

November 2020

ON&T

oceannews.com

OCEAN NEWS & TECHNOLOGY

Navigating a Course to Sustainable
Shipping pg. 10

CONFIDENCE UNDERWATER

videoray.com



PORTABLE *and* POWERFUL

VideoRay is the global leader in underwater Remotely Operated Vehicles.

We back our quality-driven solutions with exceptional service and support. We also offer accessories and tools that power you through inspection and light intervention challenges. Discover the "VideoRay Difference" and experience *Confidence Underwater*.



sales@videoray.com +1 610 458-3000

© Copyright 2020, VideoRay LLC



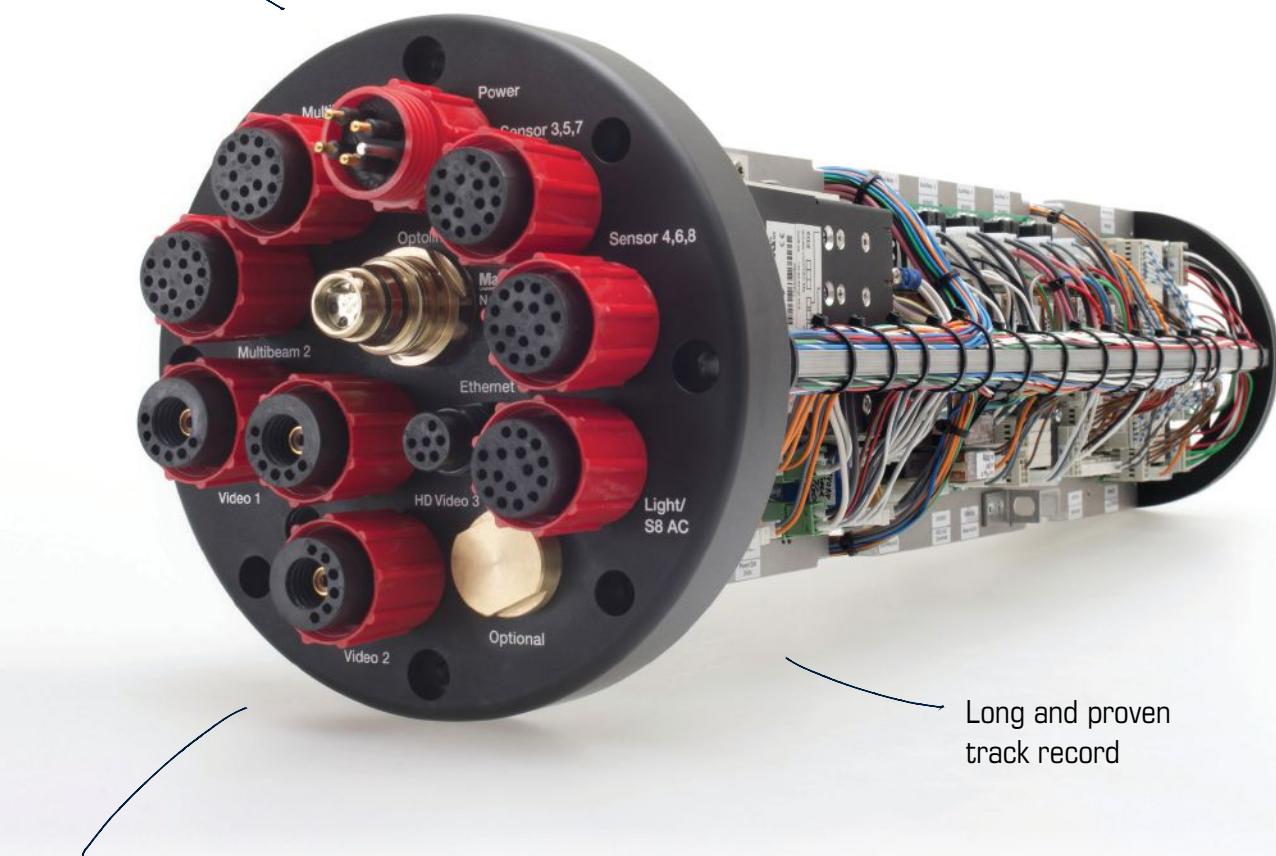
MacArtney
UNDERWATER TECHNOLOGY

NEXUS

Multiplexers and fibre optic telemetry solutions

High bandwidth

Highly versatile and
configurable



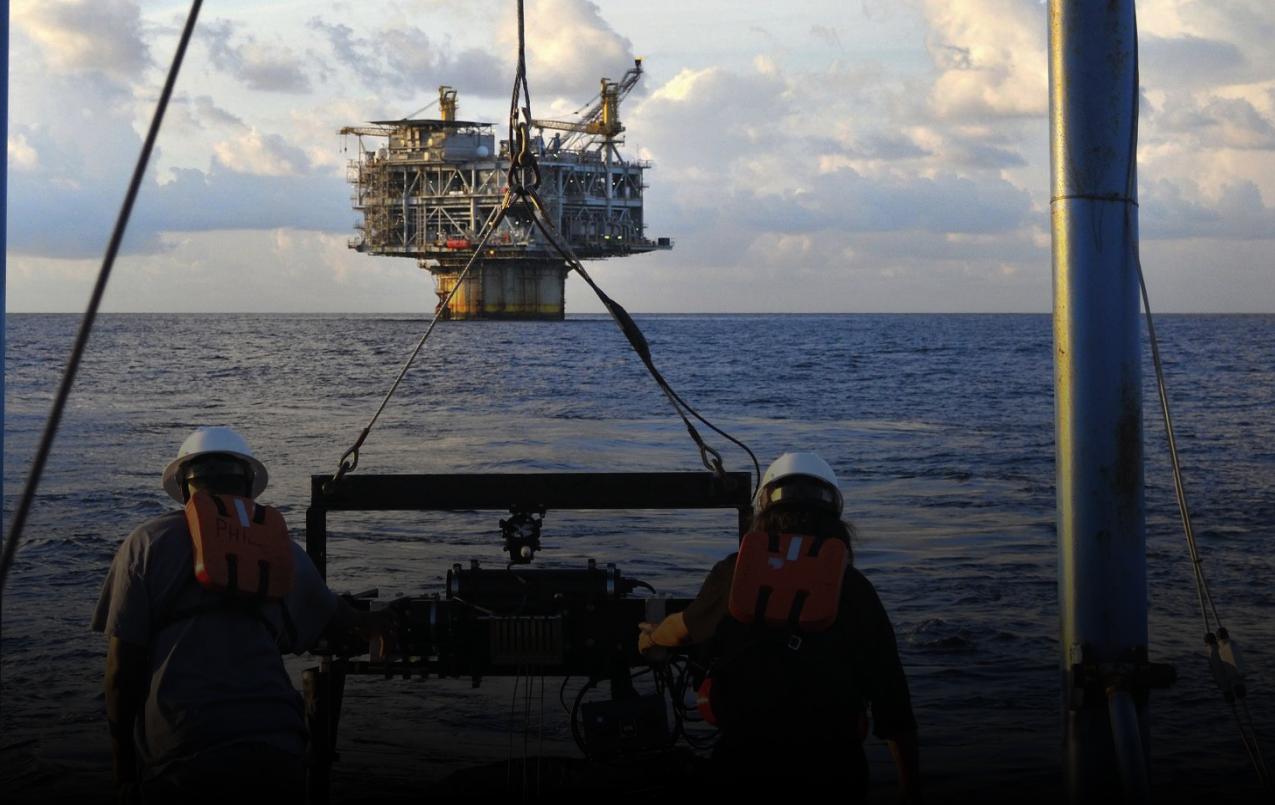
Full HD video
interface

Long and proven
track record

MacArtney global solutions

Denmark | Norway | Sweden | United Kingdom | France
Italy | Germany | Netherlands | USA | Canada | Chile
Brazil | Singapore | China | Australia





Whatever the mission...

Okeanus designs and manufactures mission-critical ocean equipment for commercial and government agencies throughout the world. We harness breakthrough Science and Technology to equip clients with the tools and trusted support they need for the rigors of ocean exploration.

Our comprehensive product portfolio—from customized deck equipment, including winches, LARS and A-Frames, to our extensive range of underwater survey and sampling equipment—is available for purchase or rent, and rapid deployment.

Whatever your mission, Okeanus has turn-key solutions to make it a success.

okeanus.com





Fifty Years of Powering Ocean Science

For over 50 years, from coastal waters to the deep, we've proudly partnered with commercial, 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.

That's always been our promise, to the ocean and our clients. What promise does the ocean hold for you?

Find out how CSA can help you manage the environmental footprint.



csaocean.com

Sea the Difference.



FEATURES

- 10 Navigating A Course To Sustainable Shipping**
- 16 Breaking The Ice:** Making Waves With Very-Low Frequency Sound Source
- 20 Dynamic Positioning** Is Becoming Increasingly Dynamic
- 33 Pressure Precision** At Any Depth
- 38 Nexans** Commits To Carbon Neutrality By 2030
- 44 Enhancing The Effectiveness Of** Port And Harbor Security

DEPARTMENTS

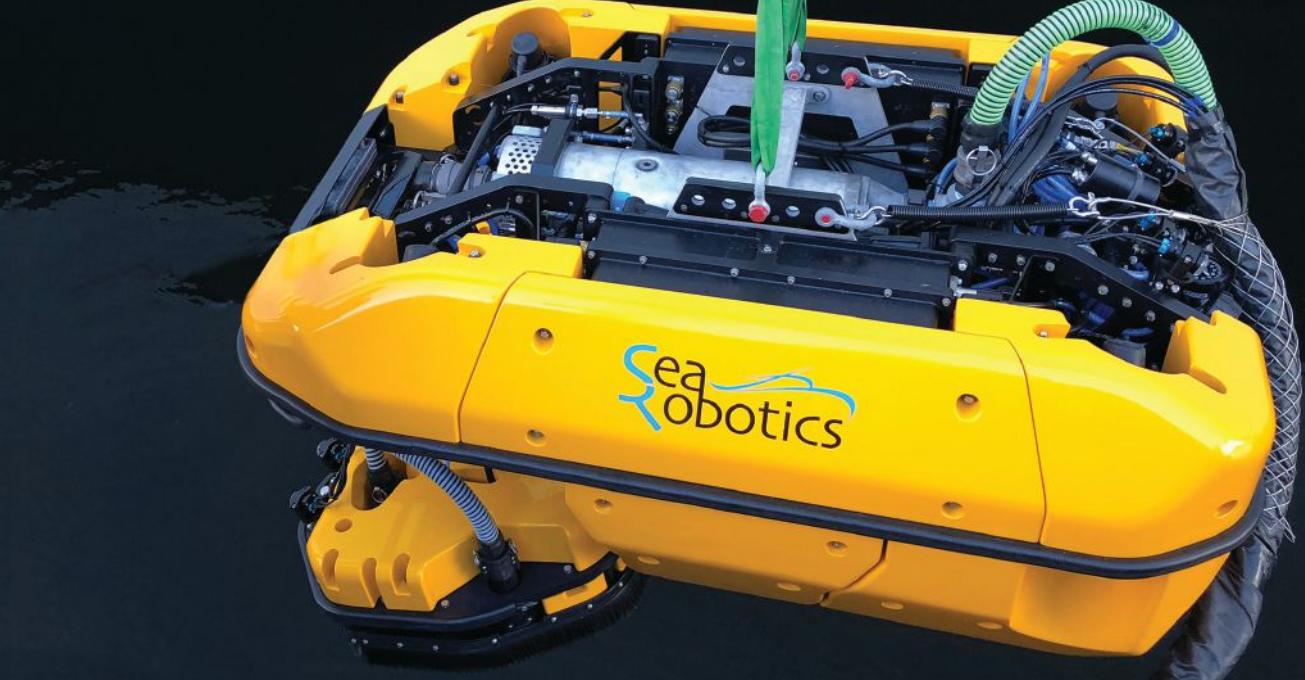
- 15 OCEAN SCIENCE & TECHNOLOGY**
- 28 OFFSHORE ENERGY**
- 32 SUBSEA INTERVENTION & SURVEY**
- 40 CABLE TECHNOLOGY**
- 46 DEFENSE**
- 08 EDITORIAL**
- 24 PRODUCT FOCUS**
- 48 STATS & DATA**
- 52 EVENTS**
- 54 MILESTONES**
- 59 OCEAN INDUSTRY DIRECTORY**

IN EVERY ISSUE



ON THE COVER:

All aboard! The shipping industry faces several key operational dilemmas as companies adjust to tightening environmental regulations. How might ocean technology help chart a sustainable future?



How Shipshape is Your Hull?

Take Control of Your Environment



Bio-inspired
ROV Technology



Dockside or Barge Deployment
and Biofouling Filtration



Hull Grooming for
Optimized Vessel Performance



Keep your vessel at sea, not the shipyard.

The gains associated with proactive hull grooming are immediate, both in terms of a vessel's efficiency and environmental footprint. The SR-HullBUG is a field-tested semi-autonomous ROV that uses light brushes to eliminate the early signs of biofouling and prolong periods between costly drydocking. The system's sophisticated capture and filter system enables operators to safely remove effluents and invasive species in portside waters.

Cleaner seas need cleaner hulls.



SeaRobotics.com

Editorial Team**ED FREEMAN**

JOHN MANOCK

G. ALLEN BROOKS

INGER PETERSON

RHONDA MONIZ

Art Director

EMILIE RODRIGUEZ

Conferences Manager

WHITNEY SCHWERIN

Subscription Management

subscriptions@tscpublishing.com

Editorial Advisory Board

Bios available at:

www.oceannews.com/magazine

DR. PHIL HART

Milton Keynes, United Kingdom

DREW MICHEL

Pierre Part, Louisiana

DR. TOBIAS STAPLETON

Westport, Massachusetts

Partners

Center for International Maritime Security (CIMSEC)

Marine & Oceanographic Technology Network (MOTN)

TMA BlueTech

Published byTechnology Systems Corporation
PATRICK C. LAGRANGE, CEO**ADVERTISING SALES**

LISA CHILIK

Tel: 574-261-4215

lchilik@tscpublishing.com

MIMI KING

Tel: +44 (0) 777 6017 564

mkting@tscpublishing.com

TO SUBSCRIBE

www.oceannews.com/subscribe

Ocean News & Technology ISSN# 1082-6106

is published 11 times a year in print and digital by Technology Systems Corporation, 8502 SW Kansas Ave, Stuart, FL 34997, telephone 772-221-7720. Copyright ©2020 Technology Systems Corp. All rights to editorial content are reserved. No article, photograph, or illustration may be reproduced in whole or part without the written permission of the publisher. Unless otherwise stated in writing by the contributor, all images submitted to TSC may be used in other promotional materials belonging to TSC without permission. Subscriptions are free to qualified individuals or companies. For all others, call TSC for subscription information.

PRINTED IN THE USA



FUTURE-PROOF SHIPPING

KITACK LIM

IMO Secretary-General

These are unprecedented times for the maritime sector, during which the capacity of international shipping services to deliver vital goods—including medical supplies and equipment—has proven essential to our societal response to the global pandemic.

Sustainable development will be key to the post-COVID-19 recovery, and shipping will play an indispensable role. But shipping also needs to ensure its own sustainability.

There should be little doubt that the single biggest challenge we face is the urgent need to combat global warming and climate change. To this end, in 2018 the IMO adopted a detailed initial strategy to achieve industry decarbonization, defined by our commitment to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008, with a view to phasing out GHG emissions from shipping entirely by the end of this century, if not before.

Investments in R&D

New fuels and innovative technologies will be instrumental to meeting the ambitions of the IMO strategy. And while research into developing zero-carbon marine fuels is well underway—with electricity, hydrogen, ammonia or biofuels considered viable options—further action is required to expedite this process. This means significant investment in R&D and infrastructure. To achieve this, the IMO is stepping up its efforts to act as the global forum and advocate for zero-carbon marine fuels, uniting interested stakeholders and sponsors from around the world, both from the public and private sectors.

In this context, work at the IMO will include discussions on a proposal to establish an International Maritime Research and Development

Board (IMRDB) designed to generate core funding from shipping companies to help accelerate the advancement of commercially viable zero-carbon emission ships by the early 2030s. This includes measures to help stimulate the uptake of technologies designed to leverage renewable energy sources.

In parallel, the IMO will be involved in discussions on emission reduction mechanisms, like market-based measures, to incentivize the uptake of alternative renewable fuels.

Transparency in a Digital World

Our aim is to ensure that no country is left behind in the maritime sector's transition to carbon-neutral shipping, and so we are busy expanding capacity building projects designed to drive ongoing cooperation. Our NextGEN initiative—where GEN stands for "Green and Efficient Navigation"—aims to facilitate greater transparency on decarbonization efforts among diverse stakeholders (including IMO Member States, NGOs, industry and academia); identify opportunities and gaps for carbon neutralization across the global shipping community; and create important networks and platforms for meaningful collaboration.

Information sharing of this nature, in an ever more digitized world, is critical to strengthening the resilience of the global supply chain. Increased data collection, processing and interconnectivity, will continue to enable automated systems and the future integration of Artificial Intelligence. How we act on data today will define our sector tomorrow and so the IMO is partnering with stakeholders worldwide to ensure that the digital revolution enables greater security, improves environmental performance, and ultimately promotes a more efficient and sustainable shipping industry.

Getting Onboard

The IMO is determined to push forward with our major policy issues despite the challenges posed by COVID-19, but progress will be contingent on the commitment of all maritime stakeholders championing efficiency and sustainability, and ultimately embracing a long-term vision towards decarbonization.

Only cooperation and collaboration will enable us to lead the shipping industry into the future.

**ON THE HORIZON****January 2021:**
The Essential 2021 Offshore Toolkit

Breakthrough technologies transforming the way we work at sea and extend our reach offshore.

Technologies: ROV tooling & control, Subsea cables, Remote inspection, Supply vessels, Turbines, Tethers, and more.

Industry Focus: Offshore Energy & Renewables, Marine Survey, Scientific, Defense

STAY IN TOUCH:
editor@oceannews.com

CONNECT WITH US:

[linkedin.com/company/oceannews](https://www.linkedin.com/company/oceannews)

[@oceannews](https://twitter.com/oceannews)

facebook.com/OceanNewsandTechnology



From shallow to deep-water

sites, our experienced engineering team develops and deploys innovative *in situ* seabed investigation methods and custom technologies that guarantee best-quality geotechnical, geophysical, and environmental data and analysis.

With an established track record of partnering with the offshore energy, marine mining and trenching industries, we're helping redefine geoscientific exploration.

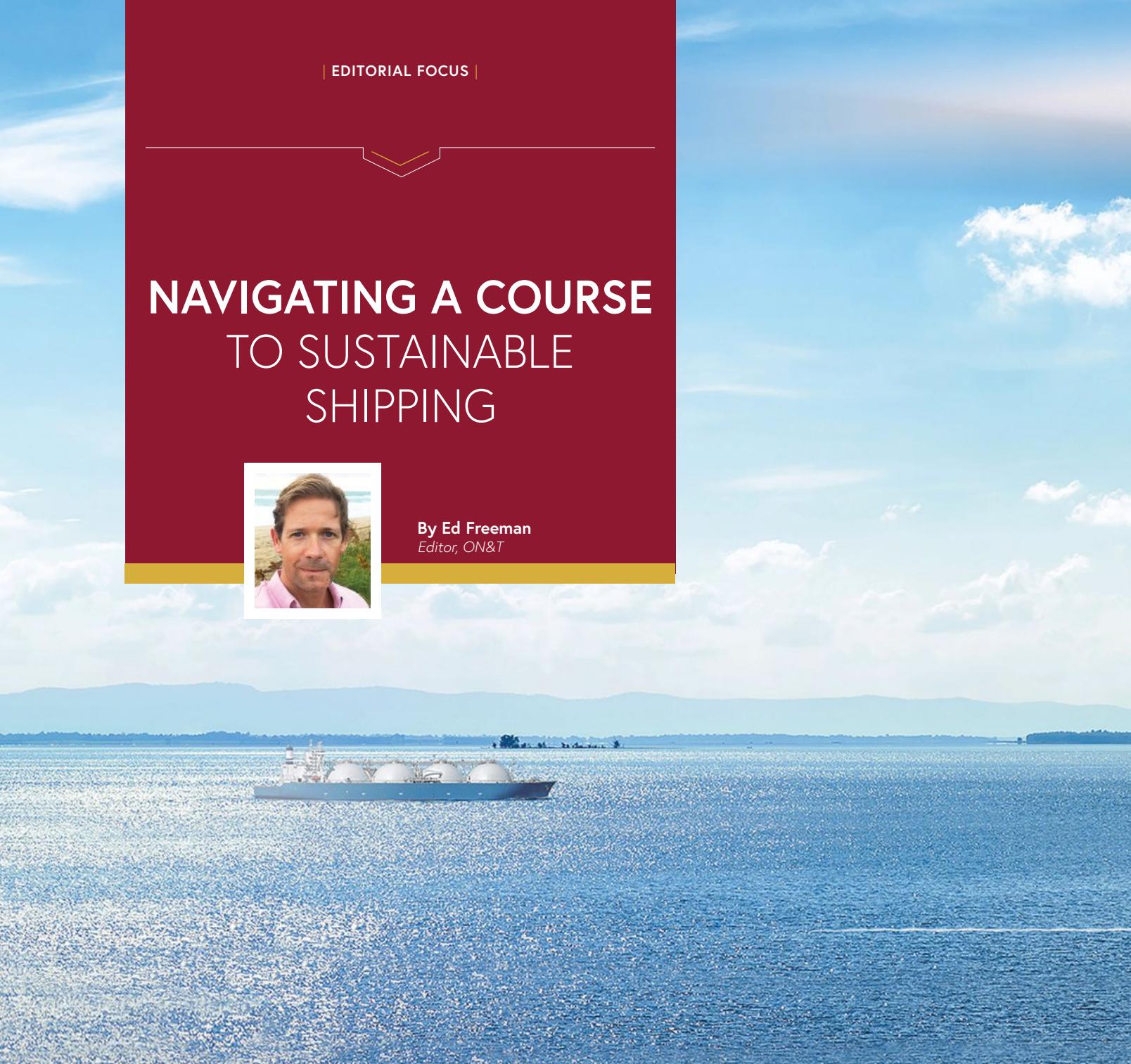
Find out how at bluefieldgeo.com

Bluefield Geoservices
Geoservices | Engineering | Technology

NAVIGATING A COURSE TO SUSTAINABLE SHIPPING



By Ed Freeman
Editor, ON&T



In 2018, the International Maritime Organization (IMO) announced details of its initial strategy to reduce annual GHG emissions by at least 50% compared to 2008 levels, including a target to curb CO₂ emissions per transport work by at least 40% by 2030. In terms of regulatory commitment, this was a stark sea change. Then, as of January 2020, the IMO decreed a global Sulphur cap of 0.5% for marine fuels (a significant adjustment from the previous 3.5% limit) to align global shipping lanes with the already established 0.1% limit in Emission Control Areas (ECAs).

Compliance falls on the shoulders of shipping companies, and while the IMO's plans involve a series of short-, mid- and long-term goals, the Sulphur cap left operators with little choice—either pay up for low Sulphur fuel or install the necessary exhaust gas cleaning systems—known as scrubbers—to "clean" emissions before they are released into the atmosphere. While scrubbers are an accepted interim measure, they require significant capital outlay and drydocking to install. They do nothing to curb CO₂ emissions, either. Further, they present complex operational issues, including the handling of corrosive

substances and the need for additional energy sources to run seawater and process pumps and supporting instrumentation.

ALTERNATIVE FUELS TODAY

A recent report published by *Shell, Decarbonizing Shipping: Setting Shell's Course*, suggests that industry must act now—with solutions available today—and that alternative fuels, in particular liquefied natural gas (LNG), may prove pivotal. Compared to heavy fuel oil (HFO), from extraction to combustion, LNG reduces GHG



» DNV GL's *Maritime Forecast to 2050: Energy Transition Outlook* warns that shipowners also need to make long-term investments. (Image credit: DNV GL)

emissions by up to 21% for 2-stroke slow speed engines and up to 15% for 4-stroke medium speed engines. There has been a notable uptake of LNG in recent years—there are now around 400 tankers in service—but vessel conversion is costly, as is the potential for methane leaks (a potent GHG).

Choice would seem like a good thing, but DNV GL's recently published *Maritime Forecast to 2050: Energy Transition Outlook* warns that shipowners also need to make investments based on long-term outlooks as "picking the wrong solution can lead to a significant

competitive disadvantage." It is with a view to full decarbonization by 2050 that the company advocates a structured scenario-based approach to "future-proofing" assets and incorporating greater fleet flexibility.

In the here and now, Grahaeme Henderson, VP of Shell Shipping & Maritime, casts little doubt: "The shipping industry needs to develop the new technologies, fuels and infrastructure required for a net-zero emissions sector at a pace never previously seen." With capital investment all but mandated, we are sure to see escalating

pressure on operational efficiency; in the age of digitization, this means more data-driven decision making.

DATA-LED INTERVENTIONS

Software for voyage and vessel optimization may prove instrumental here, not only in providing immediate accountability, but also unlocking future efficiency gains. Certain systems, like GreenSteam's Discover, use Machine Learning (ML) to provide operators with an onboard understanding of hydrodynamic inefficiencies related to

trim, fouling, and coating issues. In July 2020, Kongsberg Digital announced the acquisition of COACH Solutions, another leading developer of vessel performance management; KONGSBERG COACH Solutions is a clear indication of how prominent marine technology companies are investing in the digitalization of fleet efficiency.

The layered data then informs any number of appropriate responses and incremental measures designed to promote fuel efficiency and limit CO₂ emissions, such as thruster enhancement, bulbous extensions, and recoating. Biofouling, in particular, is a growing factor and has triggered the programmed deployment of specialized ROVs for proactive hull grooming, with Jotun (in partnership with Kongsberg), Hullwiper, ECA, TecHullClean, and SeaRobotics spearheading this preventative mindset.

