was to provide a lead role in the physical oceanographic data collection, along with the Woods Hole Oceanographic Institution. ASL provided most of the instruments for four highly instrumented moorings, including ADCP and ice profiling sonars (IPS), which were operated over two full years from September 2016 to October 2018. ASL was also instrumental in the collaboration with the Department of Fisheries and Oceans (DFO) to provide ship time on the CCGS Sir Wilfrid Laurier in support of the mooring operations.



» NOOPP Excellence in Partnering Award presented to members of the MARES team. (L-R) Jan Buermans (ASL), Matthew Aspin (ASL), David Fissel (ASL), Jeff Green (Stantec), Francis Wiese (Stantec), Ruth Perry (Shell), Guillermo Auad (BOEM), Diane Ingraham (Stantec), Rachel McMahon (Old Dominion University), Pamela Neubert (AECOM), Rowenna Gryba (Stantec), Andrew VonDuyke (North Slope Borough), Donglai Gong (Virginia Institute of Marine Science), Natalie Monacci (University of Alaska Fairbanks).



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

MARINE ENVIRONMENTAL CONSULTING SERVICES

CSA OCEAN SCIENCES INC.
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Fax: +1 772 219 3010
E-mail: gstevens@conshelf.com
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Contact: Gordon Stevens



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

MARINE VENTURES INTERNATIONAL, INC. (MVI)

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Website: www.marineventures.com
Contact: Kevin Comer



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

MOTION SENSING EQUIPMENT**KONGSBERG SEATEX AS**

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KONGSBERG

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

NAVIGATION & POSITIONING SYSTEMS**ADVANCED NAVIGATION**

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Advanced Navigation is a privately owned Australian company that specialises in the development and manufacturing of navigation technologies and robotics. The company has a focus on generating products of the highest quality standard, both in terms of hardware and software. Advanced Navigation has specialised expertise across a broad range of fields including sensors, GNSS, inertial navigation, RF technologies, acoustics, robotics, AI and algorithms. Advanced Navigation is an ISO 9001 certified company and maintains a strict quality control system across the two research facilities and three manufacturing facilities that they operate in Australia. Advanced Navigation is a carbon neutral company, offsetting all emissions due to energy use through the planting of trees.

EVOLOGICS GMBH

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EvoLogics provides the world's most advanced spread-spectrum underwater communication systems (S2C) with multi-channel data management, networking capability, built-in tracking and positioning functions with USBL. Data loggers, acoustic wake-up module and releasers optionally included. Deployments in offshore platforms (FPSO, ABS), environmental monitoring, defense systems, ROV and AUV operations and more. Applications include simple positioning and sensor information to transmission of underwater photos.

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RJE International offers product design, development, evaluation and marketing for military divers, offshore and marine scientific communities, search and rescue teams, and more. RJE has become the industry leader in diver navigation and acoustic relocation. Our team has an extensive background in developing, manufacturing, and supplying underwater acoustic marking and relocation systems, diver navigation platforms, and other subsea equipment.

NETWORK & DATA COMS**KONGSBERG SEATEX AS**

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OCEANOGRAPHIC INSTRUMENTS/SERVICES

ASL ENVIRONMENTAL SCIENCES, INC.

Victoria, BC, Canada
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E-mail: asl@aslenv.com
www.aslenv.com



• **Meteocean Equipment Leasing:** Acoustic Doppler Current Profiler ADCPs (including StreamPro & RiverRay), Ice Profilers, AZFP, acoustic releases, wave/tide gauges, pingers, satellite beacons, CTD+DO+Tu profilers, DO & turbidity loggers, weather station, cages, flotation, bottom frames.

• **Oceanographic Products:** Acoustic Zooplankton Fish Profiler (AZFP), Ice Profiling Sonar (IPSS) & shallow water Ice Profiler (SWIP), Imagenex scanning sonar logger (IRIS), instrument cages, bottom frames. Custom acoustic products and system integration.

• **Consulting:** Field work, data collection, analyses, numerical modelling, acoustics, remote sensing, oceanographic mooring design and system integration.

• **Manufacturer's Representative:** Teledyne RD Instruments, Deep Water Buoyancy, WERA Northern Radar.

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RBR creates instruments to measure the blue planet. From the ocean abyss to the polar ice caps, our sensors track water parameters – temperature, depth, salinity, dissolved gases, pH, and many others. With design and manufacturing centrally located in Ottawa, Canada, our team works in a fast-paced, dynamic atmosphere to serve customers all over the globe.

ROMOR OCEAN SOLUTIONS

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

SEA-BIRD SCIENTIFIC

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Website: www.sea-birdscientific.com
Contact: Calvin Lwin, Sales



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STAR-ODDI

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STAR:ODDI

A manufacturer of miniature data loggers with sensors as temperature, depth/pressure, salinity, tilt/acceleration, compass direction/magnetometer, light levels, acoustic receiving/transmitting. The loggers are used for various researches, including oceanography, fishing gear studies, equipment behavioral monitoring and fish tagging.