The democratization of such data may prove essential to enacting real-word solutions. The implications for naval architecture could be profound, with "big" data rewriting design principles for ever more efficient shipping lanes and fit-for-purpose hulls. And while a world without slow steaming—the intentional reduction in speed of a ship in transit to lower fuel consumption/CO₂ emissions—may feel futuristic, another recently published report, *Zero-Carbon for Shipping* by the Ocean Conservancy, calls for urgency: "Considering that the typical vessel life is 20 to 30 years, the first zero-carbon ships need to

be commercialized by 2030." This means investing in technologies that look beyond oil and gas as a primary fuel source, today.

BIO-FUELING TOMORROW'S FLEET

According to the International Energy Agency (IEA), biofuels, namely ammonia and hydrogen, will meet more than 80% of shipping fuel needs by 2070. While transport biofuel production expanded 6% YOY in 2019, the Paris-based agency suggests that stronger policy support and innovation is needed to reduce costs and ramp up adoption. But the IEA also points out that "more than 60% of the emissions reductions in 2070 come from technologies that are not commercially available today."

The time for pioneering initiatives is, therefore, right now. The Viking Energy Project is a five-year ShipFC initiative being run by a consortium of 14 European companies—including Wärtsilä and Eidesvik—that seeks to explore the long-term viability of ammonia-powered fuel cells. The project aims to deliver a zero-emissions supply vessel, *Viking Energy*, powered by a 2 MW electric motor, by 2023. Wärtsilä boasts extensive experience of fuel conversion and clearly believes that hybrid engines are key to providing flexibility—*Viking Energy* will be LNG enabled. To this end, Wärtsilä is also investigating the use of several other fuels for future use, such as synthetic methane and hydrogen. The IEA sees ammonia as the frontrunner on account

of its higher energy density (freeing up more cargo space than hydrogen), but toxicity and its highly corrosive properties raise concerns.

The case for hydrogen centers around economies of scale, and growing interest from other sectors should enable scaling. The potential is undeniable though; earlier this year, the International Council on Clean Transportation (ICCT) suggested that liquid hydrogen could have powered 99% of all the container vessels that crossed the Pacific Ocean in 2015.

In April, ABB announced a signed MoU with Hydrogène de France (HDF) to jointly manufacture megawatt fuel cell systems capable of powering ocean-going vessels. The initiative includes the partnership of Ballard Power Systems, a global provider of proton exchange membrane (PEM) fuel cell solutions. Speaking to ON&T, Jostein Bogen, Product Manager for Energy Storage and Fuel Cells, ABB Marine & Ports, said: "Fuel cell technology is responsive enough to be used as a general energy source for most loads on electric ships—and can be deployed in combination with other systems to yield additional benefits."

BeHydro is another hydrogen advocate. In September, the joint venture between Belgium-based engine builder ABC and container shipping line CMB, unveiled the first hydrogen-powered dual-fuel engine with 1 MW capacity. The company says that



» The Viking Energy Project aims to demonstrate that long-range zero-emission voyages with high power on larger ships is possible.
(Image credit: ShipFC)

larger engines—up to 10 MW—can also be produced. BeHydro is developing a mono-fuel hydrogen engine that will be ready by the second quarter of 2021. "BeHydro has already received its first order for 2 x 2-MW dual-fuel engines that will be installed on board the HydroTug," says Tim Berckmoes, CEO of ABC. "This vessel is the very first hydrogen tugboat in the world and will be deployed by the Port of Antwerp."

ENERGY STORAGE IS KEY TO FUEL INDEPENDENCE

While fuel cell technology may revolutionize how we power propulsion systems, considerable battery R&D is needed to manage the load profile of conventional vessels. Up until now, electrification has largely been limited to vessels running shorter routes—such as E-Ferry Ellen in Denmark, or Gee's Bend Ferry in the United States. Range is restricted by the energy density of existing cell technologies and the size and weight of energy storage systems (ESS), but advances in battery engineering, including lithium metal, solid state, and novel chemistries, are set to kick-start an accelerated adoption of electrification solutions.

Not only do full and hybrid electric propulsion systems run cleaner and quieter, progressive battery platforms offer ever longer life spans. With a view to mid- to long-term investment, the source of energy—assuming it is emissions compliant—could become less important than the ability to store it efficiently. This paradigm shift would free vessel owners to select the most economical energy—be it derived from oil, gas, nuclear, or renewable sources—and safeguard themselves against oil price fluctuations. Greater fuel independence will further encourage the development of technologies designed to harvest renewable energy.

RENEWABLE ENERGY

Japan-based Eco Marine Power (EMP) has engineered a range of renewable energy systems for ships and offshore applications, including the Aquarius MRE® (Marine Renewable Energy) system of rigid sails, marine-grade solar panels, and energy storage devices. Central to the concept is EMP's EnergySail® technology, designed to harness wind and solar power, whether in transit or in port. The system can be retrofitted to existing assets or integrated into future vessel designs, as is the case with the company's Aquarius Eco Ship concept. The company is currently preparing Aquarius MRE for Approval-in-Principal with ClassNK, in Japan.

Bound4Blue's WingSail technology is another approach devised to harness offshore wind resources, via the deployment of a foldable and autonomous series of sails which drive a complementary propulsion system. The company says that the system is capable of delivering fuel consumption/emission reduction of up to 40%, with a payback period of just five years. By 2025, the Bound4Blue projects that WingSail will be operational on 184 vessels, delivering annual savings of more than 100,000 tons of fuel and CO2 emission reductions of 320,000 tons.



» ABB and HDF are teaming up to build enormous hydrogen fuel cell powertrains for large marine vessels. (Image credit: ABB)



» BeHydro first 2x2MW dual-fuel engines will power the first hydrogen tugboat in the world, for deployment in the Port of Antwerp. (Image credit: BeHydro)



eco marine power OPENING UP THE FUTURE WITH OUR HIGHEST TECHNOLOGY TERAMOTO IRON WORKS CO.,LTD. **FB** FURUKAWA BATTERY **KEI**system

» Eco Marine Power's Aquarius MRE® system is designed to harness wind and solar power. (Image credit: Eco Marine Power)



» Bound4Blue's WingSail system features foldable and autonomous sails capable of fuel consumption/emission reduction of up to 40% (Image credit: Bound4Blue)

NO "SMALL CHANGE" INVESTMENT

Earlier this year, a UMAS study for the non-profit consortium Getting to Zero Coalition cited that the cumulative investment needed between 2030 and 2050 to meet IMO targets is between \$1 trillion to \$1.4 trillion. If the shipping industry was to fully decarbonize by 2050, this would be more to the tune of \$1.9 trillion. While daunting, this signals a new era of sustainable investing.

Charting safe passage to the IMO's 2030/2050 goals will also require a mindset that recognizes that investments in new technology—now—go hand-in-hand with long-term cost reductions, not increases. Vessel owners need to act as environmental stewards and electrification offers a clear pathway to reduced emissions and maintenance costs. As the scaling of innovation drives down the marginal cost of

zero-emissions energy, operators need to embrace a new wave of opportunity: New fuel sources; novel vessel design; and a reliance on "big" data to unlock efficiency gains.

The shape—and compliance—of the maritime sector in 2050 will, unquestionably, be reliant on how the shipping industry reacts today. We will likely see a steady integration of autonomous systems, both at-sea and as major ports and shipping lanes become busier. With reduced crews, we should see the phased introduction of "smart" ships to the global fleet, powered not only by an ever more environmentally friendly and cost-effective fuel mix, but Artificial Intelligence.

In September, Massterly, a Kongsberg Wilhelmsen JV, and Kongsberg Maritime announced signed contracts with Norwegian grocery distributor ASKO to equip two new vessels with autonomous technology, and



» Future fuel flexibility: Engines that incorporate dual-fuel technology, like BeHydro, ensure a continuous power supply even when no renewable energy or hydrogen is available. (Image credit: BeHydro)

to manage their operations at sea. The fully electric ships, which will enter service in 2022, will initially host a reduced crew before switching to fully autonomous operations. The fjord crossing will keep delivery trucks off the road and, as a result, cut present day emissions by 5,000 tons of potential CO₂ every year.

Now there's food for thought.



» Massterly is to equip two new vessels with autonomous technology to enable crewless operations for Norwegian grocery distributor ASKO, cutting emissions by 5,000 tons of CO₂ every year. (Image credit: Massterly)

DNV GL AND BLUEWATER TO TEST HYBRID DIGITAL TWIN TECHNOLOGY

Pilot Targets FPSO Safety and Operational Costs



» Bluewater's Aoka Mizu FPSO
(Photo credit: Bluewater)

DNV GL and FPSO specialist Bluewater are undertaking a pilot project to use hybrid digital twin technology to predict and analyze fatigue in the hull of an FPSO in the North Sea.

The project aims to validate and quantify the benefits of creating a virtual replica of the FPSO to optimize the structural safety of the vessel and enhance risk-based inspection (RBI), a decision-making methodology for optimizing inspection regimes. The pilot underpins Bluewater's mission to take a proactive, responsible approach to safety and environmental care in its operations.

Bluewater's Aoka Mizu FPSO, currently in operation in the Lancaster field, west of Shetland, will be used. To date, the pilot test has shown encouraging results.

DNV GL's unique combination of domain experience, inspection capabilities and digital analytics and modelling, enables the monitoring of the asset's hull structure during operation without dependence on costly routine inspection regimes. Termed 'Nerves of Steel', the underlying concept permits the use of various data sets (external environmental data or local sensor data) combined with digital models of the asset, to develop a hybrid replica model of the vessel's structure. This can be used in real-time to monitor the asset's condition, identify and monitor high risk locations, and plan targeted and cost-efficient maintenance and inspection activities.

Hybrid twin technology uses a combination of numerical design models and data from actively recorded strain gauge sensors on board the FPSO. These sensors allow for a full understanding of the accumulative loading and current state of the FPSO structure. The technology blends computer-simulated modelling with real-time data, which is then streamed to the operator via DNV GL's Veracity data platform or an existing data transfer solution.

"By informing and enhancing the RBI process, operators can reduce operational costs and time, providing significant improvements in safety, thereby extending the lifespan and integrity of assets."

"With fluctuating oil price and the impact of Covid-19 on travel, delivering a mirror image of an asset from the safety of shore needs to be trusted and of value," said Koheila Molazemi, Technology and Innovation Director, DNV GL—Oil & Gas.

DNV GL's visual dashboard presents data to Bluewater on stresses in the hull's structure, alongside information that can be used to identify areas with relative higher risk of cracks or deformities to occur. The information, which is constantly recorded, can be accessed and analyzed to inform decision-making and implement inspection based on risk priority.

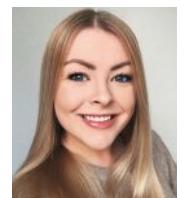
The trial will expand on traditional FPSO integrity management strategies, which are based on software-based assumptions made at the design stage as well as current inspection record to enhance RBI decision-making. The pilot with Bluewater is expected to provide new insight and smarter ways of managing risks and costs related to structural integrity management.

This is DNV GL's third pilot project evaluating the performance of hybrid digital twin technology. With global support from the advisor's experts in Singapore, the UK and Norway, the first involved defining a repair procedure for a FPSO flare tower. Another trial, which is still ongoing, is being performed on a fixed offshore platform.

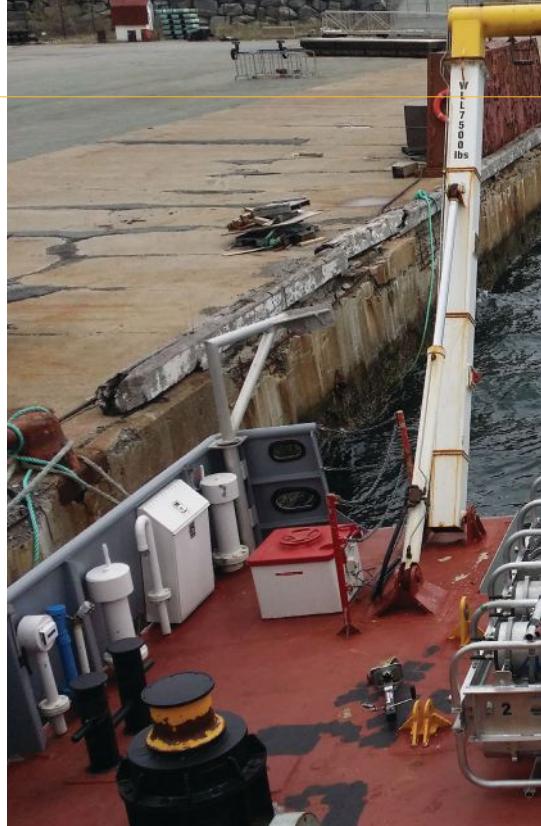
"Like an insurance policy, the hybrid digital twin can potentially save millions by avoiding the costly and possibly catastrophic repercussions of ill-informed integrity management by preempting and preventing detrimental damage. For an asset operating in a harsh environment, where the loads play an important part in the possible degradations of the asset, using data from the site as a basis for optimized inspection planning, alarms for extreme events and asset suitability for life extension is crucial," added Francois-Xavier Sireta, Technical Lead for Naval Architecture and Principal Engineer, DNV GL—Oil & Gas.

Peter van Sloten, Department Head Technology Management, Bluewater said: "We [Bluewater] decided to extend our digital twin program to include our FPSO Aoka Mizu. Our ambition for the structures largely matched with the novel digitalization services of DNV GL. We are therefore pleased to team up with DNV GL to develop a tool to monitor the structural integrity of this most versatile FPSO, designed and proven to operate in harsh environments with high uptimes and a maintained, strict regulatory and safety regime. This will enhance the safety and enables an optimized inspection regime."

BREAKING THE ICE: MAKING WAVES WITH VERY-LOW FREQUENCY SOUND SOURCE



By Megan Constable
GeoSpectrum Technologies Inc.,
Business Development



GeoSpectrum Technologies Inc. is fast becoming a global gold standard for very-low frequency (VLF) sound sources, notably with our M72-30 VLF CBASS, which went into production at GeoSpectrum's Dartmouth facility in Nova Scotia in 2017.

CBASS: WHAT'S THE BUZZ?

Originally developed for marine seismic applications, CBASS was intended to replace air guns by providing a friendlier approach to the current industry standard, reducing both peak power and frequency content to allow for less disruption to marine mammals.



» GeoSpectrum's CBASS sound sources are smaller, lighter, and less expensive than legacy sources. (Image credit: GeoSpectrum)

GeoSpectrum's CBASS sound sources are a significant innovation for the challenges of VLF sound source technology. The sources are smaller, lighter, more capable, less expensive, and offer greater reliability than legacy sources.

CBASS sound sources are coherent and can be used like an underwater loudspeaker to produce any type of desired sound transmission within their frequency band. With resonant frequencies as low as 15 Hz and operating bands reaching above 1 kHz, they are designed to operate continuously over extended timeframes and can be used as a stand-alone source or in a variety of towed bodies.

With such broad application, there was concern as to whether CBASS could provide the same amount of power as its legacy counterparts in a live environment. CBASS trials at Seneca Lake, however, exceeded all expectations and triggered further development plans.

CBASS HITS THE ICE

With climate change a major consideration for ocean tech companies around the globe, GeoSpectrum paired up with some formidable names last October for one of our most comprehensive collaborations to date. The Coordinated Arctic Acoustic Thermometry Experiment (CAATEX), a joint program of the Nansen Environmental and Remote Sensing Center of Bergen, Norway, and the Scripps Institution of Oceanography of La Jolla, California, marks the first time in 20 years that scientists have gathered data of this magnitude from the Arctic Basin.

The program unites partners from all corners of the globe and has put Dartmouth, Nova Scotia firmly on the map, with GeoSpectrum's CBASS acting as the critical component of the program.

The two CBASS sound sources were deployed on subsea moorings containing computers, signal generators, amplifiers, and batteries (in the summer/fall of 2019). Unlike other sources, CBASS uses batteries not ships as a source of power. The systems were programmed to transmit signals every third day for one year. The reception ranges from the CBASS sources extended across the entire Arctic Basin, stretching in excess of 2,500 km.

The objective of the CAATEX program is to research the central Arctic Ocean, especially the ocean climate change. The program allows scientists to collect new ocean observations covering the central Arctic Ocean, obtain new knowledge about the decadal changes in heat content of the Arctic Ocean and improve our understanding of uncertainties in heat content estimates from climate change.

The prime output from CAATEX field experiment is baseline data on mean ocean temperature and heat content of the central Arctic Ocean, which will be used for estimation of ocean climate change, as well as evaluation of global climate models. The new observations from the fixed moorings will be compared to similar observations made in 1994 and 1999 and thereby quantify how much the mean ocean temperature along the



» Baseline data from the CAATEX experiment will be used to estimate ocean climate change, as well as estimate global climate models. (Image credit: Woods Hole Oceanographic Institution)

» The Coordinated Arctic Acoustic Thermometry Experiment (CAATEX) used two GeoSpectrum CBASS sound sources on Arctic subsea moorings containing computers, signal generators, amplifiers. (Image credit: GeoSpectrum)

mooring array has changed over two decades. To obtain an improved estimate of the heat content of the central Arctic Ocean, the new data obtained in CAATEX will be used in combination with a high-resolution ice-ocean model. This estimate will be highly valuable for benchmarking the skill of climate models to represent Arctic Ocean heat content.

The advent of CBASS has allowed organizations of the CAATEX program to conduct low frequency acoustic tomography experiments more efficiently and less expensively than ever previously possible.

CANADIAN ARCTIC SURVEILLANCE

Adding to its list of achievements, GeoSpectrum was awarded two contracts under the All Domain Situational Awareness (ADSA) program from the Department of National Defence in 2017. One of the program requirements was to demonstrate Long Range Detection and Communications using a sound source and an acoustic array optimized for low frequency. Once again, the groundbreaking technology of CBASS highlighted its efficiency and unprecedented compact form and low costs.

As part of the ADSA program, the systems were deployed cooperatively in operational conditions achieving communication ranges exceeding 600 km off the Scotian Shelf and confirming modelling expectations. Such a performance demonstrates the capability to deliver a complete subsea persistent surveillance solution enabling targeted localization and monitoring of key Arctic regions for improved strategic decision-making.

Leveraging the technology developed for the ADSA program, a family of several types of C-Bass sources was developed with flexible power and size attributes suitable for defense, scientific and commercial applications.

The completion of GeoSpectrum's ADSA projects marks the beginning of the next phase of Canadian Arctic sub-sea surveillance. GeoSpectrum has determined that the low frequency source can help to support four key capabilities critical for persistent Arctic surveillance: environment-specific performance predictions, subsea communication between unmanned assets and operators, long-range passive monitoring using cost-effective



» CBASS deployment on the All Domain Situational Awareness (ADSA) program, off the Scotian Shelf. (Image credit: GeoSpectrum)

unmanned platforms, and under-ice localisation and tracking at key choke point locations.

WHAT'S ON THE HORIZON:

CBASS has a unique range of applications, including long-range surveillance and communication; diver and fish deterrence; submarine noise augmentation; ASW training; sub-bottom profiling; and bioacoustics (to name a few).

With a five-year plan in place, the team at GeoSpectrum is focused on both the defense and commercial sectors, with goals for CBASS being a primary augmenter on nuclear submarines, as well as providing ocean infrastructures with a more environmentally safe deterrent for aquatic life. To further their involvement with the science and technology industry, CBASS has the potential to aid in the protection of Right Whales and other porpoises from entering dangerous shipping lanes.

With the broadening capabilities of CBASS, GeoSpectrum is always partnering with clients to regularly identify new applications for this dynamic technology.

For more information, visit: WWW.GEOSPECTRUM.CA



» Thuraya 4 NGS Earth View (Photo credit: Kongsberg)

KONGSBERG AWARDED CONTRACT FOR MOBILE COMMUNICATION SATELLITE

KONGSBERG has developed world-class signal processing equipment that provides improved mobile coverage in areas with insufficient ground network.

The equipment is to be integrated in Airbus Defence and Space's new mobile communication satellite, Thuraya 4-NGS. The agreement includes manufacturing and test of electronics from Kongsberg Defence & Aerospace, division Space & Surveillance in Horten, Norway.

The satellite will deliver higher capabilities and flexibility while increasing capacity and coverage across Europe, Africa, Central Asia and the Middle East. The new generation of modular digital processors from Airbus Defence and Space offers full flexibility for more than 3,200 channels and dynamic allocation over a large number of spot beams.

KONGSBERG will deliver integrated L-band pre- and post-processors. These enable the satellites to meet the communication needs at all times, both when new requirements appear and/or when the local capacity is too poor. The L-band processors are «SAW»-based (Surface Acoustic Wave filters) and the development is supported by European Space Agency and the Norwegian Space Agency.

KONGSBERG has a strong design and manufacturing capability for satellite onboard electronics, per date with hardware on more than 200 satellites. The company has a global footprint with all major primes.

"We are proud to be a trusted partner to Airbus Defence and Space. They have been an important customer for many years, and this contract secures our leading position within the mobile GEO-satellite market. It gives us a solid foundation for further growth and development," says Director of Marketing in Space and Surveillance at Kongsberg Defence & Aerospace, Ellen Dahler Tuset.

GREENSEA'S OPENSEA AS A PLATFORM PUT TO WORK FOR HOUSTON MECHATRONICS

Greensea's OPENSEA®, the universal open software architecture for the marine industry, was recently selected by Houston Mechatronics Inc. (HMI) as the development platform for their revolutionary product, Aquanaut. HMI was able to leverage Greensea's experience in subsea navigation and vehicle control while focusing their development efforts on their core competencies—robotics, manipulation, and autonomy.

"OPENSEA enabled us to quickly integrate an executive control and mission planning solution onto Aquanaut, our transforming AUV/ROV. The open and modular architecture of Greensea's software allowed us to pick and choose tools within the SDK that covered our own software gaps. This, in turn, allowed us to bring our testing forward and achieve both our customer's and company's milestones during early Aquanaut development and testing," said Jide Akinyode, Aquanaut Program Manager.

"HMI is the perfect example of how OPENSEA as a Platform can be used to expand a company's technology footprint without adding the overhead of having foundation-level technologies such as navigation and vehicle control," commented Ben Kinnaman, CEO of Greensea. "Greensea has spent more than a decade developing and testing systems needed for highly accurate subsea navigation and control in all kinds of hostile, demanding environments. Using the OPENSEA SDK, HMI is able to develop a revolutionary idea on a robust platform."

HMI's Aquanaut is a multipurpose subsea robot which employs a patented shape-shifting transformation from an Autonomous Underwater Vehicle (AUV) to a tetherless Remotely Operated Vehicle (ROV), removing the need for large vessels and umbilicals. The vehicle's two distinct operating modes enables both the efficient collection of data as well as the remote operation of maintenance and repair tasks at a significantly lower cost than today's technology.



» HMI's Aquanaut is a multipurpose subsea robot (Photo credit: HMI)

MARINETRAFFIC EXTENDS PARTNERSHIP WITH ORBCOMM FOR SATELLITE AIS DATA

MarineTraffic has extended their contract through the end of 2023 for ORBCOMM's satellite Automatic Identification System (AIS) data used for ship tracking and other maritime navigational and safety efforts. MarineTraffic, which has been an ORBCOMM partner since 2013, uses ORBCOMM's satellite AIS data to track real-time and historical movements of ships as well as their arrivals and departures in harbors and ports around the world. MarineTraffic combines ORBCOMM's comprehensive AIS data with positional data from their extensive network of land-based receiving stations to provide actionable maritime intelligence solutions and improve the maritime ecosystem. By leveraging ORBCOMM's reliable, high-performance AIS service, MarineTraffic helps their government and commercial customers enable maritime domain awareness, search and rescue, environmental monitoring and maritime intelligence applications. In addition, MarineTraffic will explore ORBCOMM's other monitoring solutions as part of their efforts to expand their offering for the shipping industry and provide complete supply-chain visibility.

"We are excited to continue supporting MarineTraffic's efforts to improve the overall maritime ecosystem by harnessing the power of ORBCOMM's satellite AIS technology," said Greg Flessate, ORBCOMM's Senior Vice President and General Manager, Government and AIS. "As we collaborate on the next phase of our partnership, MarineTraffic will be able to leverage ORBCOMM's industry-leading IoT solutions to enhance the end-to-end view of the global supply chain."

"We are delighted to extend our long-standing relationship with ORBCOMM for another three years," said Demitris Memos, MarineTraffic's Chief Executive Officer. "MarineTraffic takes great pride in the collaboration with ORBCOMM and especially appreciates the reliability of ORBCOMM's satellite AIS service, which is respected across the industry. We look forward to working with ORBCOMM as we continue to provide our global customers with digital maritime solutions that improve visibility, safety, compliance and operational efficiency at sea."

ORBCOMM's pioneering satellite AIS data service has provided the most comprehensive and reliable global coverage in the market over the last decade. ORBCOMM continues to advance its AIS business by enhancing its satellite AIS service with two new, next-generation AIS CubeSats, which are expected to expand coverage of ORBCOMM's constellation, increase visibility to smaller Class B ships and extend its polar footprint with launches planned on separate missions within the next year. In addition, ORBCOMM is working with AAC Clyde Space and Saab to develop a next-generation, space-based VHF Data Exchange System (VDES) satellite, expected to launch in 2022, which will revolutionize maritime communications by providing more extensive global coverage, increased bandwidth and enhanced versatility.

For more information about ORBCOMM's satellite AIS service, download ORBCOMM's whitepaper, Accelerating Digitalization in Global Maritime Trade and Supply Chains: The Evolving Role of AIS Data. www.orbcomm.com/ais-data-supply-chain


**SAFER FLIGHTS.
BETTER DATA.
ACTIONABLE INSIGHTS.**

Our team of UAS pilots, engineers and machine learning specialists develop and deploy custom-developed aircraft and data processing algorithms to support offshore and onshore inspections.



Contact our team to learn more about our UAS inspection services and technology development capabilities.

 **ULC** ROBOTICS

www.ulcrobotics.com

DYNAMIC POSITIONING IS BECOMING INCREASINGLY DYNAMIC

Sasha Heriot, Business Development & Portfolio Manager, Sensors, Wärtsilä Voyage

Mike Ford, Sales Manager, Americas, Dynamic Positioning Technology, Wärtsilä Voyage

MOVING DP TECHNOLOGY FORWARD

Wärtsilä, the Finland-based global provider of smart technological solutions to the marine and offshore sectors, is an established leader in the development and delivery of Dynamic Positioning (DP) systems and the specialized sensors used by these systems. The Wärtsilä DP group has a lineage dating back to the 1960s, and the sensor group has an almost 20-year history of delivering sensors to the offshore industry. While both groups continue to support the traditional DP customers, the products have continued to evolve to support new applications and markets.

The core capability of a DP system is the closed loop controller. This is designed to handle the mundane task of maintaining the vessel's position and heading for long periods for applications such as holding station while drilling, offloading supplies, or supporting diver operations. It is also used for following Remotely Operated Vehicles (ROVs) when performing pipeline inspections. It is important to understand that while a human can perform these tasks, the availability of an automated system dramatically increases the repeatability of the task and reduces the workload of the crew, allowing them to focus more on the operational aspects of the job.

The evolution of DP largely involves the addition of new operational modes that have enabled the technology to expand into covering new applications. Typical DP systems are complex, the successful operation of which requires trained and



» Wärtsilä's SmartDock represents a market-ready step towards full vessel autonomy. (Photo credit: Wärtsilä)

certified operators. Other applications, which could greatly benefit from "DP-like" capability, require a more simplified method of operation. The cruise industry, for example, directly benefits from tools simplifying vessel maneuvers during low speed port operations, thus enhancing the capability of the Captain. In this case the DP controller is used to take care of one or two axes of movement (surge, sway, or heading) while manual control of the remaining axis can be reduced to a single control handle—the joystick. This simplifies

operations such as docking, where the controller can hold heading and the fore-aft position, while the joystick can be used to drive the vessel laterally towards the dock. Similarly, with a vessel rotation operation within a turning basin, the controller can hold the vessel on station while the joystick is used to control the rotation. Wärtsilä's SmartDrive product can also simplify the operation of other difficult to control vessels, by reducing the impact of higher clutch in levels and numerous thrusters, to a single easy to use coordinated control joystick.

AUTOMATING VESSEL OPERATIONS

In a more radical development, the closed loop controller has been applied to automated vessel operations, resulting in a new product, Wärtsilä SmartDock. Tracks and waypoints are used to provide instructions to the controller, which can then undock a vessel, transit it to a new area of interest, and subsequently guide the vessel to the next docking situation, all without input from the Captain. The SmartDock controller takes care of vessel maneuvers, enabling the Captain to use more time monitoring any ongoing situations surrounding the vessel. Particularly in ferry services, the Captain is relieved of the repetitive task of frequent transits and dockings, resulting in increased safety and more consistent operation of the vessel, potentially even reducing fuel consumption.

While the initial SmartDock product relies on a library of routes for the Captain to



» Particularly in ferry services, SmartDock promotes consistent vessel operation, resulting in greater safety and efficiency gains. (Photo credit: Wärtsilä)

select from, it has evolved to accept track segments from other products. Especially during wind farm operations, an operator may want to create a track of opportunity using a charting system, then transfer the track to the controller. SmartDock also integrates with automated route planners, thereby allowing more advanced navigation and the advancement of more autonomous operations using external situational awareness and collision avoidance systems.

Wärtsilä SmartDock is the world's first market-ready step towards realizing the full potential of vessel autonomy through the provision of docking sensors, DP controllers, and automated technology for seamless, hands-off mooring operations. In addition to increasing safety, the system also reduces crew fatigue while enhancing its capabilities.

Like everything else, DP and automated vessel control is getting smarter all the time. It is an established proven benefit to offshore oil and gas and wind farm operations, but there is tremendous potential in other areas of shipping as well. New applications and extending the use of closed loop controllers to other vessel sectors are already taking place and will certainly play a greater role in the industry's future.

SENSOR SYSTEMS

With maneuvering systems like SmartDock evolving from DP roots, the sensors systems required have also made many leaps forward. The Wärtsilä sensor group has for many years developed both optical and Radio Frequency (RF) based sensors to provide relative positional data. While

these sensors have seen great success in the offshore industry, they too are now being applied for new applications. The

most notable evolution is SceneScan—effectively a Light Detection and Ranging (LIDAR) type product, which has evolved from the laser and prismatic target based CyScan product.

When launched in 2018, Wärtsilä's SceneScan represented a major breakthrough, and a paradigm shift from conventional DP reference sensors. SceneScan is the world's first laser-based targetless relative DP reference sensor and is capable of working without the need for pre-placed positioning targets. Not only does this add significantly greater operational flexibility and deliver a higher level of safety, it also reduces costs by eliminating the need for reflector targets. In 2019, SceneScan received type approval from the DNV GL classification society. Interestingly, the type approval tests were carried out onboard an LNG bunker vessel, highlighting the fact that DP is used effectively in an increasingly broad range of maritime applications.

SceneScan is a unique technology that allows the vessel to be completely independent from the asset it is approaching. The system looks for reflections from all obstructions in its field of view and doesn't need specific reflective targets. Just to emphasize one major advantage of this, for a wind farm supply vessel fitted with a conventional onboard system comprising GPS plus targeted laser positioning, each wind turbine tower



» SmartDock takes care of vessel maneuvers, enabling the Captain to focus on ongoing situations surrounding the vessel. (Photo credit: Wärtsilä)



» SceneScan's Monopole Tracking is designed to identify and track its target (the monopole) whilst the vessel transfers people to and from the wind turbine. (Photo credit: Wärtsilä)

requires multiple reflector targets, and this is a considerable cost factor. SceneScan eliminates this cost. In addition, SceneScan completely eliminates the possibility of so-called walk-off-incidents, phenomena that all traditional targeted systems suffer. This can happen when the laser sensor locks onto a "false" target, for example the high-vis jacket of a technician walking around the wind turbine platform. If this happens, the DP system thinks that the vessel is moving rather than the person and therefore moves the vessel to compensate for its change in position. The consequence of this could be devastating.

While SceneScan has been used with traditional DP systems it has also created

opportunities in other areas. While the earlier mentioned SmartDock product greatly relies on the Global Navigation Satellite System (GNSS) as a position reference, there are situations, such as berthing areas or travelling under bridges, where the GNSS antennas may be masked by structures. For these instances SceneScan can conveniently be used as a secondary position sensor, supplying data to the SmartDock system.

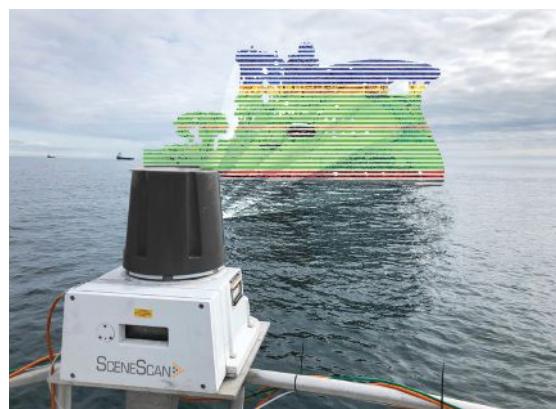
Wärtsilä's SceneScan Monopole Tracking is specially designed for use on wind farm Service Operational Vessels (SOVs). The system has been developed to enable the sensor to look for its target (the monopole) at approximately 200 meters, and then to

continue tracking it throughout the whole operation and whilst transferring people to and from the wind turbine. This represents a considerable improvement in safety levels for operations within the wind farm.

Wärtsilä is actively carrying out sea trials to demonstrate the radical difference delivered by SmartDock and SceneScan compared to conventional systems, and to firmly establish that they deliver features that are needed and asked for.



For more information, visit
[WWW.WARTSILA.COM/
VOYAGE](http://WWW.WARTSILA.COM/VOYAGE)



» Wärtsilä's SceneScan is a laser-based targetless relative DP reference sensor capable of working without the need for pre-placed positioning targets. (Photo credit: Wärtsilä)

TSC STRATEGIC BOLSTERS MARKET REPORT BUSINESS

TSC Strategic is continuing to ramp up investment in producing data-led market reports for the ocean and offshore industries. The decision comes on the back of a successful 2020, which saw the agency add four new titles to their current offering: 1. Autonomous Surface Vehicle (ASV) Market Summary and Forecast, 2020-2024; 2. Forecasting the Next Decade of US Offshore Wind Cable Demand; 3. Navigating the BiOp; and 4. 2020 Submarine Fiber Optic Market Report.

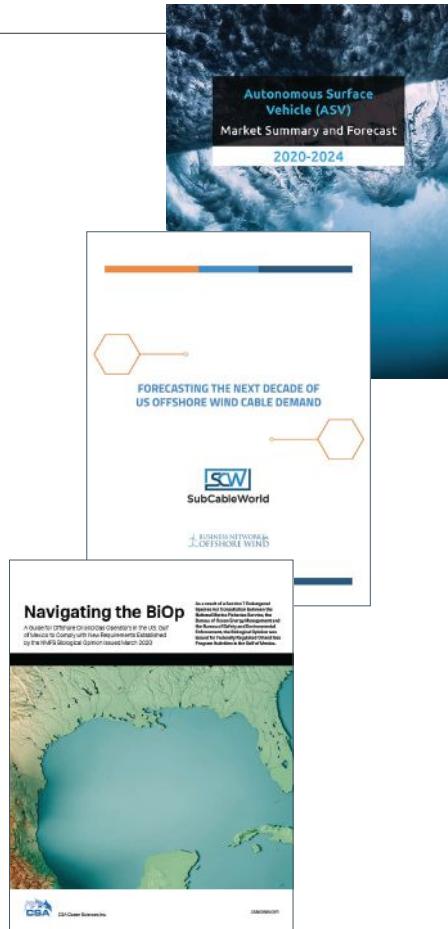
"We have seen a significant uptick in demand for reliable data and analysis amid the uncertainty surrounding the COVID-19 pandemic," according to Jessica Lewis, TSC Strategic's director of operations. "There are certain industries, both emergent and well-established, that are experiencing unprecedented growth and our reports equip readers with the ideal balance of historical

context and proprietary forecast modelling to gain a critical advantage."

The reports are designed to provide readers with quick access to actionable insights to these fast-paced markets and are authored by the agency's stable of subject matter experts. In addition to a growing catalogue of reports, TSC Strategic also offers an exclusive custom report service.

"Our team is backed by five decades of ocean domain experience, which affords us the enviable ability to focus our attentions on key sector developments, such as the advances of marine robotics, but also work with partners to develop fully custom reports," Ms. Lewis added.

To find out more about TSC Strategic's titles or consulting services, visit: www.tscstrategic.com



Watch & Record Live Video in 1080p Full HD Quality

Fishers **NEW** TOV-2HD
Towed Video System

New for
2020

- 1080p HD video
- 3000 lumen LED lighting
- Commercial construction
- Towed or suspended from boat
- Leak detection circuitry
- Powered topside for unlimited viewing
- Starting at \$5,295



JW Fishers Mfg., Inc
(800)822-4744
(508)822-7330
Email: info@jwfishers.com
www.jwfishers.com



CHECK THE TECH THE AI MASTERSHIP

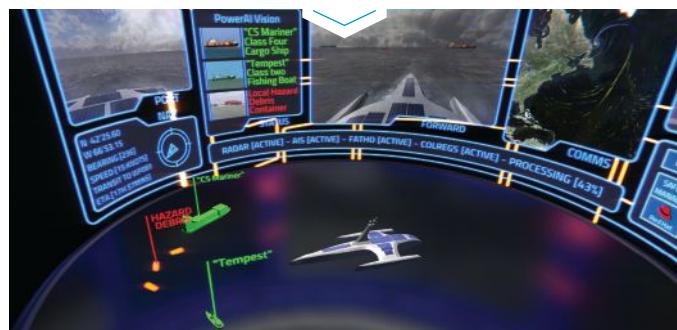
The Mayflower Autonomous Ship (MAS) is the embodiment of today's AI-powered, unmanned marine systems. Poignantly named after the merchant ship that transported the first English Puritans to the New World in 1620, this modern-day masterpiece represents a project of transatlantic collaboration like no other, uniting commercial partners Promare and IBM, as well as a raft of other global sponsors.

Following two years of design, construction and training of its AI models, MAS was officially launched on September 16 in Plymouth, UK, fittingly from the very port that bid "fair finds and following seas" to the original *Mayflower* back in the seventeenth century. However, the MAS project is less about the last 400 years, and more about the next.

September's unveiling triggered a six-month schedule of sea trials, after which the 15-meter trimaran will attempt a crewless Atlantic crossing, initially slated for April 19, 2021. The hope is that by leveraging the advances in autonomous technology—powered by machine learning and edge computing—the Mayflower Autonomous Ship will prompt a new era for oceanography, typified by the deployment of unmanned systems to safely and efficiently gather critical ocean data pertinent to climate change, micro-plastic pollution, and marine habitats.

AI-INSPIRED DESIGN

Constructed of aluminum and composite materials, and with a weight of just 5 tons, MAS has been designed to optimize vessel stability and hydrodynamic efficiency. Lithium ion-phosphate batteries, in addition to solar panels, power the onboard computer systems and drive the dual 20 kW permanent magnet electric propulsion motors. Top speed is 10 knots, with a payload capacity of 0.7 tons. Autonomous operations are personified by an "AI Captain"; Built by MarineAI and based on a number of IBM technologies, the AI Captain correlates data from MAS's onboard sensors and systems, including GNSS (Global Navigation Satellite System), IMU (Inertial Measurement Units), radar, weather station, SATCOM, and AIS.



» MAS's advanced computing system enables autonomous object detection, classification, and avoidance. (Image credit: University of Birmingham's Human Interface Technologies Team)



» MAS was officially launched on September 16 in Plymouth, UK. (Image credit: Tom Barnes for IBM)

MACHINE LEARNING (ML) AND EDGE COMPUTING

Mayflower technicians have used over a million nautical images to fine-tune the ship's AI models—and training is ongoing. To meet ML processing demands, the team relied on an IBM Power AC922 fueled by IBM Power9 CPUs and NVIDIA V100 Tensor Core GPUs, the same technologies behind the world's smartest AI supercomputers. This advanced computing system enables autonomous object detection, classification, and avoidance. While at sea, MAS will process data locally, increasing the speed of decision making and reducing the amount of data flow and storage on the ship.

BEYOND OCEANOGRAPHY

The implications of a successful and unimpeded transatlantic crossing are far-reaching; in many ways, the Mayflower is as much about autonomous marine operations as it is oceanography. Brett Phaneuf, Co-founder and Co-Director of the Autonomous Ship project, told ON&T:

"Autonomy clearly is key to the development of unmanned ships conducting research and commercial operations in the future. But perhaps the greater, more immediate need for autonomy is on manned vessels of today. This may sound counter-intuitive, but there is an important role for autonomous systems on the manned ships, acting as a co-captain, maintaining situational awareness, providing recommendations and decision support to the human crew. Think of it as 'Augmented Intelligence': machines helping people with the efficient and safe navigation of the ship."

The extent to which autonomy could transform the maritime industry remains to be seen, but pioneering initiatives like MAS will prove fundamental to refining options and extending our technical capabilities.

For more information: www.mas400.com



» Dual 20 kW permanent magnet electric propulsion motors deliver a top speed of 10 knots, with a payload capacity of 0.7 tons. (Image credit: Promare)

DIGITAL TECHNOLOGIES BOOST EARNINGS AT JOHAN SVERDRUP

One year after the field came on stream digital solutions are key to maintaining high safety standards and value creation in all parts of the operations at Johan Sverdrup. This has increased earnings by more than NOK two billion.

Digital solutions help increase subsurface understanding, ensure more efficient start-up of wells, higher stable production and more efficient maintenance.

"Our experience shows that digital tools have a positive effect on value creation on the Johan Sverdrup field, while helping improve the workday for people offshore and in the onshore organization. The use of digital tools provides a better overview of the situation, which in turn contributes to increased safety during daily work offshore and onshore. We accomplish more in a safer and smarter way," according to Rune Nedregaard, VP for Johan Sverdrup operations.

The increased earnings are mainly a result of:

- ➔ Higher stable production by means of automated production optimization.
- ➔ Improved accuracy in the reservoir by means of broader and more complex data sets, providing us with more information about the reservoir.
- ➔ More efficient operations and maintenance by means of the solutions for the digital field worker where the operators use tablets in their daily work and the digital twin, which is a virtual copy of the platform.

Collaboration with the integrated operations center onshore is vital to optimize production and de-bottleneck processes. This can reduce unscheduled downtime, and improve maintenance and energy utilization.

At Sverdrup a number of other digital initiatives are also being tested out, such as robots over and under water, machine learning and the use of 3D printing technology.

This year there has been a notable uptake of digital solutions, both in Norway and internationally. Employees onshore and offshore see that data-driven decision-making, portable units and personalized applications as part of everyday life and contribute to a simpler, safer and more efficient workday.

"For Equinor this is about continuously improving by getting increased access to relevant information and efficient use of digital technologies. This will contribute to stronger collaboration across organizational units and with our partners, and more frequent sharing of best practice," says Torbjørn Folgerø, chief digital officer at Equinor.



» Johan Sverdrup operators use tablets in their daily work and the digital twin, which is a virtual copy of the platform. (Photo credit: Ole Jørgen Bratland)



» In the first year on stream Johan Sverdrup has produced some 130 million barrels of oil. (Photo credit: Ole Jørgen Bratland)

EDAMEN COMPLETES OCEANXPLORER REBUILD

Damen Shipyards Group recently completed the extensive rebuild of research vessel *OceanXplorer* at Damen Shiprepair Rotterdam.

OceanXplorer is now the most advanced exploration, research and media vessel in the world. Equipped with a series of submersibles, sonar arrays, manned submarines, an ROV and AUV, *OceanXplorer* is fully equipped to map the oceans and collect live samples.

The project required Damen to rebuild the vessel—formally an offshore survey ship—

from the main deck upwards by remodeling the existing accommodation and adding new laboratories, workshops and submarine hangar. A fully integrated heli hangar was also added.

Damen worked closely with OceanX's specialist teams to manage updates to the interior and exterior of the vessel. The ship is unique in its pairing of up-to-the-minute research facilities—courtesy of renowned naval architects Skipsteknikn—and top-of-the-line interior accommodations, designed by Christina Fallah. Additional design elements were styled by Steve Gresham.

The project also required Damen to undertake a docking scope, which included the removal and refurbishment of azimuth and bow thrusters, as well as the blasting and coating of tanks.



» *OceanX's OceanXplorer*



» The prototype fuel cell will be tested at the Sustainable Energy Catapult Centre at Stord, Norway prior to being installed aboard one of Odfjell's newest chemical tankers for a trial period. (Photo credit: Odfjell)

FUEL CELL PROJECT DEVELOPS GROUND-BREAKING FUEL SOLUTION

New and flexible fuel cell technology can reduce emissions from shipping by 40 to 100%. Partners from shipping, R&D and oil and gas are now constructing a pilot system that can use different types of fuel. The system will first be tested at the Sustainable Energy catapult center in Norway before installation on board a chemical tanker. The unique project was presented to the Norwegian Prime Minister, Erna Solberg, during a ceremony celebrating an expansion of the catapult center yesterday into "Future Fuel Test Center".

The new technology opens for many different types of fuel, including green ammonia and LNG. With this flexibility, vessels can choose fuel according to availability. The main partners in the project are Odfjell, Prototech, Wärtsilä and Lundin Energy Norway. Odfjell has leading expertise in global shipping, Prototech in fuel cell technology, Wärtsilä in maritime technology and energy, and Lundin Energy Norway in oil and gas.

"Our tests show a CO₂ reduction of as much as 40-45% when using LNG, compared to current solutions. Increased efficiency and reduced fuel consumption also provide significant cost savings, and the ship will be able to sail significantly longer on the same amount of energy. The system will also be ready to operate completely emission-free from the locations where, for instance, ammonia is available for bunkering," says Bernt Skeie, CEO of Prototech.

"The technology also enables direct capture of CO₂, which will be yet another alternative for emission-free operation when logistics for CO₂ management become available," Skeie explains.

Around 90% of the world trade is transported by ships. Ship transport is still the most environmentally efficient way of carrying goods, but to achieve Norwegian shipping's target of becoming climate neutral by 2050, new, energy-efficient solutions must be introduced.

The project aims to develop a technology that can provide emission-free operation over long distances. Battery solutions are currently not suitable for operating ships that sail long distances, the so-called "deep-sea" fleet. This fleet consists of around 50,000 ships globally and thus constitutes a significant share of international shipping. It is impossible to achieve the goal of climate neutrality without finding solutions for this significant segment.

The unique feature of the new technology is its high energy efficiency and the flexibility that enables significant emission reductions already from day one with the use of currently available infrastructure for LNG—while also preparing for emission-free operation in line with the development of value chains and infrastructure for sustainable fuels in the years to come.

"Ships are to be operated for 20-30 years, and we need flexible solutions that can meet future emission requirements. We do not have time to wait, we have to think about zero emissions already now," says Erik Hjortland, Technology Director at Odfjell SE. "The fuel cell project is one of the paths we are pursuing. We focus on machinery rather than focusing on one single type of fuel. Fuel cell technology gives us flexibility that ensures environmentally efficient operation regardless of fuel changes that may occur in the years ahead."

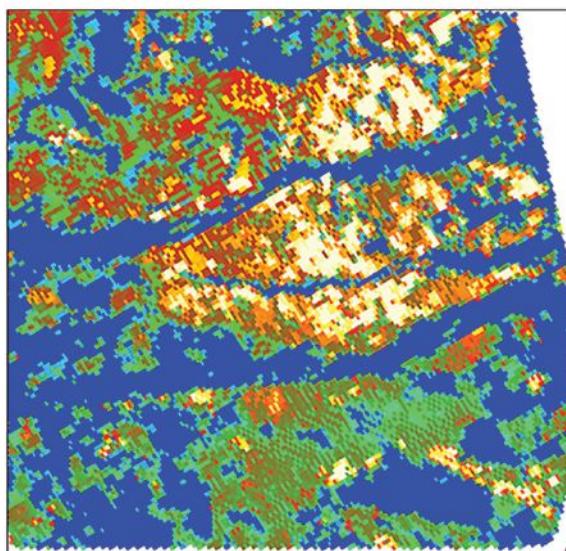
"The new energy solution has the potential to take us a big step closer to the goal of climate neutrality. And it does not stop with ships, this solution can also be used in offshore oil and gas operations," says Ingve Sørfonn, Technical Director in Wärtsilä.

Harald Solberg, CEO of the Norwegian Shipowners' Association, emphasizes the potential this project demonstrates.

"The development of this fuel cell is an example of how forward-looking shipping companies and our unique maritime expertise have the prerequisites to drive new solutions through a broad collaboration within the maritime cluster. In the long run, scaling up such solutions will be of great importance in achieving our climate goals, they will have business value, and they can create new jobs in Norway. Norwegian shipping has set ambitious climate goals. This type of project is very important for us to be able to develop solutions that quickly reduce emissions."

So far, the project has been funded with support from Gassnova, NFR, and the participants themselves. Now the project is constructing a 1.2 MW prototype fuel cell that first will be tested at the Sustainable Energy catapult centre at Stord, Norway. Then it will be mounted and tested onboard one of Odfjell's newest chemical tankers.

CGG GEOSOFTWARE RELEASES NEW RESERVOIR CHARACTERIZATION TECHNOLOGY



» Probabilistic Net Pay in the Gulf of Mexico from a facies-driven deterministic inversion. (Image credit: CGG GeoSoftware).

CGG GeoSoftware has released new versions of its Cloud-ready reservoir characterization and petrophysical interpretation software with innovative enhancements that boost performance and improve usability.

Jason Workbench 10.2 offers enhanced display options, upgraded QCs and monitoring, and more user-friendly interfaces. The Python machine learning ecosystem contains additional basic and advanced sample scripts and Jupyter notebooks, making it even easier for clients to build their own workflows. Optimizing performance continues to be prioritized, particularly within its geostatistical reservoir characterization technology.

The new features and functionality of HampsonRussell 10.6 include an interactive radon analyzer, an AVO interpretation crossplot template, improved convenience in retrieving inversion models, greater parameter flexibility and a new inversion algorithm.

PowerLog 10.2 for petrophysical interpretation now offers improvements in handling big data, performance enhancements, and data preparation automation for patching curves. A complete automated log editing workflow is available through a collection of modules which includes Outlier Detection, Log Patching, and Synthetic Curve Generation. As a critical part of PowerLog's patented workflow, Outlier Detection enables users to detect data spikes and anomalies and then replace bad data with patches or synthetic curves. The resulting high-quality curve data is essential in generating accurate interpretations, pore pressure predictions, and for use in seismic inverse modeling.

Capabilities in the Rock Physics software have also been enriched with new rock physics models, regression, curve fitting and an enhanced interface.

InsightEarth 3.6 now has new features, including the recently announced WellPath interactive well path planning technology. The WellPath QuickPlan workflow automates planning for large multi-well pads or platforms and builds all well plans simultaneously.

Kamal al-Yahya, Senior Vice President, GeoSoftware & Smart Data Solutions, said: "During these difficult times, we are proud that our teams persevered through the challenges and kept development plans on schedule. This enabled us to deliver significant innovations to the market and value to our clients. These new GeoSoftware releases demonstrate our continued commitment to providing the latest technology in machine learning and reservoir characterization workflows that are essential in helping our clients overcome their E&P challenges."

Ocean Engineering

OceanPack™

pCO₂ Underway
Modular, easy to use and reliable monitoring systems

Li-Ion Batteries
Highly reliable, efficient and safe underwater power solutions

COTS

Vehicle

Subsea

SubCtech GmbH
www.subCtech.com
info@subctech.com

SubCtech Subsea Technologies

COASTAL VIRGINIA OFFSHORE WIND READY FOR BUSINESS



Dominion Energy recently announced that the two turbine, 12-MW Coastal Virginia Offshore Wind (CVOW) pilot project, located 27 miles off the coast of Virginia Beach, successfully completed reliability testing and is ready to enter commercial service to deliver clean, renewable energy to Virginia customers.