SONAR SYSTEMS

ECHOLOGGER

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Website: www.echologger.com
Contact: Doowon Choi



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

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

EDGETECH

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

KLEIN MARINE SYSTEMS, INC.

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E-mail: sales@kleinmarinesystems.com
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Celebrating over 50 years in the marine technology industry, Klein Marine Systems continues to be a world leading sensor technology manufacturer of high-resolution side scan sonar equipment and radar-based security and surveillance systems. Klein Marine Systems has developed a worldwide reputation of excellence in the industry by providing quality products and excellent customer service. Klein sonar systems are deployed by government agencies, navies, port authorities, surveyors, oil companies and universities worldwide. Visit our web site at www.KleinMarineSystems.com and discover how Klein is Making the Oceans Transparent!

MARINE SONIC TECHNOLOGY
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 E-mail: Regan.Lipinski@na-atlas.com
 Website: www.marinesonic.com



Marine Sonic Technology builds high quality, high resolution side scan sonar systems. Located in Yorktown, Virginia, Marine Sonic has been in business for more than 25 years. Our towed systems are rugged, easy to deploy and simple to operate. We also offer highly efficient AUV/ROV embedded systems, which occupy minimal space and low power consumption.

SOUND VELOCITY PROBES/CTDS

SAIV A/S
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 Fax: +47 56 11 30 69
 E-mail: info@saivas.com
 Website: www.saivas.no
 Contact: Gunnar Sagstad



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

SUBSEA FABRICATION

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

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KONGSBERG

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

UNMANNED MARITIME VEHICLES

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 E-mail: adam.mara@gd-ms.com
 Website: gdmissionsystems.com/underwater-vehicles/bluefin-robotics
 Contact: Adam Mara

GENERAL DYNAMICS
 Mission Systems

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

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

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- Robotic systems for nuclear Industry applications
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L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. The company provides advanced defense and commercial technologies across air, land, sea, space and cyber domains.

L3Harris OceanServer develops autonomous, lightweight Unmanned Undersea Vehicles. L3Harris OceanServer has established itself as the leader in man portable UUVs, providing highly capable vehicles to a wide array of military, commercial and research customers. With over 15 years experience in the underwater field, our engineers have developed a reliable and easy to use platform that is trusted to complete marine missions all around the world.

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With more than 25 years of experience in the design, development and manufacture of ROVs and towed systems, Mariscope is one of the very few companies that can offer you really customized underwater solutions with actual integration. Instead of just adding accessories or instruments to our vehicles, we design, develop and manufacture the completely integrated solution to the client's needs.

Mariscope offers from small towed systems or compact Observation Class ROVs up to complete multifunction units. The company also provides other solutions such as antifouling devices, side-scan sonars, oceanographic instruments for ports and offshore platforms (current/wave meters), or even manned submarines.

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Website: www.outlandtech.com
Contact: Jeff Mayfield



Offering the most rugged equipment and unsurpassed customer service, Outland Technology has been the world's leading manufacturer of underwater video, lighting and ROV equipment for over 30 years. We recognize that no two jobs are the same and specialize in products that are customizable for your specific applications.

SEAMOR MARINE LTD.
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Website: www.seamor.com
Contact: Simon Douthwaite



We design, research and manufacture SEAMOR ROVs and related accessories. The SEAMOR ROVs are at the forefront of the expansion of marine industries and research, providing safe and cost-effective eyes underwater to help guide industrial activity and monitor the health of underwater ecosystems. Our ROVs are very unique because of their modular design and their wide range of capabilities. Our engineers have developed system components (vehicle, controller, tether and power source) to be interchangeable across our product line; Mako, Chinook, and Steelhead. SEAMOR vehicles are quality machines and are built to last. Our vehicles can be easily upgraded and repaired.

WINCHES, HANDLING, & CONTROL SYSTEMS

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SOSI and DT Marine brand winches, handling systems, and engineered solutions are now available exclusively from Okeanus Science & Technology. Proven, reliable, and cost-effective standard and custom designed winches range from small all-electric instrumentation winches to high horsepower all-electric or hydraulic umbilical and multi-purpose oceanographic systems. SOSI brand winches can be packaged and supplied with skids, A-frames, over-boarding sheaves, HPUs, and other auxiliary equipment. Okeanus has offices in Houston, TX, Redmond, WA and Houma, LA. Call, email or visit www.okeanus.com for more information.

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Airmar/MSI Transducer	23	Ocean Specialists, Inc.	43
www.msitransducers.com		www.oceanspecialists.com	
BAE Systems	68	Remote Ocean Systems (ROS)....	33
www.baesystems.com		www.rosys.com	
CSA Ocean Sciences	37	Sea-Bird Scientific	04
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