"This is a monumental day for the Commonwealth and the burgeoning offshore wind industry in America as CVOW is ready to deliver clean, renewable energy to our Virginia customers," said Joshua Bennett, Dominion Energy VP of offshore wind. "Our team has worked diligently with key stakeholders and regulators while safely navigating through the coronavirus pandemic to complete this vitally important project that is a key step to reducing carbon emissions."

The next significant regulatory step for CVOW is to submit the final documentation for the Bureau of Ocean Energy Management

(BOEM) to complete its technical review, which is expected to be complete by the end of the year. The turbines will remain in operation during this review process. CVOW is the only project currently permitted under the BOEM process and will be the first fully operational wind power generation facility in U.S. federal waters with the capability to generate enough electricity to power up to 3,000 Virginia homes.

Offshore wind generation is a major component of Dominion Energy's comprehensive clean energy strategy to meet standards mandated in the Virginia Clean Economy Act and to achieve the company's net zero carbon dioxide and methane emissions commitment by 2050.

The company will apply the valuable permitting, design, installation and operations experience from the pilot project to its proposed 2,600-MW commercial project. That project, which is the largest announced offshore wind project in

North America, is on track to commence construction in 2024, and upon completion, will provide enough renewable electricity to power up to 660,000 homes.

According to an economic impact study performed by Glen Allen-based Mangum Economics and commissioned and published by the Hampton Roads Alliance, it is estimated that the CVOW commercial project could create approximately 900 jobs and \$143 million in economic impact annually during construction and 1,100 jobs and almost \$210 million in economic impact annually during operation of the turbines.

Similarly, during construction, the 2.6-GW CVOW commercial project is estimated to generate nearly \$5 million per year in local and state tax revenue which increases to almost \$11 million annually once the project is commissioned and operational.

A variety of Virginia-based companies contributed to the CVOW pilot project and Dominion Energy remains committed to positioning Hampton Roads as a supply chain hub for U.S. offshore wind efforts, which can create thousands of clean energy jobs in the Commonwealth.

Customers will see no increase in rates for the pilot project under the provisions of the Grid Transformation and Security Act of 2018.

Installation of the two pilot turbines was completed in June. Ørsted served as the offshore engineering, procurement and construction lead for the pilot project. The L. E. Myers Company with members of the International Brotherhood of Electrical Workers, performed the onshore construction work.

Work continues on Dominion Energy's proposed 2.6-GW commercial wind project and its Construction and Operations Plan is on schedule to be submitted to BOEM later this year.



» The contract will see Cyberhawk collect inspection data from onshore and offshore oil and gas assets in the Middle East

CYBERHAWK AWARDED FIVE-YEAR AGREEMENT WITH MAJOR LNG PRODUCER IN THE MIDDLE EAST

Cyberhawk, the global leader in drone-based inspection and creator of iHawk, a cloud-based asset visualization software, has secured a five-year contract with a global LNG producer for the provision of drone inspection, surveying and data visualization services.

The contract will see Cyberhawk focus on collecting engineering-grade inspection data from oil and gas assets in the Middle East, onshore and offshore, which will be delivered as detailed inspection reports via Cyberhawk's drone data visualization software, iHawk.

Established in 2014, iHawk allows asset teams to view up-to-date, visual data securely in the cloud. The software improves asset management and decision-making by allowing managers to intuitively access inspection data that highlights where they can monitor defects and degradation, before deciding what action should be taken and when.

The contract with the state-owned oil and gas company was secured by Manweir LLC, Cyberhawk's local partner, which is working closely with the technology firm to build a strong regional presence and establish in country value for local operators. The agreement allows any local energy operator to enlist Cyberhawk's technology solutions through this contract, making it the preferred drone inspection and visualization partner in

key oil producing countries within the Middle East region.

Chris Fleming, CEO at Cyberhawk said: "This agreement is testament to the high standard of work that Cyberhawk has been delivering in the Middle East region for the past 10 years. By working closely with the client and local authorities, we were able to obtain the Minister of Interiors permit to fly in-country. Our aviation and oil and gas pedigree were an integral part of the selection process and we are extremely proud our track record has been recognized.

"We want to show our client and key regions in the Middle East how drone and visual data technologies can be leveraged to perform remote inspections and digitize assets. This is an extremely exciting partnership, where knowledge will be shared to benefit the local economy and businesses and allow oil and gas producers to thrive in the new digital era."

Kevin Bathgate, Manweir LLC's MD reinforced: "Manweir are extremely happy with our long-standing partnership with Cyberhawk and to be part of the client's ongoing journey through digital transformation. Not only will this partnership lead to accurate data analysis, improved planning and efficiencies, but will also lead to significant reduction to risk exposure related to employee safety and welfare."

OCEANEERING AWARDED BOP TETHERING SERVICES CONTRACT FROM PETROBRAS IN BRAZIL

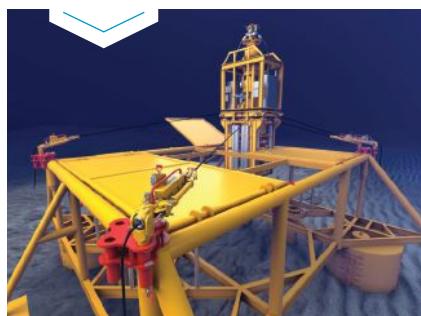
Oceaneering International, Inc. recently announced that the company has been awarded a BOP tethering services contract offshore Brazil from Petrobras. The contract duration is one-year with the option to extend for an additional 12 months.

The scope of work includes data acquisition and real-time riser analysis for dynamic positioning rig operations for up to seven wells in water depths between 150 meters and 700 meters.

Oceaneering will provide eight suction piles that will be manufactured locally as well as 10 wellhead load relief (WLR) tensioners, one monitoring system to be integrated on the BOP, and one suction pile pump to install the suction piles.

An anchor handling tug supply (AHTS) vessel will launch and install the suction piles and tensioners. The drilling rig will be used to connect the tensioners to the BOP.

"We appreciate Petrobras' trust in our ability to provide dependable and cost-effective technologies and services," said Daniel Nogueira, Manager, Oceaneering Projects Group. "This award reinforces our position and track record as a high-quality service provider in Brazil. This is an amazing opportunity for Oceaneering to expand its capabilities in Brazil with BOP anchoring services."



» Oceaneering's WLR System (Image credit: Oceaneering)

COLLABORATION TO ADVANCE ROBOTICS IN OFFSHORE RENEWABLES

Two of the UK's leading research organizations in the development of robotics for use in offshore renewables are to collaborate to strengthen the relationship between applied academic research and industry need and further develop and amplify the sector's robotics opportunity.

The Offshore Renewable Energy (ORE) Catapult and the Offshore Robotics for Certification of Assets (ORCA) Hub, a collaboration led by the Edinburgh Centre for Robotics (Heriot-Watt University and the University of Edinburgh), with Imperial College London and the Universities of Oxford and Liverpool, will work together to translate UK robotics innovation and research expertise into products and services for the offshore renewables industry and link key commercial partners with academia.

Both organizations will use their research expertise and unique test and demonstration facilities to undertake joint research programs and projects, as well as developing future skills by supporting MSc and PhD projects. They will also develop a national strategy with specific robotics technology innovation roadmaps towards commercialization.

Chris Hill, ORE Catapult's Operational Performance Director, said: "This collaboration with the UK's leading universities in the field of applied robotics will enhance the technical capability and credibility of our Operations & Maintenance Centre of Excellence. We will be able to bridge the gap between the cutting-edge applied robotics research taking place in the UK right now and the needs of industry, who are focused on driving down costs, improving health and safety and ultimately the productivity and efficiency of our offshore renew-



» 'Husky' undergoing robot safety compliance and self-certification trials at ORE's Catapult's National Renewable Energy Centre in Blyth, Northumberland.

able energy plant."

Professor David Lane CBE, ORCA Hub Director, said, "This collaboration with the ORE Catapult builds on our on-going work within the renewables sector. The ORCA Hub, part of the National Robotarium, is developing use-inspired robotics and AI technology from the science base, driven by industry challenges. There is enormous scope for the application of robotics solutions within the energy sector to reduce cost and risk, increase productivity and contribute towards net zero energy transition."

The two organizations last worked together in 2019, when ORCA Hub held a successful robotics demonstration day at ORE Catapult's National Renewable Energy Centre in Blyth, Northumberland, highlighting some of the cutting-edge technologies currently in development, and how these could be applied in the real world.



» Offshoretronic's new ADD-ON installation concept promises significant time and fuel savings. (Image credit: Offshoretronic)

Offshoretronic has developed a new game-changing ADD-ON Installation Support Tower Concept to be installed on their unique Dual Crane Offshore Wind Installation Vessel.

This new concept allows Offshoretronic to transport and install two finished wind turbines of up to 11 MW capacity in one single

OFFSHORETRONIC'S NEW ADD-ON INSTALLATION SUPPORT TOWER CONCEPT

round trip, resulting in savings of around 40% in operational time and around 15% in fuel consumption compared to large Jack-up vessels. For larger turbines, Offshoretronic can install the turbine tower together with the nacelle as one single unit, whilst the turbine blades could be installed with a smaller size Jack-up vessel in assistance mode. The ADD-ON Installation Support Tower is fully modular and can be installed and removed by the Vessel's own Heavy Lift Mast Cranes.

To allow for smaller and lighter support tower construction, all weight of the turbine is

supported on the Lower Support Beam and by the Crane Boom wires. This arrangement will give additional load stability and support to the Support Tower. The lifting and lowering of the wind turbine will be done by the mast crane main winches with a lifting and heave compensation capacity of 1200 MT.

For more information, visit
WWW.OFFSHORETRONIC.TECH

HARVEY GULF SUBSEA SOLUTIONS SELECTS OCEANEERING FOR ROV AND SURVEY SUPPORT

Harvey Gulf Subsea Solutions has selected Oceaneering International for ROV and support services onboard its four U.S. Flagged Jones act compliant vessels.

Under the agreement, Oceaneering will provide eight Millennium Plus ROV systems, personnel and accompanying survey suites in a multi-year deal supporting Harvey Gulf Subsea as they move ahead with plans to become a bespoke solution provider for Gulf of Mexico.

Harvey Gulf Subsea Solutions CEO Shane Guidry commented: "Our US Flag, Jones Act Fleet are the premier construction assets in the Gulf of Mexico. Our investment in powerful, modern, fuel efficient and built for purpose platforms continues to pay dividends. It allows our vessels to transit faster and DP in higher currents and heavier sea conditions with lower fuel consumption and carbon emissions than our competitors. Once outfitted with batteries, the fleet will further reduce carbon emissions thus helping our clients with meeting their decarbonizing goals. Additionally, both the 165MT and 250MT class vessels lower more weight faster and safer than our competition's comparable assets. This gives our clients a higher safety factory when lowering and lifting and reduces liability exposure. These vessels were built with efficiency and safety as cornerstones of their designs to save our client's time and money."

After reviewing the needs of our clients, stretching from well intervention and hydrate remediation to deep water lifts and IMR services, creating an integrated solution provider became obvious. Coupling the best vessels in the Gulf of Mexico with the best ROV solution provider made the best possible sense.

Leading Harvey Gulf Subsea Solutions Edward Galloway commented: "Aligning with the Global leader in the ROV industry and positioning them on the most versatile fleet of Jones act vessels in the GOM will provide seamless operations and value to the market for many years to come."



» Partnering with a ROV solution provider will allow Harvey Gulf to offer additional value to operators in the GOM for many years to come. (Photo credit: Harvey Gulf)

For more information, visit
WWW.HARVEYGULF.COM

AKER OFFSHORE WIND AND AKER BP PARTNER TO REDUCE CO2 EMISSIONS ON THE NCS

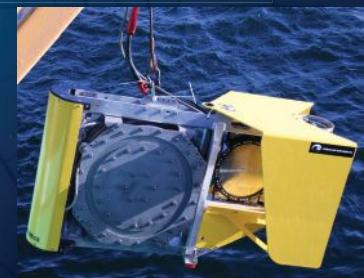
Aker Offshore Wind and Aker BP have agreed to a cooperation agreement aimed at accelerating the process of decarbonizing oil and gas assets and realizing offshore wind in Norway at large scale. The two companies intend to collaborate on concepts for efficient development of large offshore wind parks to enable effective offtake to oil and gas producing assets on the Norwegian Continental Shelf (NCS).

Aker Offshore Wind is taking a role to develop and operate the wind parks. Aker BP will contribute with industry and technology competence and be a potential customer of electricity from offshore wind along with other operators. "Electrifying assets using power from offshore wind could be a key enabler to achieve the next step-change in driving down emissions from operations," said Karl Johnny Hersvik, CEO of Aker BP.



GeoSpectrum Technologies Inc
Customizing Detection

CUTTING-EDGE VLF SOUND SOURCE



C-BASS

POWERFUL, COMPACT & VERSATILE

- 10 Hz to 1000 Hz bandwidth
- Communications to thousands of meters
- Lightweight, compact, and robust

geospectrum.ca | sales@geospectrum.ca

SONARDYNE'S TECHNOLOGIES FOR C-INNOVATION FLEET OFFSHORE BRAZIL



» The Bongo RSV is one of C-Innovation's vessels being upgraded with Sonardyne technologies.

Integrated marine services company C-Innovation (C-I) has chosen a suite of Sonardyne's underwater positioning and navigation systems to support its operations offshore Brazil.

Remotely operated vehicles (ROVs) on board six ROV support vessels (RSVs) in the country will be equipped with Sonardyne inertial, gyrocompass, and Doppler technologies, as well as hybrid acoustic-inertial systems.

Specifically, C-I has ordered SPRINT inertial navigation systems (INS), a Lode-star attitude and heading reference system (AHRS), Syrinx Doppler velocity logs (DVLs) and Sonardyne's hybrid acoustic-inertial underwater vehicle navigation instruments, SPRINT-Nav. C-I has also ordered a quantity of Sonardyne's Compatt 6+ transponders and Wideband Sub-Mini

6+ (WSM 6+) transponder/responders for tracking structures and vehicles.

Most of the vessels (including Bongo, Santos Service, Joe Griffin and Deborah Kay) will be working for Petrobras, and one vessel (Cabo Frio) will be working for Karoon Energy. The scope of work is subsea inspection, maintenance and repair operations (IMR) and ROV support.

Five of the six vessels, which start contracts in Brazil this year, are already equipped with Sonardyne's Ranger 2 Ultra-Short BaseLine (USBL) positioning system, which is used for both dynamic positioning (DP) reference and deep water target tracking.

SPRINT-Nav combines Sonardyne's SPRINT sensor, Syrinx 600 kHz DVL and a high accuracy intelligent pressure sensor pack-

aged in a compact deep-rated housing that's simple to integrate on both remote and autonomous underwater platforms. The tight integration of inertial sensor and raw acoustic aiding data at a low level enables SPRINT-Nav to regularly exceed the most stringent of positioning specifications, making it an ideal choice for vehicle guidance, station keeping and long endurance navigation.

Tomás Peixoto, Survey Manager at C-Innovation, an affiliate of Edison Chouest Offshore and its family of companies, said: "We're pleased to continue the relationship we have with Sonardyne, building on a long-standing partnership and with the local technical support that they offer here in Brazil. With these latest orders, we're ensuring our fleet continues to provide unmatched services to our customers."

Speaking from Sonardyne's base of operations in Rio das Ostras, Brazil, Sonardyne Sales & Applications Manager Andre Moura, says, "With the region's majors committing to new and expanded field developments, the number, scope and value of engineering, procurement, installation and construction (EPIC) contracts placed here in recent months has risen significantly. The versatility and consistent high performance offered by our solutions means that C-Innovation can be confident they will see a return on their equipment investment throughout the life of the projects. That confidence, together with our in-country servicing and support, in turn helps to underpin their ongoing success in the market here."



» Sonardyne's hybrid navigator SPRINT-Nav has been chosen by C-Innovation for its ROVs in Brazil



PRESSURE PRECISION AT ANY DEPTH

» Sensor heads connect easily, and pressure modules can be quickly swapped out before safe deployment.

A new range of instruments introduced by Valeport has been developed with interchangeable pressure sensors to help users who work at a range of different depths. This gives the ability to change the pressure transducers on a single instrument, avoiding the need to buy a number of different instruments.

The new miniIPS2 underwater pressure sensor with accuracy to 0.01% offers a cost effective solution for those who require highly accurate depth information in real time. The new uvSVX which features Valeport's Time of Flight technology delivers SVP with calculated salinity and density data. Both instruments are available with interchangeable pressure modules, with integral calibration in 10, 20, 30, 50, 100, 200, 300, 400 and 600 Bar variants.



A DESIGN INNOVATION

The miniIPS2 and uvSVX have been designed with Remotely Operated Vehicles (ROVs), Autonomous Underwater Vehicles (AUVs) and subsea surveys in mind and are expected to be popular with those who rent out equipment.

Both new instruments are as small and lightweight as possible, and they offer operationally specific interchangeable pressure transducers that deliver enhanced accuracy for specific depth ranges. With field-swappable sensor heads, it is easy for users to select the correct pressure range for their work. This brings benefits of increased accuracy at any depth, as well as cost and space savings because previously users would have required different instruments for shallow and deep water.

Key to Valeport's development of the interchangeable pressure heads was consideration of the ease of use whilst at sea—the sensor heads needed to connect easily and reliably every time they were changed. With no tools required, and without the need to open the instrument, these new advanced pressure modules can be quickly and easily changed whilst in the field. Once the sensor is screwed in, the instrument is sealed and safe to deploy in water.

» The miniIPS2 and uvSVX offer operationally specific interchangeable pressure transducers that deliver enhanced accuracy for specific depth ranges.



» The Mayflower Autonomous Ship (MAS) is equipped with a Valeport uvSVX to enhance operational capability during its Atlantic crossing in 2021.

PRECISION AT SEA

Valeport's uvSVX and miniIPS2 use state of the art signal processing technology, which provides stable repeatable readings that deliver high accuracy data performance.

One of the first applications for the uvSVX is onboard the Mayflower Autonomous Ship (MAS) which is set to self-navigate across the Atlantic in April 2021. Fitted through the hull of the autonomous ship, the uvSVX will help enhance the operational capability of the MAS on its epic journey.

The new miniIPS2 and uvSVX are now available to order.

For more information, contact
SALES@VALEPORT.CO.UK
 or visit VALEPORT.CO.UK



» The FLASC small-scale HPES prototype being tested in Malta in 2018. (Photo credit: FLASC B.V.)

COLLABORATION OF NON-BATTERY BASED ENERGY STORAGE SOLUTIONS

Start-up FLASC B.V., pioneering the development of non-battery based energy storage solutions for the offshore sector, has established a collaboration agreement with Subsea 7, a global leader in the delivery of offshore projects and services for the energy industry.

Hydro-Pneumatic Energy Storage

FLASC's unique, patented Hydro-Pneumatic Energy Storage (HPES) concept combines pressurized seawater with compressed air to create an efficient, large-scale energy storage device that can be applied across a wide range of offshore applications. The technology leverages existing infrastructure and supply chains, along with the marine environment itself as a natural heatsink, resulting in a safe, reliable and cost-effective solution. The first working prototype was successfully tested in 2018 and DNV-GL granted it a Statement of Feasibility based on a technical and commercial assessment.

What Does the Cooperation Entail?

The collaboration combines the innovative 'concept definition capabilities' and specialized HPES system expertise of FLASC with the proven subsea solutions, technologies and experience of Subsea 7 towards the commercialization of offshore HPES. The companies will develop solution classes based on FLASC's core technology, targeting a number of use-cases: from conventional grid-connected wind farm applications to decarbonization initiatives in the offshore oil and gas sector. The parties will also jointly pursue early-stage implementations of these solutions within Subsea 7's (near) future projects.

Daniel Buhagiar, Co-Founder and CEO of FLASC B.V., said:

"We truly believe that sustainable co-located energy storage will be crucial to unlocking the full potential of offshore renewables."

We have seen consistently growing interest for innovations that address the unique challenges of the offshore environment. This collaboration with Subsea 7, a global leader in the sector, is a major milestone in the process of taking our innovative energy storage solution from a proven concept to a versatile commercial product. Through this collaboration, we look forward to accelerating our path to market, in line with the growing demands of an offshore sector in the midst of an accelerating green transition."

Thomas Sunde, VP Strategy and Technology of Subsea 7, said:

"We believe that cost effective and reliable industrial scale energy storage solutions are essential to unlock the promise of offshore renewables and accelerate the energy transition. FLASC's Hydro-Pneumatic Energy Storage (HPES) solution is an innovative technology with significant potential, offering a competitive and more sustainable alternative to Li-ion battery farms. The collaboration with FLASC will allow us to leverage Subsea 7's world-class technical expertise in the development of offshore subsea solutions to accelerate the deployment of utility scale, low maintenance, HPES storage solutions."

"Subsea 7 is strongly committed to a low carbon future and long-term value creation in the energy sector, leveraging our expertise and our experience in the subsea and renewables industries to provide innovative and cost-effective solutions to our clients as they continue on their energy transition journey."

For more information, visit
WWW.OFFSHOREENERGYSTORAGE.COM

ULTRABEAM AND USS TEAM UP FOR AUTONOMOUS PIPELINE SURVEY

Ultrabeam Hydrographic, a multi-award winning, dynamic and agile hydrographic survey company, recently teamed up with Unmanned Survey Solutions (USS) to conduct two subsea gas pipeline inspection surveys in Northern Ireland.

The contract was awarded by Mutual Energy who were keen to gain experience on how unmanned autonomous platforms can increase the knowledge of their pipelines whilst reducing risk and overall cost. Shane Rafferty, Group Engineer, Mutual Energy explained:

"Mutual Energy contracted with Ultrabeam Hydrographic in August 2020, following an open competitive tendering process, to perform inspection surveys of our Larne and Belfast lough crossing pipelines, key components of Northern Ireland's natural gas transmission network. In a first for Mutual, an Unmanned Survey Vessel (USV), the "USS Accession", provided by Ultrabeam's project

partners Unmanned Survey Solutions, was to be deployed. The project commenced only a matter of a few weeks later and was performed as programmed despite some inclement weather and sea states. We were pleased to see early data capture and quality provide assurance of equal standards to previous surveys, such that the assets could be returned a clean bill of health."

The challenges faced by these route surveys were solved by using an Accession Class USV built by USS. This 3.5 m USV was fitted out with an R2SONIC 2024 high resolution multi-beam sonar, SBG Ekinox Navsight Inertial Navigation System and sound velocity sensors from Valeport. The data was acquired in QINSy which was also used as the autopilot for the autonomous line running. James Williams, USS commented:

"The survey conditions were marginal with strong winds, tidal currents and waves



» The USS Accession USV

however the vessel's stabilisation fins ensured that the data was exceptionally clean. We were also able to get closer inshore than on any previous surveys using manned vessels."

Ultrabeam is backed by decades of experience in coastal hydrographic and geophysical survey. They also build their own unmanned platforms for detailed sonar and laser asset inspection. Project Manager Simon Baldwin commented: "We are very happy to have provided Mutual Energy with a great dataset and deliverables as part of their 2020 subsea pipeline inspection campaign. The environmental conditions on site in Northern Ireland were far from benign and the USV and operational team worked faultlessly to provide great bathymetric data, safely and efficiently."



A Performance Inflatables Company
www.AEF-Performance.com



HIGH-DURABILITY FLEXIBLES

- Liquid containment systems
- Berm liners
- Emergency water distribution systems
- Air cushion vehicle skirts
- Industrial diaphragms
- Deployable solids management

Contact:
Address: 113 Street A, Picayune, MS 39466 U.S.A.
Phone: (601) 889-9050 Email: sales@AEF-Performance.com



www.PerformanceInflatables.com



A Performance Inflatables Company
www.Subsalve.com



BUOYANCY INFLATABLES

- Underwater lifting bags
- Vehicle recovery systems
- Pipe pluggers
- Aircraft lifting bags
- Proof load testing products
- Ordnance disposal systems

Contact:
Address: P.O. Box 2030, North Kingstown, RI 02852 U.S.A.
Phone: (401) 884-8801 Email: sales@Subsalve.com

CORETRAX'S ReLineWL EXPANDABLE TECHNOLOGY RESTORES WELL IN GULF OF MEXICO

Coretrax, a global well integrity and production optimization leader, is delivering significant operational efficiencies for operators with its latest expandable technology.

The ReLineWL straddle is a one-trip, rigless system developed to address common well integrity issues and has enabled a Gulf of Mexico operator to troubleshoot an inoperable safety valve, passing through a restriction that conventional straddles could not pass through.

The tool is proven to deliver a 700% greater flow area when compared to traditional straddles, allowing operators to install a patch without creating a restriction and to unlock greater commercial value from existing wells.

The ReLineWL was recently deployed for an independent operator in the Gulf of Mexico when a safety valve malfunctioned on a producing well. With no control of the flapper valve and no way of hydraulically or mechanically forcing it to stay open, the device was implemented to remediate the issue.

Unlike conventional straddles, the ReLineWL's slim outer diameter meant it could bypass various ID restrictions to reach the flapper valve. Once in position at 8,675 ft, the patch was expanded to permanently

open the valve. This resulted in full well access so upper completion removal could be facilitated. This saved significant rig-time when compared to costly and time-consuming traditional milling operations.

Using a light intervention vessel, the wireline deployed patch creates a large ID to optimize access to the wellbore. This can negate integrity issues caused by water, gas and sand shut off; corrosion isolation; collar leaks and perforation shut off. Thereby allowing a maximum production conduit to the surface.

Scott Benzie, Chief Technology Officer at Coretrax said: "Our expandable technology is disrupting the traditional well intervention market. By creating a maximum production conduit and eliminating the requirement for complex and costly well intervention methods, the ReLineWL straddle is unlocking production in wells which were previously seen as uneconomical and delivering significant results for operators."

As part of Coretrax's range of Mohawk expandable technology, the tool has a high expansion ratio of 75%. It is designed for stackability, to create a longer, integrated straddle to be deployed, without losing ID. This also allows operators to gain access below if well intervention is required at a later date.

Available in various CRA materials, the tool can be configured to smart completion products such as autonomous inflow devices (AICDs) to enhance production by selectively eliminating gas and water production and provide a comprehensive workover solution.

Mr. Benzie continued: "As the industry continues to focus on enhanced oil recovery and production efficiencies, the ReLineWL successfully overcomes well integrity issues. We are already seeing increasing demand for this technology in North America, the North Sea and Norway with operators keen to gain greater recovery and revenue from mature fields."



» ReLineWL straddle is a one-trip, rigless system.
(Image credit: Coretrax)



» The ReLineWL delivers a 700% greater flow area when compared to traditional straddles. (Image credit: Coretrax)

ENPRO SUBSEA'S F-DECOM SYSTEM ENABLES SAFE REMOVAL OF 'ATTIC' OIL

Hunting Energy Services, Subsea Technologies division supporting DeepOcean has successfully completed another campaign in the North Sea using Enpro Subsea's proven Field Decommissioning (F-Decom) system. The recent campaign on Shell UK Limited (Shell) Brent Bravo concrete structure was completed with no safety incidents, ahead of schedule and within budget.

Enpro's patented technology enabled the safe access and removal of 'attic' oil from concrete storage cells at the base of the Brent Bravo platform in 140 m water depth. The system, which on previous campaigns had been deployed direct from platform topsides, was this time deployed from a DeepOcean construction vessel, leading to a significant reduction in operating days per cell.

The F-Decom system is the only field proven system for securely accessing fluids within gravity-based structures (GBS) concrete cells assisting operators to safely meet their decommissioning regulatory obligations to protect Europe's marine environment.

The project involved Enpro's offshore engineers and onshore support teams working alongside DeepOcean's operations and subsea teams onboard the construction vessel, the *Maersk Forza*. Enpro Subsea's proprietary solution centers around their patented 'anchor hub' technology which mechanically locks into the concrete cell cap and allows a suite of tooling (i.e. drilling, sampling, wireline, pumping) to be compact and lighter, thereby enabling it to be easily installed and operated using work class ROVs and operate within a broad weather window.

This is the fourth such campaign the company has undertaken for Shell to support its ongoing decommissioning program in the Brent field, located north-east of the Shetland Islands.

Enpro Subsea engineering director Neil Rogerson said: "The system is well proven, and Shell have previously deployed our F-Decom technology on both their Brent Bravo and Brent Delta platforms. For the 2020 Bravo project, our collaboration with DeepOcean has allowed us to optimize this same low risk system, specifically for working from a vessel, yielding significant operational efficiencies, and increasing value to our client. As a result, we now have extended the track record of the only field proven system, which can be configured to suit a variety AOR (Attic Oil Recovery) decommissioning programs."

Roy Nilsen, DeepOcean project manager said, "The attic oil recovery project on Shell's Brent Bravo platform was a great project for DeepOcean and its success comes from the combination of Enpro Subsea's F-Decom system and DeepOcean's expert subsea engineering and WROV capabilities as well as the good collaboration between all parties involved."

» Enpro's F-Decom tooling system deploying their 'anchor hub' onto a subsea cell top.



STINGER TECHNOLOGY AND HOUSTON MECHATRONICS IN COLLABORATION AGREEMENT

Stinger Technology AS (Stinger) and Houston Mechatronics Inc. (HMI) have entered into a new collaboration agreement. HMI will provide Aquanaut and the necessary services needed to target and execute inspection, repair, and maintenance operations within the Norwegian Oil & Gas market, and Stinger will add Aquanaut capabilities to its existing services portfolio.

Stinger is a growing, innovative subsea technology and service company offering robotic underwater solutions. The goal is to become the go-to provider of lightweight, smart, and fast deployable underwater drones for resident applications. Not only is the Stinger technology suited to the intervention, maintenance, and repair (IMR) services for energy, telecom, aquaculture, mining, and renewables markets, but also the defense sector. The services provide customers the necessary data and manipulation capability to support maximizing production while minimizing their operating footprint, operating cost, carbon footprint, and offshore HSE exposure.

HMI's Aquanaut includes the capability of inspection and manipulation into one untethered solution and can operate in full or supervised autonomy mode making it a truly unique solution. In 2021, Aquanaut will be in Norway finalizing product qualifications in order to be ready for commercial applications in 2022.

"Stinger Technology AS challenges traditional and cost-driving habits in the industry. We are in a strong expansion, focusing on innovative underwater technology, with a low environmental footprint. We are now entering into a collaboration with Houston Mechatronics to introduce the groundbreaking Aquanaut technology for Underwater Intervention Drones in Norway. Houston Mechatronics complements our own robots / drones and through this collaboration we offer our customers a wider product range," according to Stinger CEO Bjarte Langeland.

NEXANS COMMITS TO CARBON NEUTRALITY BY 2030



By Christopher Guérin
CEO of Nexans

Nexans has been a long-standing player in the world's sustainable electrification. The shift by major industrial groups to be more committed to energy decarbonization is more of a priority than ever before.

The global demand for electricity will continue to increase into the future, posing several challenges for electrification projects. Nexans is at the heart of these issues and are fully aware of our responsibility to electrification and is operationally committed to achieving this goal, which is why the company announced at its inaugural Climate Day event that it will be carbon neutral by 2030.



A ROADMAP TO NEUTRALITY

Nexans plans to achieve carbon neutrality through a series of clearly defined targets:

- 4.2% average annual reduction of company greenhouse gas emissions, particularly on scopes 1&2 (This objective applies to scopes 1 and 2 as well as part of scope 3 relating to business travel, waste produced, as well as upstream and downstream transport, as defined by the GHG protocol)
- 100% of production sites certified ISO 14001
- 100% of production waste to be recycled
- 100% of R&D projects to be dedicated to energy efficiency and energy transition, promoting eco-design and low carbon offers
- Optimization of logistical flows by using multi-modal transport and shorter delivery routes
- 100% of Nexans cable drums to be connected using Internet of Things (IoT) technologies and recyclable
- 100% of Nexans employee automobile fleet to switch to either hybrid or electric vehicles
- Use of renewable energy via local production or the purchase of decarbonized energy for all locations
- Deployment of energy efficiency solutions at all sites

In light of the commitment set out by the European Green Deal and the Paris agreements (COP21)—to set a limit of 1.5°C for global warming by 2030—we see the need for immediate concrete action to fight global warming.

Our commitment to carbon neutrality concerns all aspects of our company, from manufacturing products, developing innovations and solutions, managing daily operations, to the use of raw materials and working habits. All Nexans teams are mobilized and fully engaged, both individually and collectively, as the success of our commitment is at the heart of our corporate management philosophy of 3P's: People, Planet, Profit. More than ever, we are reaffirming our cultural, industrial and commercial responsibility and commitment because we are aware that our actions, as well as our production, products and services, have an immediate impact on climate issues.

INVESTMENTS IN INFRASTRUCTURE

As a world leader in the submarine power cable market, we are also upgrading our plant in Charleston, South Carolina. This will become the first plant in the U.S. to manufacture high voltage cables for offshore wind applications. The \$80 million plant expansion is well underway and will include a shipping terminal at our site where our cable-laying ships will load up before heading to offshore wind projects. We are manufacturing cable there for an offshore wind farm project in Scotland.

To further support operations, Nexans is also building a new cable ship, the Aurora. Construction of this state-of-the-art cable laying vessel is in full swing and in October work commenced on the installation of the MAATS cable lay equipment at the Ulstein Verft shipyard.

On October 14, the MAATS & Marine Fabricators installation team arrived on site to begin the installation, which kicked off with the 2 lay wheels being fitted at the stern. These wheels, in combination with the specially designed fairings, assist in guiding the cable in a controlled manner as it enters and exits the vessel. Following the lay wheels, final installation work is now being completed on the MAATS Tensioners and 75t SWL Capstan.

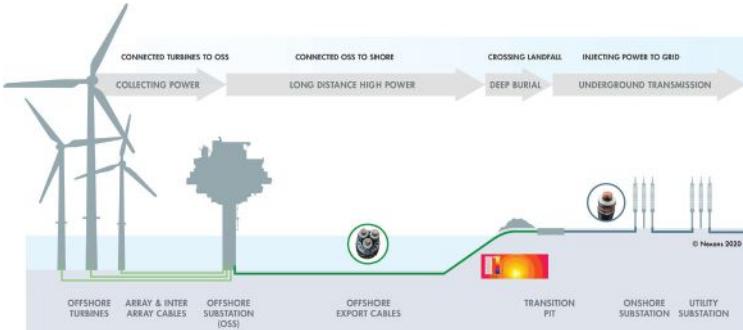


» Aerial view of Nexans' Charleston cable plant. (Photo credit: Nexans)

Nexans
BRINGS ENERGY TO LIFE



» Cutaway view of an export cable.
(Photo credit: Nexans)



» How offshore wind power gets to shore. (Image credit: Nexans)



» Aurora will be prepared for vertical lay operations and complex subsea construction tasks. (Image credit: Nexans)

This innovative vessel is a project of true collaboration and built upon the combined expertise of Nexans' extensive cable laying experience, Skipsteknisk's naval architecture know-how, Ulstein Verft's ship-building prowess, and MAATS' specialist engineering. The vessel boasts a concentric, split basket 10,000Te carousel, dual cable lay capabilities, utilization of separate capstan or tensioner firing lines, and the ability to complete operations in the most severe weather conditions anywhere in the world.

WWW.NEXANS.COM

PRYSMIAN'S LEONARDO DA VINCI BEGINS FINAL CONSTRUCTION PHASE



» Leonardo da Vinci's cutting-edge laying features make it the most advanced cable layer in the world.
(Photo credit: Prysmian)

Prysmian Group's new cable ship completed the long journey from the Black Sea to Norway this summer and will now undergo the final stages of construction. After being towed from Vard's shipyard in Tulcea, Romania, across the Black Sea, the Mediterranean Sea, then along the ocean shores of Portugal, Spain and France up to Scandinavia, Prysmian Group's cutting-edge cable-laying vessel, the *Leonardo da Vinci*, reached Vard's shipyard in Brattvåg, Norway. Here, proceeding on time according to the overall project schedule, the ship will undergo the last steps of its complex building process: the outfitting phase and installation of main onboard cable-laying equipment.

Once completed, the ship will be ready for the sea trials and leave the shipyard with its own engines to reach to the open sea. From September 2020 to spring 2021, Vard and Prysmian will work closely to accomplish the task. With an onboard accommodation for 120 people, the *Leonardo da Vinci* will be outfitted to offer comfortable and ample working spaces and recreational areas for all personnel, including a fully equipped gym, auditorium, game room, dayroom and officers' lounge.

Prysmian is responsible for the design, manufacturing, supervision during installation and final commissioning of all cable-laying equipment, such as capstan, laying sheaves,

turntables, pickup arms, and caterpillars. These state-of-the-art tools, benefitting from the unrivalled Prysmian Group's experience in cable-laying, will be installed onboard the *Leonardo da Vinci* in Norway over the next winter period, in order to start sea trials in Norway's fjords in spring 2021.

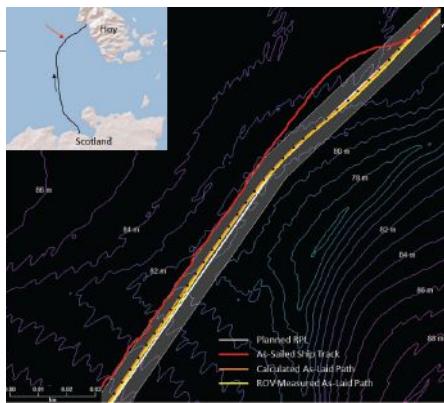
Once the outfitting and equipment installation phases are completed, the main switchboards will be energized, the engines will be powered up and they will start running for the first time. *Leonardo da Vinci* will then be ready to be taken to the sea on its own and start its sea trials. During the commissioning sea trials, the deadweight, speed and bollard pull will be verified. Prysmian said that the *Leonardo da Vinci* will have the highest carousel capacity and bollard pull to date and will be able to operate for extended periods in challenging weather and work to the deepest depths. The capstan, with a capacity of up to 100 tons, is double the industry average.

Prysmian's experts will test *Leonardo da Vinci*'s cutting-edge laying features that make the new vessel the most advanced cable layer in the world. The ship will allow Prysmian to offer an ever wider and more versatile range of installation services and strengthen the leadership position in the submarine cables business, being one of the most strategic

assets to enable the energy transition.

Prysmian took the naming of this ship very seriously. Firmly believing that its strength is rooted in the quality and the talent of its people, the company decided to engage all employees in the task of giving a name to its new cutting-edge cable-laying vessel. Around 1,700 applicants from all over the world suggested different names, with a dedicated committee examining all the applications and finally choosing one that totally fitted the requirement: *Leonardo da Vinci*. The name that has its roots in Prysmian Group's history and activity, being linked to engineering, science, innovation, excellence and Italy. It is a tribute to the famous Italian genius, inventor, engineer, sculptor, architect, who is globally recognized as a leading figure of the European culture.

At the heart of Prysmian Group's mission is the belief that green energy should be available to all. That's why the group is working to link the world, efficiently and sustainably, with its cable technology, building infrastructures that will allow the green transition to a zero-emission world. Prysmian's motto is 'Deeper, Lighter, Longer, Greener' and demonstrates its commitment to supporting smarter and greener power grids worldwide. www.prysmian.com



» Figure 1: A section of the Pentland East cable installation showing the planned cable route (white) with a 5 m buffer, the as-sailed ship track (red), the MakaiLay calculated as-laid cable path (orange), and the post-lay ROV surveyed cable path (yellow).

The best-in-class cable deployment control software, MakaiLay™, was commissioned on the Cable Laying Vessel (CLV) *Normand Clipper* in July 2020 by Global Offshore.

Global Marine Group is a leading provider of subsea cable installation, maintenance and burial services world-wide for both telecom and power cables through its brands Global Marine and Global Offshore.

As part of Scottish and Southern Electricity Networks' (SSEN) Pentland Firth East project,

MAKAILAY POWER COMMISSIONED BY GLOBAL OFFSHORE

a 37-km subsea power cable was installed between the Scottish mainland and the island of Hoy, in Orkney. Global Offshore completed the installation using the *Normand Clipper* with support from Makai and their industry-leading subsea cable deployment software, MakaiLay. The cable was installed to a maximum depth of 90 m, with the majority of the route between 70 and 80 m water depth. The strong tidal currents in the region of the lay, were particularly challenging during this installation, with surface currents periodically exceeding 3 kts, and currents at depth exceeding 1 kt. The Pentland Firth is known to have one of the most powerful tidal currents in the world.

While Global Marine already utilizes MakaiLay software for telecom cable installations, the Pentland East installation marked their first use of the MakaiLay Power Module. The MakaiLay Power Module contains an

additional suite of tools designed to address specific issues faced during power cable installations.

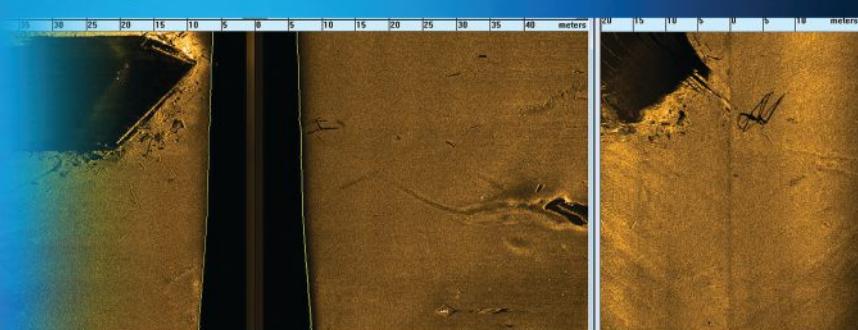
"We were impressed with the accuracy of the MakaiLay Power Module, and believe the MakaiLay software will be a key component in proactively managing the cable installation and reducing dependence on ROV monitoring," said Ian Griffiths, Subsea and Cable Operations Survey Manager at Global Marine Group.

Figure 1 shows data from a post-lay survey showed that the average deviation of the MakaiLay calculated as-laid cable path, from the post-lay ROV measured path was 0.73 m over the entire 34 km route.

For more information, visit
WWW.MAKAI.COM

KLEIN MA-X VIEW 600 RE-DEFINING SIDE SCAN SONAR

INDUSTRY'S FIRST SIDE SCAN SONAR WITH INTEGRATED GAP FILLER



Imagine a survey done in 40% less time.
Imagine 40% less fuel cost.
Imagine an unprecedented resolution both in side scan and nadir.

Today MIND Technology re-defines seafloor imaging with a revolutionary two frequency system which provides 100% swath coverage - so different yet so simple to use.



KLEIN
A MIND Technology Business

mind-technology.com

Real-time image of a subsea structure.
On the right the nadir window shows a tubed frame off the bottom.

NKT INVESTS TO SUPPORT THE GROWING OFFSHORE WIND MARKET

The demand for offshore power cables is expected to grow in the years to come as offshore wind continues to be essential for the global transition to renewable energy.

With the positive market outlook and a strong order backlog, NKT is now investing in a new specially designed barge built for cable transportation on the river Rhine to increase the transportation capacity and enhancing the security of delivery from its manufacturing site in Cologne. NKT also increases capacity in its logistical center in Rotterdam from where the offshore cables manufactured in Cologne are loaded to cable-laying vessels.

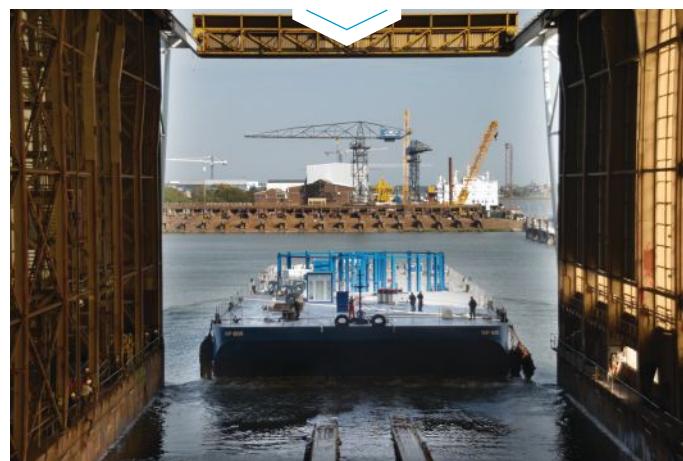
"With the investment in the purpose-built barge and in increased capacity at our logistical center in Rotterdam, we strengthen our position as a leading provider of offshore power cables. The investments are driven by a growing demand from the offshore industry and will enhance our delivery security even in times with abnormal weather conditions or with multiple projects being executed in parallel," says Executive Vice President Mika Makela, who is heading the manufacturing site in Cologne.

The barge is designed and built by Neptune Marine for the changing condition of the Rhine and can operate in very shallow water and thereby minimizing the effects of low water levels. To minimize the environmental impact, the barge is powered by green electricity during

cable loading at the harbor in Cologne where the factory is also powered by electricity generated from renewable energy.

With high-voltage cable factories in both Cologne and Karlskrona, Sweden, NKT is strategically well-positioned to deliver power cables for the growing offshore wind sector in the North and the Baltic Sea as well as for the interconnector market also being driven by the transition to renewable energy across Europe.

NKT expects the barge to be fully operational in Q4 2020.



» The new barge is designed for the changing condition of the Rhine and can operate in very shallow water. (Photo credit: NKT)

For more information, visit
WWW.NKT.COM

SEAWAY 7 STRENGTHENS RENEWABLES FLEET WITH NEW CABLE SHIP

To further improve and grow its position in the submarine cables installation market, Seaway 7 will convert the cable ship *Seven Phoenix* to become a dedicated inner array grid and export cable installation and trenching support vessel.

Seven Phoenix was originally constructed as a dedicated trans-oceanic submarine fiber optic cable lay vessel. Operational readiness is planned for Q2 2021 and subsequently the vessel will operate under her new name *Seaway Phoenix* on her first Seaway 7 assignment.

Seaway 7 is the renewables and heavy lifting business unit of Subsea 7, which has won a number of major submarine ca-

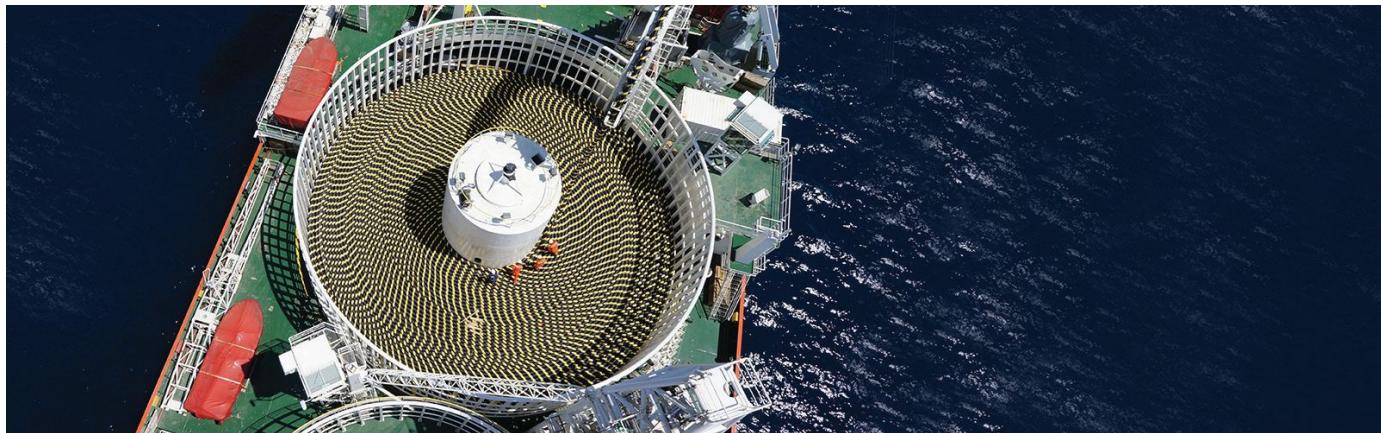
ble installation projects for offshore wind farms in Europe and Asia in 2020. These include a contract for a submarine cable system for an offshore wind farm project in Taiwan, a contract for the installation of array cables for the Hollandse Kust Zuid

(HKZ) 1-4 offshore wind farm project in the Netherlands, an array cable installation contract for the Seagreen Offshore Wind Farm in Scotland, and an array installation award for the Kaskasi offshore wind farm project in Germany.



» *Seven Phoenix* (circled) will help Seaway 7 fortify their renewables fleet. (Photo credit: Seaway 7)

For more information, visit
WWW.SUBSEA7.COM



HELLENIC CABLES' PARENT JOINS CLEAN HYDROGEN ALLIANCE

Cenergy Holdings, the parent company of submarine power cable maker Hellenic Cables, has signed the European Clean Hydrogen Alliance declaration as an integral part of its strategy for sustainable growth in balance with the Paris Climate Agreement, the UN Sustainability Goals and the EU Green Deal.

Being at the forefront of technological innovation, Cenergy Holdings companies lead the way in R&D initiatives for hydrogen transportation through existing or new energy networks, develop the technology and the new products that can bring the hydrogen era closer to the realization of a decarbonized clean energy future.

The Alliance aims at an ambitious deployment of hydrogen technologies by 2030, bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution. With the alliance, the EU wants to build its global leadership in this domain, to support the EU's commitment to reach carbon neutrality by 2050.

Hellenic Cables is a leading provider of land and submarine cable solutions that enable the energy transition around the world. Its products and services are integral parts of onshore and subsea interconnectors, offshore wind and other renewable energy projects. In line with this mission, Hellenic Cables also develops solutions to seamlessly integrate hydrogen into the energy infrastructure. In cooperation with leading European Universities and industrial partners, Hellenic cables contributes to the development of the necessary innovative products to bring the hydrogen era closer.

Large-scale use of hydrogen as a clean energy solution requires the cooperation of national technical authorities, universities, standardization bodies and market leaders to develop and create new regulations, technical specifications in order to secure the smooth and seamless introduction of hydrogen in the energy mix. Hundreds of projects worldwide extend the research in scaling up hydrogen, next generation electrolyzers, offshore hydrogen production, blending hydrogen in gas network, use of hydrogen in heating & transportation, health and safety systems etc. Cenergy Holdings companies contribute their expertise in this important task that will create the basis for the transition to a hydrogen economy.

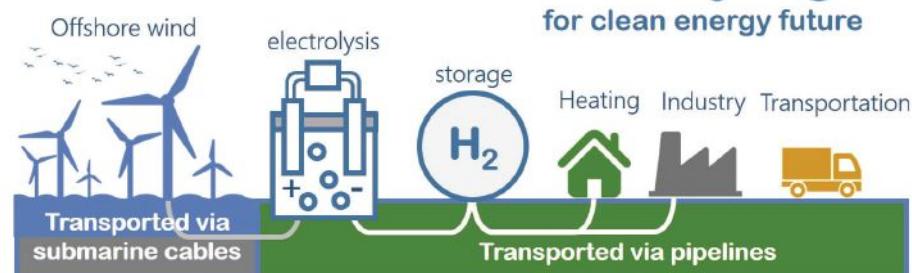
Hydrogen is a key enabler to achieve the objectives of the European Green Deal and Europe's clean energy transition. Hydrogen has several energy and non-energy uses, from storing renewable energy to fueling heavy transport, and as energy and feedstock in energy-intensive industry, such as in the steel or chemical sectors. The alliance will establish an investment agenda and support the scaling up of the hydrogen value chain across Europe.



» Hellenic Cables' submarine power cable being spooled onto a turntable.

Most importantly, hydrogen is climate friendly as it does not emit any carbon dioxide when used. It thus offers a solution to decarbonize industrial processes and economic sectors where reducing carbon emissions is both urgent and hard to achieve.

For more information, visit
WWW.CABLEL.COM



» How "green" hydrogen fuel is produced

The background of the article features a wide-angle aerial photograph of a bustling port. In the foreground, there's a massive stack of colorful shipping containers in various shades of red, blue, and yellow. Behind them, several large cargo ships are docked at the pier, and several tall red industrial cranes stand ready for loading and unloading. The water is a vibrant blue, and the overall scene conveys a sense of global trade and commerce.

| FEATURE |

ENHANCING THE EFFECTIVENESS OF PORT AND HARBOR SECURITY



By George Galdorisis

*Director of Strategic Assessments and Technical Futures
at the Naval Information Warfare Center Pacific*

When most people think of globalization, they immediately think of the international trade that has lifted hundreds of millions out of poverty over the past few decades, but they should also consider the freedoms and laws that govern our oceans. As a former active-duty U.S. Naval Officer, that is where my focus has been for most of my professional life—on the high seas. That changed in August 2020, when deadly explosions rocked the harbor in Beirut, Lebanon. Amidst the breathless reporting of this tragic event, many may have overlooked the growing importance of ports and harbors to global commerce.

I live in an American city astride a major U.S. port. It is clear to me that the critical nodes that support trade are the world's harbors. From Shanghai to Rotterdam, to Los Angeles to Hong Kong and other mega-ports, harbors are critical to world prosperity. A catastrophic event could close one of these essential gateways for an indefinite time, not to mention contaminate local waters.

Port authorities must ensure security 24 hours a day, 365 days a year. This task includes continuous inspection of port assets, threat detection and security response, as well as ongoing surveys to ensure navigable waterways, ship hull inspections, and a wide range of other missions. The magnitude of providing comprehensive security for an average size port—let alone some of the world's mega-ports—can sometimes lure port authorities into "wishing away" the challenge. But in an increasingly dangerous world, ports that can be attacked via land or sea present an inviting and vulnerable target.

THE CURRENT STATE OF PLAY FOR PORT SECURITY

Current security measures in most ports involve monitoring video footage captured by cameras installed throughout the port, as well as patrolling the port's waters with a fleet of manned vessels. This approach stresses the ability of port authorities to provide around-the-clock security.

Cameras seem to offer an effective solution, but several people must monitor the video for the cameras to have any effectiveness. With some ports maintaining scores of cameras, this entails having a command center and enough watch-standers to monitor all of the cameras 24 hours a day.

The use of manned craft to patrol a harbor of any size comes with its own issues. Manned vessel operations are expensive, are often limited by weather and water conditions, and place additional physical stress on port professionals. For most ports, multiple manned vessels are needed to guarantee sufficient revisit time to ensure that a threat has not slipped through the proverbial security net.

Compounding the issue is the physical toll of riding a small vessel—either a rigid hull inflatable boat (RHIB) or other small craft. Add rain, wind, waves, fog and other natural phenomena that often reduce visibility and slow patrol speeds, and the need for more craft and more people can multiply significantly.

Given the manifest challenges of providing adequate—let alone comprehensive—security for ports with current state-of-the-art systems and capabilities, it is little wonder that port officials are searching for technology solutions that will enable them to provide better security, at lower costs.

THE PORT OF LOS ANGELES: A MEGA-PORT WITH A CHALLENGE

The Port of Los Angeles (POLA) is the busiest port in the United States. This mega-port comprises 43 miles of waterfront, 42 square miles of water, 26 passenger and cargo terminals and 86 ship-to-shore container cranes. POLA handled over ten million twenty-foot equivalent units (TEUs) of cargo last year.

Current measures to secure the Port of Los Angeles involve monitoring the video provided by 500 cameras throughout the port, as well as patrolling the port's expanse of water with a fleet of manned vessels. This operation is increasingly expensive and does not provide comprehensive security. For these reasons, POLA officials were granted the mandate, from a number of stakeholders, to explore the possibility of using unmanned surface vehicles to enhance local port security.

In their search for a solution, port authorities invited Maritime Tactical Systems Inc. (MARTAC) to stage an in-situ demonstration of their MANTAS unmanned surface vehicle. One of the primary reasons that the Port of Los Angeles requested the MANTAS system demonstration was the fact that MANTAS had performed well in a port security evaluation conducted by the U.S. Army. Three MANTAS T-series vessels were part of the Army's Mobile Ocean Terminal Concept Demonstration in Concord, CA. The primary objective of this demonstration was to assess MANTAS' ability to patrol and protect the harbor and ammunition loading container ships.

MANTAS is a high-performance USV built on a catamaran-style hull and comes in a number of variants, ranging in size from eight-foot to 50-foot. The POLA demonstration was conducted with a 12-foot MANTAS. MANTAS can be equipped with a wide variety of above-surface sensors (EO/IR/thermal video) and below-surface sensors (sonars and echo-sounders), as well as other devices such as chem/bio/nuclear sensors, water quality monitors, and above/below surface environmental sensors. Real-time monitoring is provided by a MANTAS

communications package that can support redundant radio, 4GLTE, or satellite communications.

At the request of Port of Los Angeles officials, MARTAC representatives provided a comprehensive briefing on MANTAS capabilities, examined the span of POLA operations, and provided a remote demonstration that enabled POLA officials to control MANTAS being deployed off the eastern coast of Florida. The demonstration provided POLA stakeholders with a comprehensive understanding of how a USV could enhance port security.

In coordination with POLA officials, as well as the U.S. Coast Guard, MARTAC Inc. was asked to consider providing larger USVs for the port and harbor security role, to extend the vehicle's payload and endurance. MARTAC engineers did just that, and a T38 (38-foot) MANTAS was demonstrated this summer during the U.S. Navy's Trident Warrior exercise in San Diego. Not only can the T38 carry a number of additional cameras and related security sensors, it also has the ability to patrol the harbor at a 15-20 knot cruise speed for 8-10 days until refueling is needed. With a burst speed of up to 70 knots, it can be used by the port/harbor command center to immediately intercept and identify vessels or areas of interest.



» MANTAS is a catamaran ASV and comes in a number of variants, ranging in size from eight-foot to 50-foot. (Photo credit: Jack Rowley)

technology to provide reliable and affordable USV support to augment manned capabilities at facilities such as the Port of Los Angeles has only emerged over the past few years. This POLA demonstration showed that commercial "off-the-shelf" unmanned surface vehicles can conduct a comprehensive security inspection of a mega-port.

Given the way that commercial USVs have performed in an increasing number of military and civilian exercises, experiments and demonstrations, one has to ask why they are not being leveraged more fully—and more quickly—for a wider range of missions. Deploying—or even adapting—the mission-ready assets we have at hand would appear to provide a near-term, affordable and effective solution to the challenge of providing comprehensive port and harbor security for both civilian and military ports.



» MANTAS can be equipped with a wide variety of above-surface sensors (EO/IR/thermal video) and below-surface sensors (sonars and echo-sounders), as well as other devices such as chem/bio/nuclear sensors. (Photo credit: Jack Rowley)

DOD TAPS SEA MACHINES FOR AUTONOMOUS VTOL REPLENISHMENT VESSELS



» A remotely commanded replenishment vessel. (Image credit: Sea Machines)

Boston-based Sea Machines Robotics, a leading developer of autonomous command and control systems for surface vessels, has announced the award of a multi-year Other Transaction (OT) agreement by the U.S. Department of Defense (DOD)'s Defense Innovation Unit (DIU). The primary purpose of the agreement is to initiate a prototype that will enable commercial ocean-service barges as autonomous Forward Arming and Refueling Point (FARP) units for an Amphibious Maritime Projection Platform (AMPP).

Under this OT agreement, Sea Machines will engineer, build and demonstrate ready-to-deploy system kits that enable autonomous, self-propelled operation of opportunistically available barges to land and replenish military aircraft. The kits will include Sea Machines' SM300 autonomous-command and control systems, barge propulsion, sensing, positioning, communications and refueling equipment, as well as items required for global deployment. Each modular kit will meet U.S. Navy criteria and will be in compliance with classifications and regulations from the DOD's aviation bodies.

The contract includes a concept demonstration phase, with an option for following phases to deploy SM300 Operational Kits. The live concept demonstration is scheduled for the fourth quarter of 2020, in Washington state, for which Sea Machines has teamed with FOSS

Maritime, a leading maritime transportation and logistics provider based in Seattle. FOSS will provide naval architecture, support engineering and operations management to outfit a remotely commanded deck barge to land helicopters and host a scaled fueling station for aircraft, surface vessels and shore replenishment. Using the SM300, shoreside operators will have remote situational awareness and will be able to demonstrate the capabilities of remote command and control of the vessel, her operating systems and flight deck.

Sea Machines is the prime contractor for the multi-year contract and is working closely alongside FOSS Maritime and other significant industry leaders, including Huntington Ingalls, America's largest military shipbuilding company and a provider of professional services, based in Newport News, Va., and Bell Flight, a producer of commercial and military, vertical-lift aircraft, based in Fort Worth, Texas, to ensure a successful demonstration.

"The AMPP autonomous replenishment systems will solve critical logistics challenges of expeditionary missions. We are pleased to enable this innovative capability, which will increase the effectiveness and flexibility for the U.S. military," said Sea Machines' Phil Bourque, director, sales. "With Sea Machines systems already working off the waters of four continents, this project is well suited for us and

one that we look forward to delivering on for the U.S. Government."

"Foss is excited about this new opportunity with Sea Machines. This contract has led to discussions with Sea Machines in a number of other areas where their expertise can help Foss, including bringing more technology to our tug fleet. What they are doing in automation is very interesting and that technology could help our mariners and our vessels safety," said Foss' Will Roberts, chief operating officer.

DIU's work is part of the DOD's Resilient Expeditionary Agile Littoral Logistics (REALL) Joint Capability Technology Demonstration (JCTD) project. Funded by the Office of the Secretary of Defense Research & Engineering, the JCTD Program addresses Combatant Command (CCMD) and Joint warfighting gaps through prototyping and demonstration of innovative and game-changing technologies. The following offices are involved with defining performance requirements and developing capabilities for REALL: U.S. Central Command, U.S. Transportation Command, U.S. Marine Corps Warfighting Laboratory, Naval Facilities Engineering and Expeditionary Warfare Center, Army Engineer Research and Development Center, and the Naval Aviation Warfare Center—Lakehurst.

RIPTIDE™ UUV-12 LAUNCHES BAE SYSTEMS INTO MEDIUM UUV MARKET

BAE Systems has unveiled the newest addition to its unmanned undersea vehicle (UUV) portfolio, the Riptide™ UUV-12. The 12" diameter vehicle is the company's entry into the medium UUV market—joining three small UUV variants—and marks the first new vehicle since last year's acquisition of Riptide Autonomous Solutions.

"The Riptide UUV-12 system significantly extends the Riptide family of UUVs by taking us into the medium UUV market," said Jeff Smith, chief scientist at BAE Systems' FAST Labs™ research and development organization. "With this medium-size platform, we are strategically aligning our modular, open architecture-based UUV platform to meet rapidly expanding applications and requirements."

The Riptide UUV-12 can be easily adapted to meet a variety of mission needs, including those that require larger and more power-hungry payloads. When integrated with the company's mission system payloads, it can deliver critical capabilities including combinations of Radio Frequency (RF) signal collection,

RF electronic warfare, active acoustics, acoustic Identification Friend or Foe, acoustic and RF communications, mission autonomy, and navigation.

Key Riptide UUV-12 offers operators:

- **Versatility**—agnostic, modular system design enables easy modification and customization for various development needs;
- **Endurance**—high-efficiency electronics architecture coupled with a highly efficient, low-noise propulsion system;
- **Open system**—native integration with industry-leading sensors and technology.

The Riptide family of UUVs is a combination of sophisticated yet simple, efficient, and highly flexible platforms that perform at great depth, at long range, with high endurance, and at significant speed to meet various commercial and military requirements.

MIND TECHNOLOGY'S KLEIN UNIT COMPLETES ADVANCED NAVAL TECHNOLOGY EXERCISE

MIND Technology, Inc. and its Klein Marine Systems subsidiary successfully completed a live Advanced Naval Technology Exercise (ANTX) in a collaborative effort with the Naval Surface Warfare Center Panama City Division (NSWC PCD); Commander, Naval Meteorology and Oceanography Command (CNOOC) and in coordination with the Naval Oceanographic Office's Fleet Survey Team (FST), at NSWC PCD.

Despite COVID-19 limitations and numerous planning challenges caused by Hurricanes Laura and Marco, the collaborative team succeeded in conducting a live ANTX event. Participants traveled across the country to both Gulfport, Mississippi and Panama City, Florida to assess the operational and technical capabilities of emerging technology innovations.

Klein and a group from NSWC Panama City partnered to integrate the Klein UUV 600 and μMAX technologies into their Iver3 vehicle. In addition, Klein partnered with Seafloor Systems, Inc. to integrate the Klein MAX View 600 gap-filling side scan sonar system with their large-format, wave adaptive HydroCat-180 USV. The HC-180 has been integrated with a winch and Towfish Launch

& Recovery System (T-LARS) designed and tested by Seafloor Systems. The USV is designed to be deployed by boat or from shore and be remotely piloted or programmed to conduct a pre-planned mission. The MAX View towfish was remotely deployed and recovered and the sonar data was sent back in real-time to either the mother ship or shoreside via a radio data link.

"The main benefits of ANTX are two-fold, the government gains first-hand interaction with emerging technology and the innovation providers gain warfighter feedback and insight on how to better work with government," said Todd Holland, director, mine warfare prototyping at NSWC PCD. "Our team here at Panama City Division, including our test directors, test engineers, range managers, and public affairs personnel did a great job of responding to various challenges while hosting an outstanding ANTX event in collaboration with Klein Marine Systems."

Guy Malden, Co-Chief Executive Officer and Executive Vice President Marine Systems, MIND Technology, added, "We were very pleased to have successfully demonstrated the benefits of our MA-X and μMA-X technologies despite the challenges of



» Team members review the survey plan prior to beginning the Advanced Naval Technology Exercise (ANTX) event. (Photo credit: Anthony Powers)



» Klein Marine Systems' Multi-Angle X-Pattern Side Scan Sonar (SSS) system was towed by Seafloor Systems' HydroCat-180 USV for the test event.

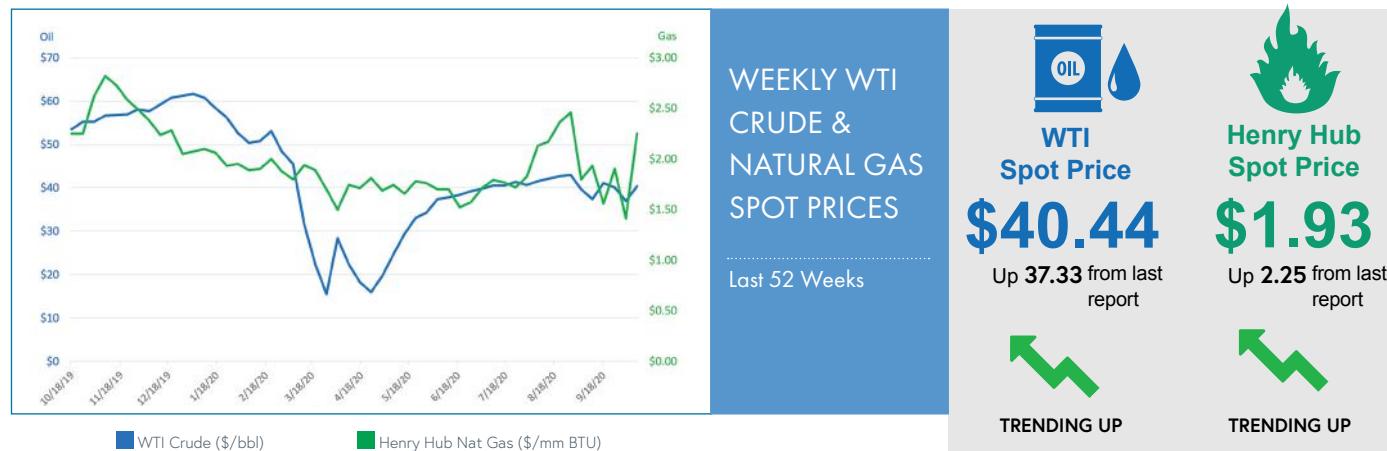
weather and COVID-related travel restrictions and greatly appreciate the efforts of NSWC Panama City and Seafloor Systems in this project. We believe through improved data quality and reduced time on station, MA-X provides for more than a 40% improvement in survey efficiency."

CRUDE & NATURAL GAS Spot Prices

PRICES IN US DOLLARS AS OF OCTOBER 12, 2020

Oil prices have been largely flat since the beginning of the summer, hovering in the high \$30s to low \$40s per barrel range. In the last four weeks, prices on the West Texas Intermediate (WTI) spot prices dipped below the \$37 per barrel mark before rallying back above \$40.00 at press time. CNBC attributed the largely static prices to sluggish demand, particularly the lessening of air travel due to the COVID-19 pandemic, which is resulting in weaker demand for jet fuel.

Natural gas prices moved sharply upward during the past month. With prices below the \$2.00 per million British thermal units (MMBtu) mark throughout September and the first half of October, The Henry Hub spot prices rose significantly in mid-October to around the \$2.25 per MMBtu mark. Barron's attributed the rise to falling production and forecasts of colder than usual weather in much of the United States.



KEY EQUITY Indexes

PRICES IN US DOLLARS AS OF OCTOBER 16, 2020

Equity indexes continued their upward track, gaining modestly during the past month. The Dow Jones Industrial Average (DJIA) dipped briefly below the 27,000-point mark before rallying to nearly 28,500 points. The S&P 500 followed a similar pattern before closing on October 12 above 3,400 points. According to CNBC, the rally was largely attributed to strong retail sales data.

The Philadelphia Oil Services Index (OSX), however, saw a significant loss during the last month. After showing some stability by remaining in the 30-40 point range following months of turbulence, the OSX dropped below 30 points and stayed there for four consecutive weeks leading up to press time.

SELECTED EQUITY INDEXES



SPECIALIZED OCEAN TECHNOLOGY AND MARINE OPERATIONS

Commercial, Scientific,
and Government
Projects



Ocean Specialists' expertise is in integrating engineering, technology and marine operations. We provide cost effective, rapid deployment and discrete solutions for a wide range of projects.



SUBSEA TELECOM



GOVERNMENT
& DOD



POWERS CABLES



OIL & GAS



OCEAN SCIENCES
& OBSERVING



SEABED MINING





ELECTION, WEATHER AND ECONOMIC UNCERTAINTIES DRIVE COMMODITY PRICES

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

CRUDE OIL:

Oil prices continue to fluctuate in the low \$40s per barrel, but with sufficient daily movement to give traders a chance to make a few pennies on trades. For industry execs, the lack of sustained upward price movement has them focused on controlling and cutting costs. Success in this effort is demonstrated by the recent upticks in the drilling rig count and number of well completions. So far, the activity uptick has yet to stem the oil production decline, and the market knows much higher prices will only come once the inventory piled up during this spring's COVID-19-driven demand collapse is eliminated.

Although weekly crude oil production continues sliding, producers are restarting previously shut-in wells and drilling and completing new ones at today's prices, signaling the worst for the industry is behind it. But where are prices going, and what does it mean for the industry?

Energy investment bank TPH recently surveyed energy CEOs and directors seeking their views on the industry's outlook. The survey reported that 82% of respondents expect a \$50 oil price to prevail at the end of 2021, with 9% calling equally for higher and lower prices. Amazingly, two-thirds of respondents anticipate the oil price will still be \$50 at the end of 2023! One-third expects \$70, but no one expects a \$30 price, which is a vote of confidence for a better industry future. However, the history of oil price forecasts is not good, since they often reflect extensions of current trends. In other words, no one sees black swans, white swans, or any swans.

A more telling survey response was that 99% expects increasing rates of industry consolidation. That is important, as we just witnessed three merger announcements within 22 days! This will produce a more efficient industry that can profit at current oil prices—even if they don't improve, as the survey expects. Consolidation is not good news for employees, as companies will need fewer of them. Significant industry consolidation is necessary for a recovery to occur—something akin to what we experienced in the late 1990s that set the industry up for its glorious run of the early 2000s.

Contrary to some views, the end of the Age of Oil is not imminent. While the ending may be starting, there is no alternative fuel system that can facilitate such a transition for several decades. It will happen first in mature economies where demographics and politics facilitate the transition. The developing and populous economies of Asia, Africa and Latin America need efficient and potent fuels, meaning gasoline and diesel power. Expensive battery-powered cars with limited range and needing a charging infrastructure will restrain growth in these regions. The upcoming U.S. election will be an opportunity to gauge the future transition for fossil fuels in the U.S., but energy's physical realities is what will truly dictate the pace of the energy transition.

NATURAL GAS:

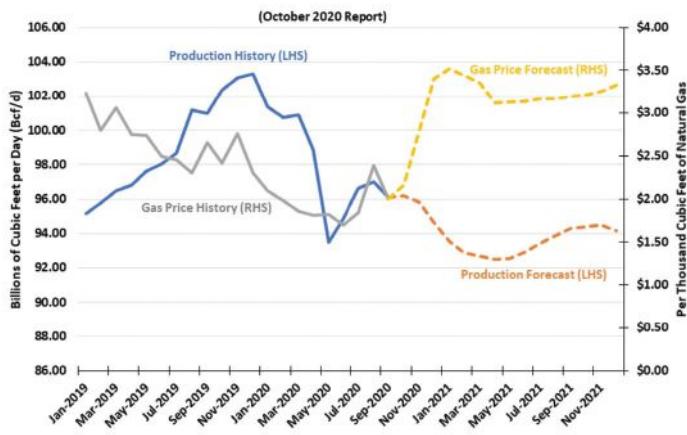
Henry Hub gas prices are in rarified air north of \$3 per thousand cubic feet. For the past few months, gas prices have bounced up and down on weather and LNG export demand trends. Bouts of cold air sent gas prices up, only to have them fall back when hurricanes cut off LNG exports. The end to hurricane season is in view, and LNG export volumes are climbing as terminals impacted by storm damage come back on-line. Winter remains the key driver for gas prices, as we are on track for possibly an all-time record storage volume.

An early boost to gas prices this fall was helped by collapsing oil prices this spring that saw producers shut in wells with a loss of associated gas supply. That helped tighten the gas market until oil prices rebounded, capped wells were uncapped, and gas supply stopped shrinking.

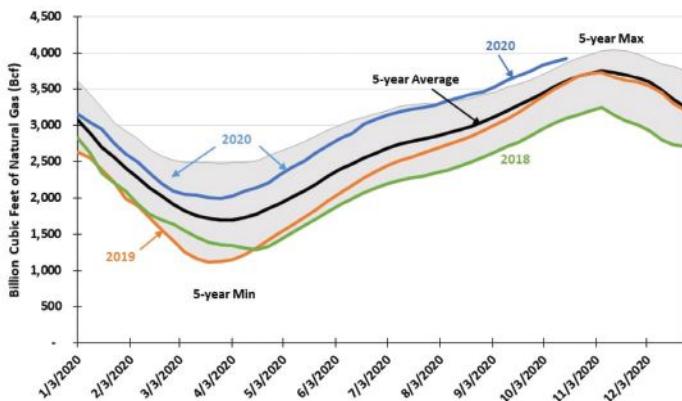
We are nearing 4 trillion cubic feet of gas in storage, which should be depressing gas prices, but the rebound in global LNG prices has increased margins for U.S. exporters who are stepping up shipments. When added to anticipated winter demand, the LNG increase is boosting gas prices. Moreover, gas production is struggling, despite higher prices because gas drilling continues to lag. The EIA's short-term projections call for gas production to steadily fall until next May, and as a result, it sees gas prices climbing close to \$3.50. They believe higher prices will be necessary to stimulate a supply recovery. The predicted gas prices take us to the highest levels since 2016, other than experienced during the two polar vortexes. Importantly, the EIA doesn't see gas prices falling below \$3.10 throughout all of 2021. For an industry that had to learn to live with \$2-\$3 gas prices following an era of \$8-\$10, an extended period of prices north of \$3 will be an enjoyable experience. The question is: Will international gas prices remain elevated to allow U.S. LNG exports to be profitable in the global gas market?

If LNG exports remain stable throughout the winter, gas price movements will be most influenced by weather patterns. NOAA's winter forecast is influenced by the continuation of La Niña, which means cooler, wetter conditions across the North, while warmer, drier conditions will dominate the South. The Old Farmer's Almanac has a similar outlook, with a few areas being significantly colder and snowier than last year. Overall, this should not be a severe winter, which is confirmed by our watching the neighborhood squirrels who aren't hoarding nuts. Gas prices will likely weaken by early spring with only modest winter gas demand, and higher oil prices boosting associated gas supply and more gas drilling. Producers hoping for higher prices should pray for a polar vortex or two this winter.

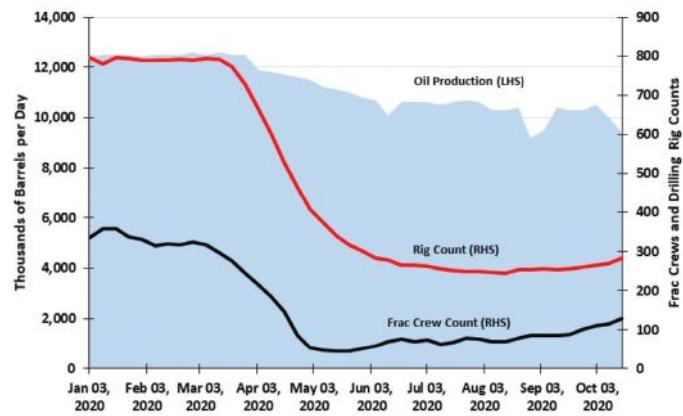
EIA STEO Natural Gas Production and Forecast (Oct.2020)



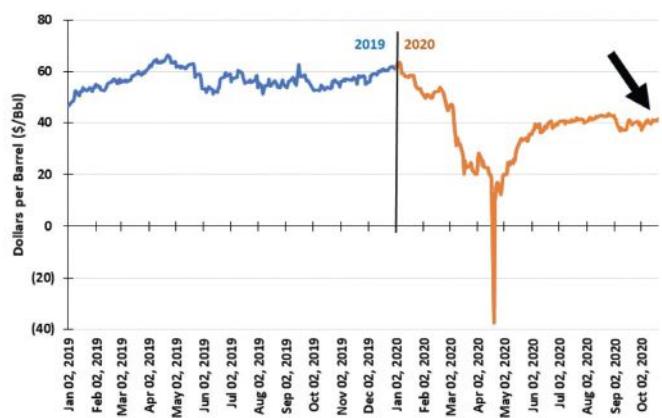
Despite High Storage
Gas Prices Rising -
End of Glut Ahead?



2020 U.S. Oilfield Activity Versus Weekly Production



Oil Price Stable
Since Collapse:
Up or Down Next?





AMERICAS

WOC SOS

Virtual » December 9-11

www.sustainableoceansummit.org

PTC

Virtual » January 17-20, 2021

www.ptc.org/ptc21

Floating Wind Solutions

Houston, TX » February 25-26, 2021

<https://floatingwindsolutions.com>

Offshore Well Intervention LATAM

Rio de Janeiro, Brazil » March 9, 2021

www.offsetnet.com/latam

Int'l Conference on Ocean Energy (ICOE)

Virtual » April 28-30, 2021

www.icoe2021.org

Offshore Technology Conference

Houston, TX » May 3-6, 2021

<http://2021.otcnet.org/>

EUROPE

Ocean Energy Europe

Virtual » December 1-2

www.oceanenergy-europe.eu/annual-event/oee2020

Oceanology Int'l

Virtual » December 1-4

www.oceanologyinternational.com

Deep Sea Mining Summit

London, UK » May 27-28, 2021

www.deepsea-mining-summit.com

SMM

Hamburg, Germany

» February 2-5, 2021

www.smm-hamburg.com

Upstream Digital Transformation Europe

Virtual » February 10-11, 2021

www.offsetnet.com/udt-eu

Submarine Networks EMEA

London, UK » February 16-17, 2021

www.terrapinn.com/conference/submarine-networks-world-europe/index.stm

Subsea Expo

Aberdeen, UK » February 23-25, 2021

www.subseaexpo.com

Conference for Wind Power Drives

Aachen, Germany » March 9-10, 2021

www.cwd.rwth-aachen.de/konferenz/cwd-2021

Decommissioning of Offshore & Subsea Structures

Aberdeen, UK » March 29 – 30, 2021

www.sut.org/event/decom-2021-3rd-international-conference-on-the-decommissioning-of-offshore-subsea-structures

OTHER REGIONS

Offshore Well Intervention Australia

Virtual » Feb. 8-12, 2021

<https://offsetnet.com/owi-aus>

Underwater Technology (UT)

Virtual » March 2, 2021

www.ut2021.org

Int'l Conference on Coastal and Ocean Engineering

Tokyo, Japan » April 3-5, 2021

www.iccoe.org

Offshore Well Intervention APAC

Kuala Lumpur, Malaysia

» May 18-19, 2021

www.offsetnet.com/owi-apac

PHILMARINE

Manila, Philippines

» June 15-17, 2021

<http://philmarine.com/>

Offshore Well Intervention West Africa

Accra, Ghana » September 8-9, 2021

<https://www.offsetnet.com/owi-wa>

MONTH & DEADLINES	EDITORIAL FOCUS	TECHNOLOGY & INDUSTRY FOCUS
JANUARY Editorial: Dec. 28 Ad: Jan. 14	» The Essential 2021 Offshore Toolkit	Technologies: ROV tooling & control, Subsea cables, Remote inspection, Supply vessels, turbines, tethers, and more. Industry Focus: Offshore Energy & Renewables, Marine Survey, Scientific, Defense
FEBRUARY Editorial: Jan. 25 Ad: Feb. 11	» Ocean Observation	Technologies: Buoys, ADCP, Data Software, Sensors, Drifters, Gliders, and more. Industry Focus: Marine Survey, Scientific, Offshore Energy & Renewables
MARCH Editorial: Feb. 22 Ad: Mar. 11	» Unmanned Vehicles & Marine Robotics	Technologies: USVs, AUVs, ROVs, Aerial drones, Control systems, Seafloor residency, and more. Industry Focus: Offshore Energy, Marine Survey, Defense, Academic, Subsea Infrastructure
APRIL Editorial: Mar. 22 Ad: Apr. 08	» Defense & Security	Technologies: Autonomous Navigation, Comms & Telemetry, Magnetometers, GIS, Sonar, and more. Industry Focus: Subsea Defense, Government, Offshore Energy, Subsea Infrastructure
MAY Editorial: Apr. 19 Ad: May 06	» Marine Renewables	Technologies: Turbines, Subsea Cables, Inspection Drones, Subsea Batteries, Grid Integration, and more. Industry Focus: Offshore Wind, Wave Energy, Tidal Energy, Alternative Offshore Energy
JUNE Editorial: May 17 Ad: June 03	» Bathymetric Mapping & Hydrographic Survey	Technologies: Oceanographic Equipment & Instrumentation, Sensor Suites, ADCP, Buoys, ROVs, and more. Industry Focus: Marine Survey, Academic, Geotechnical Services



**WE
ARE
READY!**

MEDIA CARD | 2021 » **ONT**

» GET DETAILS TODAY!

bit.ly/ONTMediaCard2021

KONGSBERG DIGITAL'S K-SIM® FISHERY SIMULATOR WINS SAFETY4SEA AWARD

Kongsberg Digital's acclaimed K-Sim Fishery simulator training solution has secured an important industry accolade by winning the SAFETY4SEA 2020 Training Award. After being shortlisted back in July, K-Sim Fishery was voted into first place by a substantial number of instructors and students who have been impressed by this vessel-specific training resource.

Tone-Merete Hansen, Sr. VP in Kongsberg Digital accepted the prize on behalf of Kongsberg Digital with a speech delivered by video link at a virtual awards ceremony which was streamed on YouTube, Facebook and LinkedIn on Tuesday, October 20. Presenting the award, Romanos Rodopoulos, Head of Maritime Academy and a board member of category sponsor Metropolitan College, noted that the award recognizes "the contribution of Kongsberg Digital to the technological evolution of maritime education. The K-Sim Fishery simulator complies with STCW training requirements, DNV GL certification standards and the UN Sustainability Goal 14."

SAFETY4SEA is widely regarded as an influential source of global shipping news with an unwavering emphasis on stories which promote and engender maritime safety, sustainability, regulatory compliance and pivotal developments in smart technology. The K-Sim Fishery simulator training solution exemplifies these values, providing trainees with a safe, environmentally-responsible and high-tech means of gaining all the operational skills and experience they will require when tackling their job roles on fishing boats in the real world.

In line with newly intensified STCW training requirements, the K-Sim Fishery simulator enables instructors to monitor and evaluate each exercise undertaken by individual users. These exercises can be repeated as many times as is necessary for trainees to attain the mandated standard of competence in operating onboard navigation and control equipment as well as gaining essential winch-handling expertise. By precisely replicating the instrumentation and working environment on the bridge of a fishing vessel in all weathers, sea states and situations, the simulator produces an immersive experience which is effectively indistinguishable from the real thing. The main difference, of course, is that users can learn from their mistakes without causing any hardship or suffering any consequence.

"We are delighted to receive this recognition for our K-Sim Fishery simulator, which we believe is an essential tool in building a safer,

more sustainable and ethical future for the fishing industry," commented Tone-Merete Hansen. "The power of simulation training to enhance crew safety, best-practice operations, fuel savings and carbon-footprint reduction is clear, and directly relevant to over 50 million people who rely on fisheries and aquaculture for their livelihoods. By equipping fishermen with the right knowledge, delivered in a secure, accessible and relevant way, they can build experience with the vessel and equipment, learn to increase the quality and repeatability of their catch, and help to reduce the risk of overfishing."



» Enhancing skills, safety and sustainability in the fishing industry, the K-Sim Fishery simulator won the prestigious SAFETY4SEA Training Award 2020

ABERDEENSHIRE START-UP WINS AWARD FOR ENVIRONMENTAL SERVICES

Aberdeenshire start-up company, Legasea, recently won the award for Best Energy Industry Environmental Service Provider 2020, making this their second award since establishing the company 18 months ago.

The Scottish Enterprise Awards recognize small sized businesses from Scotland,

whose efforts have produced excellent products and services over the course of the year. The Environmental Service Provider Award is presented to companies that show distinguished commitment and dedication to providing the best environmental service possible.

"We are delighted to receive

this award, particularly as it is for environmental sustainability, a subject that we are very passionate about. I would like to say a big thank you to the judges, for acknowledging the considerable efforts of our whole team, throughout the last 18 months," stated Ray Milne, Legasea Operations Director.

This marks the fourth annual SME News Scottish enterprise awards which recognizes the best of innovation in the service and customer service field. To move successfully from nominee to winner, there must be evidence of extensive expertise and skills, dedication client satisfaction with an on-going commitment to excellence and innovation.



THE ON&T PODCAST

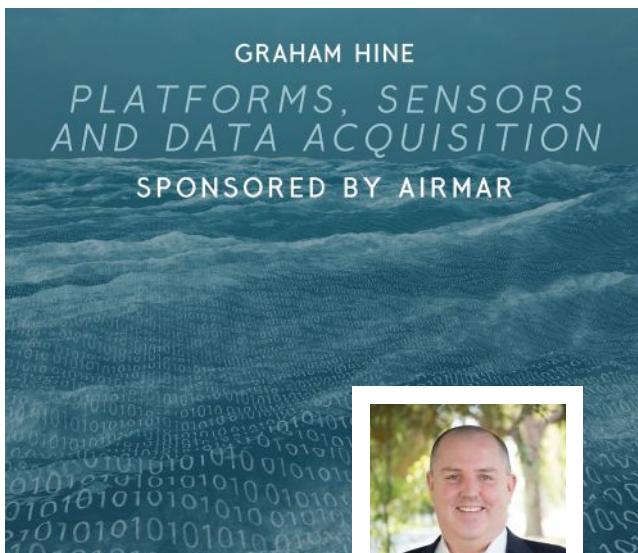
SEASON 1 / EPISODE 6

PLATFORMS, SENSORS, AND DATA ACQUISITION SPONSORED BY AIRMAR

Join us on the next episode of ON&T's SeaState when we talk to Graham Hine. Graham is the CEO of Liquid Robotics, a Boeing company based in Sunnyvale California. As one of the founders of Liquid Robotics, Graham's expertise in business, technology, and operations has played a major role helping to transform Liquid Robotics from a small start-up to an industry leader of autonomous ocean robots. Liquid Robotics manufactures the Wave Glider, an autonomous unmanned surface vehicle (USV) that operates individually or in fleets and is designed to support a wide range of sensors and payloads. The modular and adaptable payload design, coupled with a powerful solar energy system and on-board compute environment, allows Liquid Robotics to develop and deliver unique solutions to customers. More importantly, it allows customers to scale a proven application across many Wave Gliders quickly.

Prior to Liquid Robotics, Graham managed Software Engineering at Asyst Technologies, a manufacturer of robotics, control systems, and embedded applications. Earlier in his career Graham was president and CEO of Gibraltar Software, Inc., a security management enterprise application and president and CEO of Tuxtops, Inc., maker of Linux-based laptops and mobility software. He led the creation of the software engineering function and served on the board of directors at Hine Design, his family's robotics company. He helped negotiate its sale to Asyst Technologies and helped integrate the two companies. He started his career as an embedded software engineer at Centigram, Inc., one of the pioneers of voice processing technology. www.oceannews.com/seastate

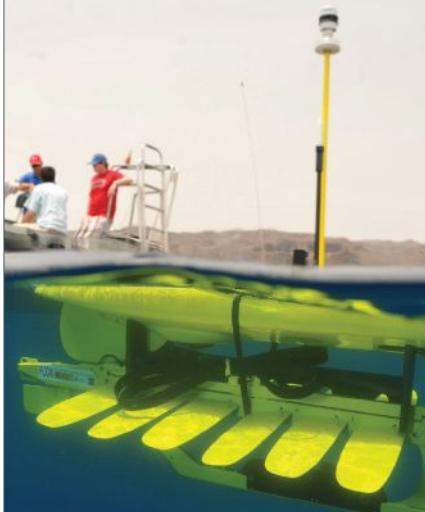
GRAHAM HINE
PLATFORMS, SENSORS
AND DATA ACQUISITION
SPONSORED BY AIRMAR





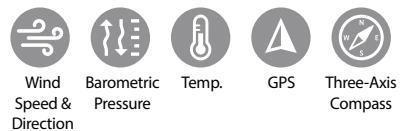
» Graham Hine

**PROVEN
RELIABILITY**
for the
Toughest Missions



WeatherStation® 200WX-IPX7

WEATHERSTATIONWX.COM



AIRMAR®
TECHNOLOGY CORPORATION

TRELLEBORG UPGRADES ITS OIL & GAS TRANSFER AND SHIP PERFORMANCE SOLUTIONS FACILITY TO MEET INCREASING DEMAND OF LNG INDUSTRY

Trelleborg's marine and infrastructure operation has transferred its business that supplies oil & gas transfer systems and ship performance solutions to a new, purpose-built 1,800 square meter manufacturing and office facility in Hawarden, Wales.

Dave Pendleton, Managing Director of Trelleborg's marine and infrastructure operation, said: "The investment in this facility highlights our intent to support our customers to capitalize on the growing LNG market and further expand operations to keep up with demand. Driven by the global desire to reduce emissions, LNG demand is expected to continue to grow beyond 2035. This will result in more LNG carriers and LNG import and export terminals, as well as LNG fueling projects.

"The opening of our new facility in Hawarden, ensures that we will continue to serve our customers in over 60 countries across the world and build on what was already one of our global centers of excellence and technology leadership. Having founded the company in what was the old village courthouse 21 years ago, this relocation just

down the road means we remain true to our roots and will continue to invest in the local area."

Housing 55 employees across various disciplines, with further room to expand, the new facility will design, manufacture and provide aftersales support for a variety of technologies for both the LNG and ship performance sectors across the world. Featuring increased office and production space, it provides enhanced manufacturing capacity and lead times for customer projects. The facility also boasts two bespoke factory acceptance test (FAT) rooms, fitted with video conference technology that allows customers to attend testing even when travel is restricted.

Trelleborg will continue to manufacture its Ship-Shore Link (SSL), Universal Safety Link (USL) and Emergency Safety Link (ESL) products from the new facility, as well as its Ship Performance Monitoring System.

As a leader in SSL technology, Trelleborg has supplied its system, which enables the safe transfer of LNG from ships to terminals, to



» Trelleborg's 1,800 square meter facility in Hawarden, Wales. (Photo credit: Trelleborg)

over 80% of the world's LNG carrier fleet and 75% of the world's LNG terminals, while the USL and ESL products are suitable for use in the LNG fueling and chemical transfer markets. Trelleborg's Ship Performance Monitoring System monitors waves, weather, vessel trim, propeller power and fuel consumption in order to help crews optimize fuel consumption and reduce emissions.

Trelleborg received financial support from the Welsh government to help deliver the new facility and maintain their proud ongoing connection with the village of Hawarden. Going forward, the site will continue to support local schools across various STEM (science, technology, engineering and math-based) initiatives.

For more information on Trelleborg's marine and infrastructure operation, visit: www.trelleborg.com/en/marine-and-infrastructure

RE2 ROBOTICS ACHIEVES 50% GROWTH DESPITE PANDEMIC

RE2 Robotics, a leading developer of intelligent mobile manipulation systems, recently reported its 2020 hiring goal of increasing its staff by 50 percent. In particular, 83 percent of the new hires were engineers from a variety of disciplines, including mechanical, electrical, and software engineering. In addition, the company has added to its operations team with the hiring of a head of talent, director of IT, and accountant, and has augmented its production team with the addition of a CNC machinist and lab assistant.

As announced in January, RE2's hiring push is a direct result of the company's significant expansion into commercial markets, including the aviation, energy, and medical industries. Throughout the remainder of the year, the company will continue to hire additional engineering and production staff.

"RE2 has been extremely fortunate to continue our growth despite these challenging times," said Amy Tisdale, head of talent, who also joined RE2 earlier this year. "We had to quickly adapt



» RE2 Robotics is a leading developer of mobile manipulation systems

to not only working remotely, but also recruiting, hiring, and onboarding our new employees remotely. The benefit of rapidly adapting was that we honed our recruiting and onboarding process and became a well-oiled hiring machine. We plan to use these best practices moving forward to ensure all new employees, whether remote or on-site, have a seamless experience."

According to Jorgen Pedersen, president and CEO of RE2 Robotics: "We came together as a team, developed new remote work processes across the company, including recruiting and onboarding, and hired incredible talent throughout the company. I must commend the entire RE2 team for their agility and perseverance during this extremely difficult time. Not only did the team adapt, but we exceeded our 2020 hiring goal well before the end of the year."

For more information about RE2's open positions, visit: <http://www.resquared.com/careers>

FIRST HARVEST NAVIGATION SELECTS SEA MACHINES TO LAUNCH AUTONOMOUS CARGO VESSEL

First Harvest Navigation has selected Boston-based Sea Machines' technology to launch the first autonomous hybrid cargo vessel in the U.S. Powered by Sea Machines' SM300 autonomous command and remote-helm control system, the electric-powered *Captain Ben Moore* will also be the first hybrid cargo vessel to feature remote crew-assist technology and to generate zero emissions.

Once complete, the vessel's intelligent capabilities will offer First Harvest Navigation redundancy and flexibility for crew shifts, with the capability to autonomously command *Captain Ben Moore* from the company's land-based control station. In addition to autonomous control and remote vessel monitoring tools, the SM300 system also features obstacle detection and collision avoidance technology for added operational safety.

Captain Ben Moore will enter service between Norwalk and Huntington, NY, to deliver food and other cargo faster, more reliably and affordably than truck transportation. The terminal-to-terminal voyage of 35 to 45 minutes will offer an alternative to a near nine-hour round trip for trucks.

"The Sea Machines SM300 autonomous navigation system will help us achieve many of our goals because it enables shipping movements to be completed very reliably and efficiently in a seamless and sustainable delivery system," said Bob Kunkel, president, First Harvest Navigation. "Shifting cargo from streets and highways also alleviates the growing congestion, lower emissions and reestablishes our waterways as a viable and cost-efficient alternative to land-based transport."

Michael G. Jonson, founder and CEO, Sea Machines said: "The SM300 ensures predictable and performance-based vessel operations while providing a 24/7 crew support system that is always on watch."

The hybrid vessel can carry approximately 28 pallets and is powered by a pair of Cummins QSB 6.7 diesels, generating 104 kW each at 2,400 kW, and lithium batteries connected to a pair of BAE Systems HybriDrive electric motors.

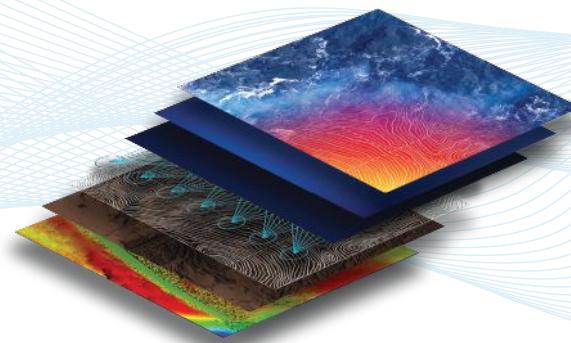


» Captain Ben Moore

Oceanology
international®
2020

1–4 DECEMBER 2020
ONLINE

Register to attend for FREE
oceanologyinternational.com



NEW
SHOW DATES



DISCOVER



SOURCE



CONNECT



LEARN

Organised by:



In partnership with:

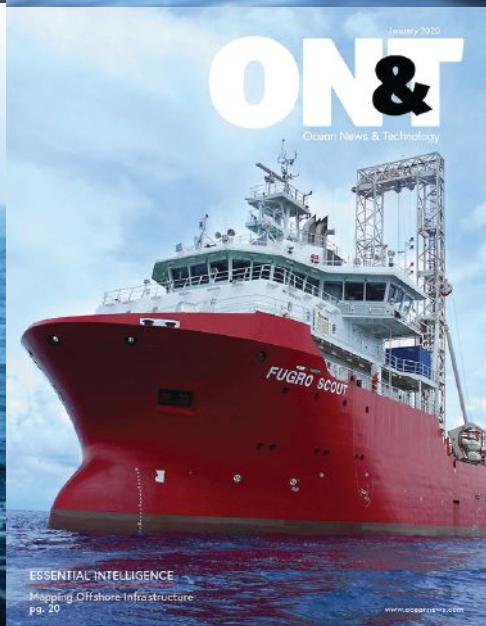
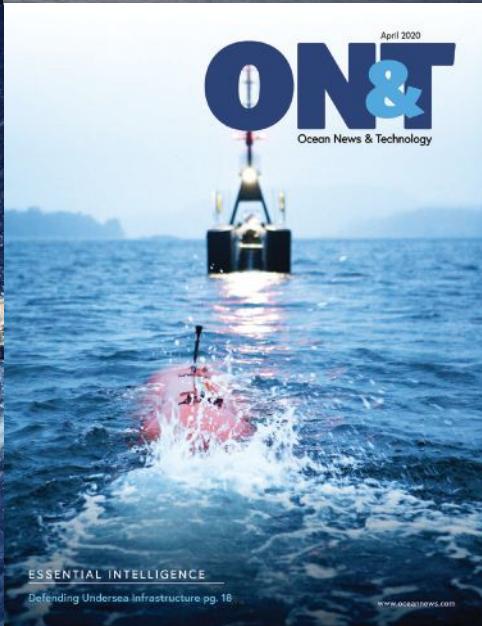
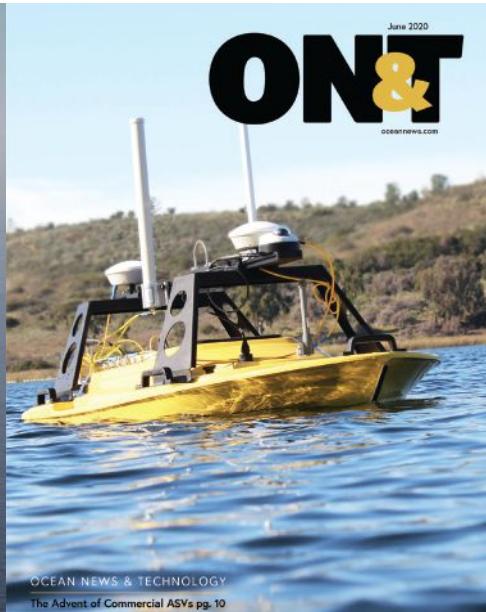
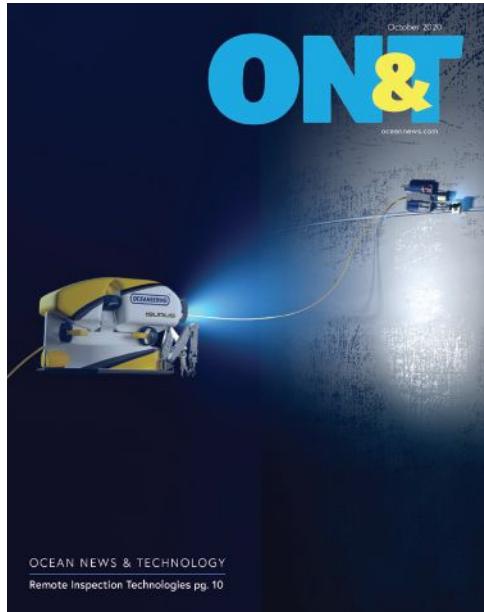


Endorsing associations:



ON&T COVERS WHAT'S NEXT

STAY INFORMED



» SUBSCRIBE TODAY!

oceannews.com/subscribe

OCEAN INDUSTRY DIRECTORY



ON&

ACOUSTIC SYSTEMS

HIGH TECH, INC.

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



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

OCEAN SONICS LTD.

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



Ocean Sonics designs and manufactures icListen, the world's first smart digital hydrophone. Compact and easy to use, its small size makes it the perfect tool for sound data collection. Listen in real-time and improve decision making, or use as an acoustic recorder for long term deployments. The best data is collected by the best tools. icListens internal processing saves time. Digital sound is streamed live.

Ocean Sonics is dedicated to your success. We provide services in deployment, system design and integration, and data processing.

Listen Now. The Ocean Sonics Way.

ADCP/DVL

NORTEK AS

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



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

BUOYS

METOCEAN TELEMATICS

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



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

BUOYANCY PRODUCTS

DEEPWATER BUOYANCY, INC.

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



DeepWater Buoyancy Inc. is the world's largest producer of subsea buoyancy products for the oceanographic community and has a vast product line of buoyancy solutions for offshore oil & gas, energy and technology companies. This product portfolio has been built over the course of 40 years serving these industries. Though products are offered for shallow water applications, the company specializes in deepwater, providing solutions to depths of 6000 meters and beyond.

NAUTILUS MARINE SERVICE GMBH

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



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

Simple, reliable and affordable.

SUBSALVE USA

P.O. Box 2030
North Kingstown, RI 02852
Phone: 401 884 8801
Fax: 401 884 8868
E-mail: richard@subsalve.com
Website: www.subsalve.com
Contact: Richard Fryburg



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

CAMERAS / LIGHTS / LASERS

ARCTIC RAYS LLC

382 Chicopee Row
Groton, MA 01450
Tel: +1 567 343 2370
E-mail: lee@articrays.com
Website: www.articrays.com
Contact: Lee Fray



Arctic Rays LLC is a specialist in the design and manufacture of deep sea lighting and imaging products specifically for use on AUVs, but also prove ideal for manned vehicles and all other underwater, surface vehicles or platforms. Our designs feature the smallest possible size and lowest power consumption available.

CATHX OCEAN

Unit D3, M7 Business Park,
Newhall, Naas,
Kildare W91F780
Ireland
Phone: + 353 (0) 45 252 786 / UK: +44 (0) 1224 432 180 / USA: +1 (832) 808-3403
E-mail: apastor@cathxocean.com
Website: www.cathxocean.com
Contact: Alberto Lopez Pastor
Cathx Ocean design and manufacture advanced subsea imaging and precision measurement systems for subsea operations.



Designed to meet stringent technical, operational and integration requirements associated with various subsea applications and vehicle types, Cathx Ocean's systems offer precision, reliability and peace of mind. Products include advanced still imaging, colour laser point cloud and video systems, designed to deliver precision subsea data in a way that allows automation for subsea vehicle operations.

The range includes the Hunter system (AUV Imaging and Laser), the Scout system (Observation Class ROV Imaging and Laser Profiling), the Pathfinder system (Work Class ROV Imaging and Laser Profiling) and the Prowler I & II systems (Towed Vehicle Imaging Range and Scale Measurement).

DEEPSSEA POWER & LIGHT

4033 Ruffin Rd.
San Diego, CA 92123
Phone: 858 576 261
Fax: 858 576 0219
E-mail: sales@deepsea.com
Website: www.deepsea.com



For over 30 years, DeepSea Power & Light has provided high-quality and innovative products to the oceanographic community. The company's expertise and product line has grown to include underwater video systems, lighting solutions, pressure relief valves, and lasers.

Design criteria for products include ease of service, reliability, high performance, and cost effectiveness. Products are rigorously tested in both the initial design process and manufacturing stage to perform in the harsh marine environment—from wet/dry surface applications to full ocean depth deployments. DeepSea Power & Light offers a versatile product line while developing new designs to continue exceeding market expectations.

SIDUS SOLUTIONS, LLC

7352 Trade Street
San Diego, CA 92121
Phone: 619 275 5533
E-mail: info@sidus-solutions.com
Website: www.sidus-solutions.com



SIDUS Solutions LLC, 'SIDUS' is a worldwide company that designs, manufactures and installs systems in the most extreme of environments. SIDUS products include Cameras, Pan & Tilts, Lights and Lasers for use in hazardous areas for and SUBSEA, serving the, energy, scientific, military, nuclear, and shipping industries. Engineering experience makes us the perfect choice for application specific surveillance systems to provide end to end safety and security. SIDUS provides complete integration, design, documentation, and commissioning for all systems. From sea-floor observation platforms, to surveillance systems on drilling rigs, or sonar deployment systems - SIDUS is a field proven solution.

CABLES**SOUTH BAY CABLE CORP**

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



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

CONNECTORS**BIRNS, INC.**

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



BIRNS has served the subsea industry since 1954, and is an ISO 9001:2015 certified global leader in the design and manufacturing of high performance connectors, cable assemblies and lighting systems. With a NAVSEA PRO-020 certified molding facility, it offers sophisticated connector lines, including 6km-rated electrical, electromechanical, coaxial, electro-coax, optical, electro-optical and electro-opto-mechanical hybrids. BIRNS provides the industry's highest volume of cost-effective hydrostatic and helium pressure testing, and has a wide range of ABS Product Design Assessment (PDA) certified fiber optic and electrical penetrators. BIRNS' LED and tungsten-halogen marine, chamber, security and commercial diving lights are trusted in the world's most extreme environments.

BIRNS AQUAMATE LLC

122 Waltham St.
Pawtucket, RI 02860 USA
Phone: +1 401 723 4242
Fax: +1 401 753 6342
E-mail: sales@birnsaquamate.com
Website: www.birnsaquamate.com
Contact: Michelle DeTerra



Birns Aquamate design and manufacture underwater electrical connectors, cable assemblies, and cable terminations. The company produces a wide range of standard industry products such as the 5500 Series, SC, MC, LP, FAWL/FAWM, NANO, TC, Rubber Molded, etc. Birns Aquamate is the only manufacturer to guarantee compatibility with other uvw connectors. Birns Aquamate also specializes in fast turn-around for custom design of special connector solutions. All connectors are manufactured under DNV ISO 9001:2000 certification. Dealers in Canada, Brazil, UK, Belgium, Holland, Norway, Germany, South Africa, Holland, Italy, and China.

SOURIAU - SUNBANK | CONNECTION TECHNOLOGIES

1740 Commerce Way
93446 Paso Robles, USA
Phone: +1 805 423 5046
E-mail: VMansour@souriau.com
Website: www.souriau.com
Contact: Vincent Mansour,
North America Product Manager Marine/Space/Milaero



SOURIAU - SUNBANK
Connection Technologies

SOURIAU-SUNBANK Connection Technologies is a global leader in interconnect solutions engineered to withstand the harshest of environments as aeronautics, space, defense, transport, energy, industrial equipment, healthcare devices, and lighting. It invests in R&D and manufacturing facilities to produce solutions that comply with environmental requirements and international trade rules. SOURIAU-SUNBANK's wide range of products are designed using cutting-edge electrical and optical connection technologies. All are suitable for use in non-hazardous environments as well as those involving extreme temperatures, strong vibrations and corrosive liquids, and meet specific international market standards.

DESIGN & ENGINEERING**HYDRO LEDUC NA, INC.**

19416 Park Row, Ste. 170
Houston, TX 77084
Phone: 281 679 9654
E-mail: bogden@hydroleduc.com
Website: www.hydroleduc.com



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

DIGITAL VIDEO RECORDING SYSTEMS

DIGITAL EDGE SUBSEA, LTD

Doubletree Court, Cavendish St.
Ulverston, Cumbria
LA127AD
Phone: +44 (0) 1229 206456
E-mail: john@digitaledgesubsea.com
Website: www.digitaledgesubsea.com
Contact: John Benson

The EdgeDVR is currently used worldwide by most of the major ROV and Diving contractors. With our present Version 4 software, we have 6 models. The EdgeDVR has become an essential part of any ROV and Diving system offshore, easy to use and reliable. The system is capable of recording simultaneous High Definition and Standard Definition video, together with auto creation of Dive, Video, Photo and Anomaly logs. Multi channel digital overlay is also available for all recorded channels, logos and realtime survey data can be displayed. With around 500 systems now offshore, we have a proven record of reliability.

Our version 5 software is currently in development and full details will be released soon...

EQUIPMENT RENTAL

OKEANUS SCIENCE & TECHNOLOGY, LLC

2261 Denley Road
Houma, LA 70363
Phone: 985 346 4666
Fax: 985 346 8444
E-mail: Bleblanc@okeanus.com
Website: www.okeanus.com
Contact: Benton LeBlanc



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



FIBER OPTIC PRODUCTS/SERVICES

OCEAN SPECIALISTS, INC.

8502 SW Kansas Ave
Stuart, FL 34997
Phone: +1 772 219 3000
Fax: +1 772 219 3010
E-mail: contact@oceanspecialists.com
Website: www.oceanspecialists.com



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

GYRO COMPASSES

KONGSBERG SEATEX AS

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



KONGSBERG

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

LIQUID STORAGE

AERO TEC LABORATORIES, INC. (ATL)

45 Spear Road Industrial Park,
Ramsey, NJ 07446 USA
Phone: +1 201 825 1400
Fax: +1 201 825 1962
E-mail: atl@atlinc.com
Website: www.atlinc.com
Contact: David Dack



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

MARINE ENVIRONMENTAL CONSULTING SERVICES

CSA OCEAN SCIENCES INC.

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



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

MARINE VENTURES INTERNATIONAL, INC. (MVI)

8524 SW Kansas Avenue
Stuart, FL 34997
Phone: +1 772 419 9627
Fax: +1 772 419 9628
E-mail: kcomer@marineventures.com
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

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



KONGSBERG

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

Level 8, 37 Pitt Street, Sydney 2000

New South Wales, Australia

Phone: +61 2 9099 3800

E-mail: sales@advancednavigation.com.au

Website: www.advancednavigation.com

Contact person: Tim Laws at sales@advancednavigation.com

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

Ackerstrasse 76

13355 Berlin, Germany

Phone: +49 (0) 30 4679 862 0

Fax: +49 (0) 30 4679 862 01

E-mail: sales@evologics.de

Website: www.evologics.de



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.

KEARFOTT CORPORATION

1150 McBride Avenue

Woodland Park, NJ 07424

Phone: +1 973 785 6000

E-mail: marketing@kearfott.com

Website: www.kearfott.com



Kearfott is a leader in the design, manufacture, and support of guidance, navigation, and motion-control products for the aerospace, defense, energy exploration, and unmanned system markets. For over 100 years, Kearfott has been committed to delivering the best, most innovative technology for guidance, navigation, and motion-control products. Its products guide spacecraft and strategic missiles, navigate autonomously undersea, provide navigation and fire control for ground vehicles, and control motion aboard aircraft. Kearfott is a subsidiary of Astronautics Corporation of America, a global leader in the design, development, and manufacture of avionics equipment and systems for the commercial and military aerospace industry.

KONGSBERG SEATEX AS

Pirsentert

N-7462 Trondheim, Norway

Phone: +47 73 54 55 00

Fax: +47 73 51 20

E-mail: km.seatex.sales@kongsberg.com

Website: www.km.kongsberg.com/seatex

Contact: Finn Otto Sanne at finn.otto.sanne@kongsberg.com

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



KONGSBERG

RJE INTERNATIONAL, INC.

15375 Barranca Parkway, Ste I-112

Irvine, CA 92617

Phone: +1 949 727 9399

E-mail: sales@rjeint.com

Website: www.rjeint.com

Contact: Bruce O'Bannon



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.

NETWORKS & DATA COMS

KONGSBERG SEATEX AS

Pirsentert

N-7462 Trondheim, Norway

Phone: +47 73 54 55 00

Fax: +47 73 51 20

E-mail: km.seatex.sales@kongsberg.com

Website: www.km.kongsberg.com/seatex

Contact: Finn Otto Sanne at finn.otto.sanne@kongsberg.com



KONGSBERG

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.

OCEANOGRAPHIC INSTRUMENTS/SERVICES

ASL ENVIRONMENTAL SCIENCES, INC.

Victoria, BC, Canada

Phone: +1-250-656-0177

E-mail: asl@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.

ROMOR OCEAN SOLUTIONS

41 Martha Avenue

Mount Uniacke, NS Canada

BON 1Z0

Phone: +1 (902) 466 7000

Fax: +1 (902) 466 4880

E-mail: Sales@romor.ca

Website: www.romor.ca



Contact: Darrin Verge, President & CEO

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

SEA-BIRD SCIENTIFIC

13431 NE 20th St.

Bellevue, WA 98005

Phone: +1 425 643 9866

Fax: +1 425 643 9954

E-mail: info@sea-birdscientific.com

Website: www.sea-birdscientific.com

Contact: Calvin Lwin, Sales



Sea-Bird Scientific provides best-of-class sensors and systems for oceanographic research and environmental water quality monitoring of physical and biogeochemical properties. Sea-Bird Scientific is the leader in accurate, stable ocean instruments for measuring conductivity (salinity), temperature, pressure, oxygen, pH, chlorophyll, CDOM, turbidity, beam attenuation, irradiance, radiance, PAR, nitrate, and phosphate. Our CTD profilers, water samplers, moored CT recorders, wave/tide recorders, DO sensors, and optical sensors are used by research institutes, ocean observing programs, government agencies, and navies globally.

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

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.

STAR:ODDI

ROPE

CORTLAND COMPANY
 10633 West Airport Blvd Ste 300
 Stafford TX 77477
 Phone: +1 832 833 8000
 E-mail: cortland@cortlandcompany.com
 Website: www.cortlandcompany.com
 Contact: Slobodan Nikolic



Cortland designs, manufactures, and supplies technologically advanced synthetic fiber ropes, slings and synthetic fiber strength members. For example, we offer deep water synthetic fiber rope solutions, oceanographic mooring systems, synthetic reinforcing over braids, hair fairing to reduce drag / strumming, and inline attachments or lifting points (cable grips).

Collaborating with customers, our team uses its experience in high performance materials and market knowledge to transform ideas into proven products. We continue to innovate fit-for-purpose synthetic solutions for the ocean sciences. Cortland is a part of the Enerpac Tool Group (NYSE: EPAC), a diversified industrial company. Visit us online at cortlandcompany.com.

SONAR SYSTEMS

EDGETECH
 4 Little Brook Rd.
 West Wareham, MA 02576
 Phone: +1-508 291 0057
 E-mail: info@edgetech.com
 Website: www.edgetech.com
 Contact: Amy LaRose



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

IMAGENEX TECHNOLOGY CORP.
 209 – 1875 Broadway Street
 Port Coquitlam, BC
 V3C 4Z1 Canada
 Phone: +1 604 944 8248
 E-mail: info@imenex.com
 Website: www.imagenex.com
 Contact: Steve Curnew



Imagenex Technology Corp. is an innovative company that was founded in 1988 by pioneers in the development of high resolution sonar. With thousands of systems in use on imaging and profiling projects all over the world, Imagenex has developed a reputation for products that break new ground for depth capability, size, cost, imaging quality and functionality. Each system in this growing product line integrates the latest in sub-miniature electronics into industry proven, robust underwater housings for a total package that is small, rugged, and will provide years of maintenance-free use. Products include multibeam, mechanical scanning, and sidescan sonars.

KLEIN MARINE SYSTEMS, INC.

11 Klein Drive
 Salem, NH 03079
 Phone: +1 603 893 6131
 International: 603 893 6131
 E-mail: sales@kleinmarinesystems.com
 Website: www.kleinmarinesystems.com



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!

SOUND VELOCITY PROBES/CTDS

SAIV A/S
 Nygårdsviken 1, 5165
 Laksevåg, Norway
 Phone: +47 56 11 30 66,
 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
 6032 Railroad Avenue
 Morgan City, LA 70380
 Phone: +1 985 385 6789
 E-mail: bill.new@newindustries.com
 Website: www.newindustries.com
 Contact: Bill New



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

SUBSEA TECHNOLOGY

SUBTECH GMBH
 Wellseedamm 1-3, 24145 Kiel,
 Germany
 Phone: +49 431 22039 880
 Fax: +49 431 22039 881
 E-mail: info@subtech.com
 Website: www.subtech.com



Ocean Power: Leading manufacturer of Subsea Oil+Gas, Storage, UPS, ROV and AUV vehicle Li-Ion batteries - fully approved according API17F, MIL-STD, UN T38.3 etc. to guarantee highest efficiency, reliability and safety for your jobs.

Ocean Monitoring: Leading manufacturer of autonomous, standardized underway measurement systems for greenhouse gases e.g. pCO₂ and other water quality parameters. Producer of datalogger and CO₂ analyzers with SOCAT standard.

UNMANNED MARITIME VEHICLES

GENERAL DYNAMICS MISSION SYSTEMS'
BLUEFIN ROBOTICS PRODUCTS

553 South Street
Quincy, MA 02169
Phone: +1 617 715 7000
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.

INTERNATIONAL SUBMARINE
ENGINEERING LTD. (ISE)

1734 Broadway Street,
Port Coquitlam, BC, V3C 2M8
Phone: +1 604 942 5223
E-mail: info@ise.bc.ca
Website: <https://ise.bc.ca/>



International Submarine Engineering Ltd. (ISE) is a world leader in the design and integration of autonomous and remotely operated robotic vehicles and terrestrial robotics. Over our 40+ years in business, we have accumulated a great deal of expertise in the design, manufacture, and maintenance of:

- Autonomous Underwater Vehicles (AUVs)
- Remotely Operated Vehicles (ROVs) for subsea operation
- Human Occupied (HO) submersibles
- Customized systems for the offshore oil industry
- Customized systems for the Military-Naval sector
- Hydraulic, pneumatic, and electric robotic manipulators
- Teleoperated and autonomous robotic systems
- Robotic systems for nuclear Industry applications
- Communications and real-time control system

L3 HARRIS (OCEANSERVER)

275 Martine Street
Fall River, MA 02723 USA
Phone: +1 508 678 0550
Fax: +1 508 678 0552
E-mail: IVER.Sales@L3Harris.com
Website: www.L3Harris.com
Contact: Jim Kirk



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.

MARISCOPE MEERESTECHNIK

Eichkoppel 21, 24214 Gettorf,
Germany
Phone: +49 4346 6000 490
E-mail: info@mariscope.de
Website: www.mariscope.de
Contact: Niklas Becker



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.

OUTLAND TECHNOLOGY

38190 Commercial Ct.
Slidell, LA 70458 USA
Phone: 985 847 1104
Fax: 985 847 1106
E-mail: jeff@outlandtech.com
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.

1914 Northfield Road,
Nanaimo BC V9S 3B5 Canada
Phone: +1 250 729 8899
E-mail: sales@seamor.com
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

OKEANUS SCIENCE & TECHNOLOGY LLC

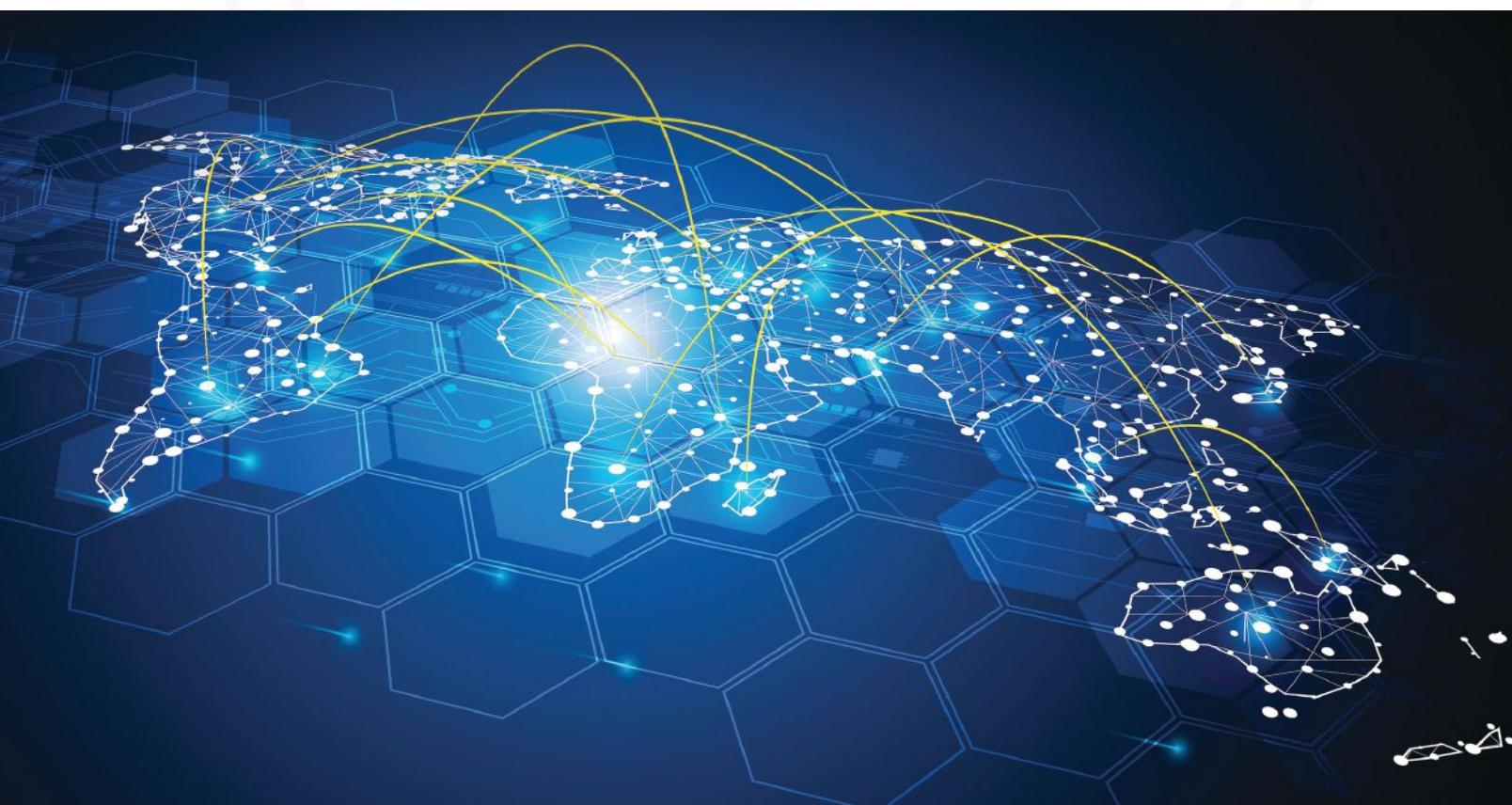
17455 NE 67th Court, Suite 120
Redmond, WA 98052
Phone: +1 425 869 1834
Fax: +1 425 869 5554
E-mail: info@okeanus.com
Website: www.okeanus.com
Contact: Ted Brockett



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.



SubCableWorld



Analyzing the cable industry.

Airmar	55	Oceanology Int'l	57
www.airmar.com/unmanned-surface.html			
BAE Systems	68	Ocean Specialists, Inc.	49
www.baesystems.com			
Bluefield Geoservices	09	Okeanus Science & Technology	04
www.bluefieldgeo.com			
CSA Ocean Sciences	05	SubCtech GmbH	27
www.csaocean.com			
EvoLogics GmbH	67	Subsalve USA	35
www.evologics.de			
GeoSpectrum Technologies, Inc.	31	SubCableWorld	65
www.geospectrum.ca			
J.W. Fishers Manufacturing, Inc.	23	SeaRobotics	07
www.jwfishers.com			
Klein Marine Systems, Inc.	41	ULC Robotics	19
www.kleinmarinesystems.com			
MacArtney A/S	03	VideoRay	02
www.macartney.com			



Evo
Logics®

SMART SUBSEA SOLUTIONS

Delivering data in most adverse conditions: underwater acoustic modems with advanced communication technology and networking

Accurate USBL and LBL positioning of underwater assets

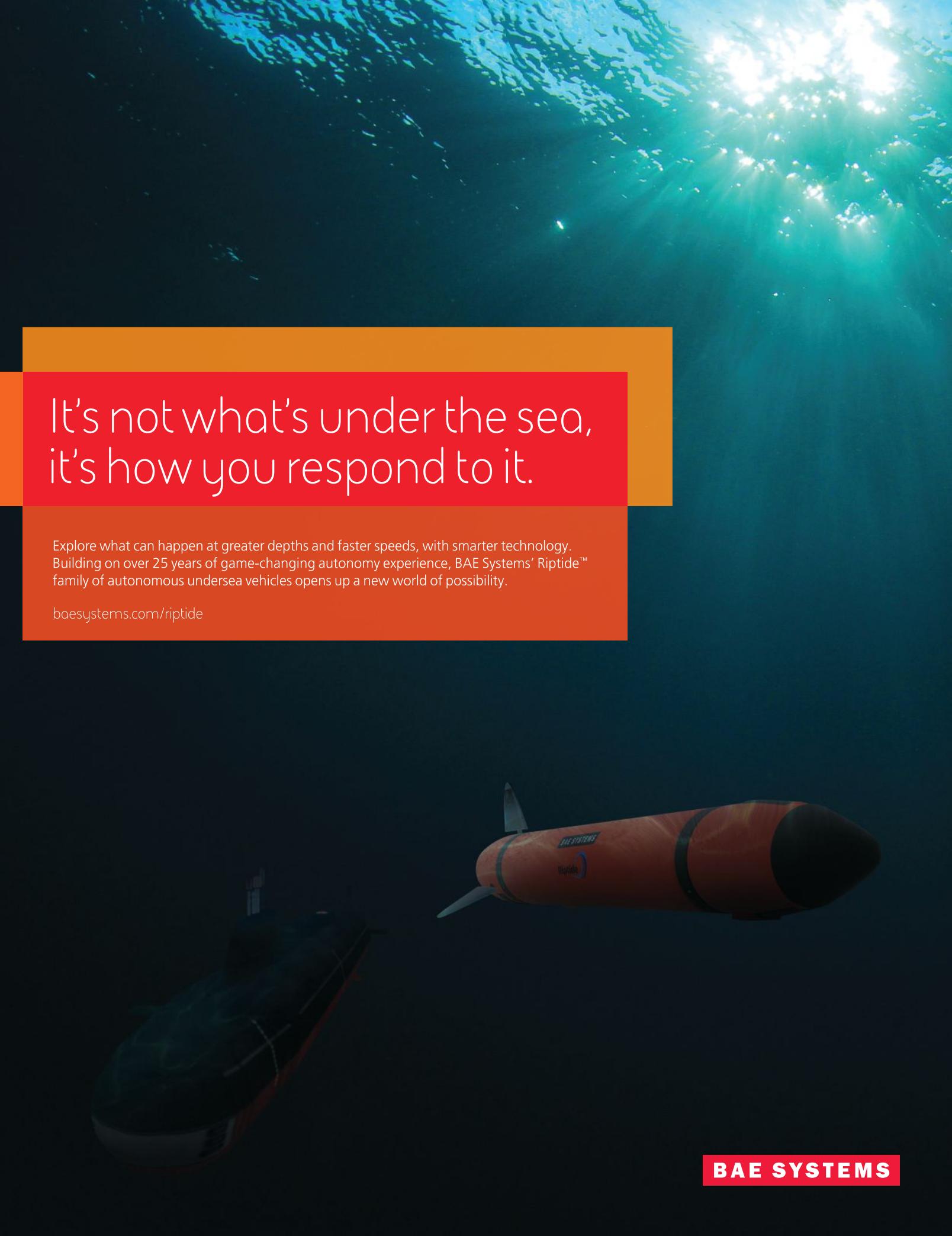
Modem emulator and other cost-saving developer tools

Autonomous surface vehicle for bathymetry, monitoring and AUV support

**ULTRA-COMPACT
“TINY” MODEMS**



S2C M (left) and the new S2C T “tiny” modem - 20% smaller and lighter



It's not what's under the sea,
it's how you respond to it.

Explore what can happen at greater depths and faster speeds, with smarter technology. Building on over 25 years of game-changing autonomy experience, BAE Systems' Riptide™ family of autonomous undersea vehicles opens up a new world of possibility.

baesystems.com/riptide



BAE SYSTEMS