MARINE TECHNOLOGY REPORTER

May 2017

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Anti-Submarine Warfare
Unmanned Future

Country Report Ireland
The Emerald Isle Goes "Blue"

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Renewable Energy
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Volume 60 Number 4

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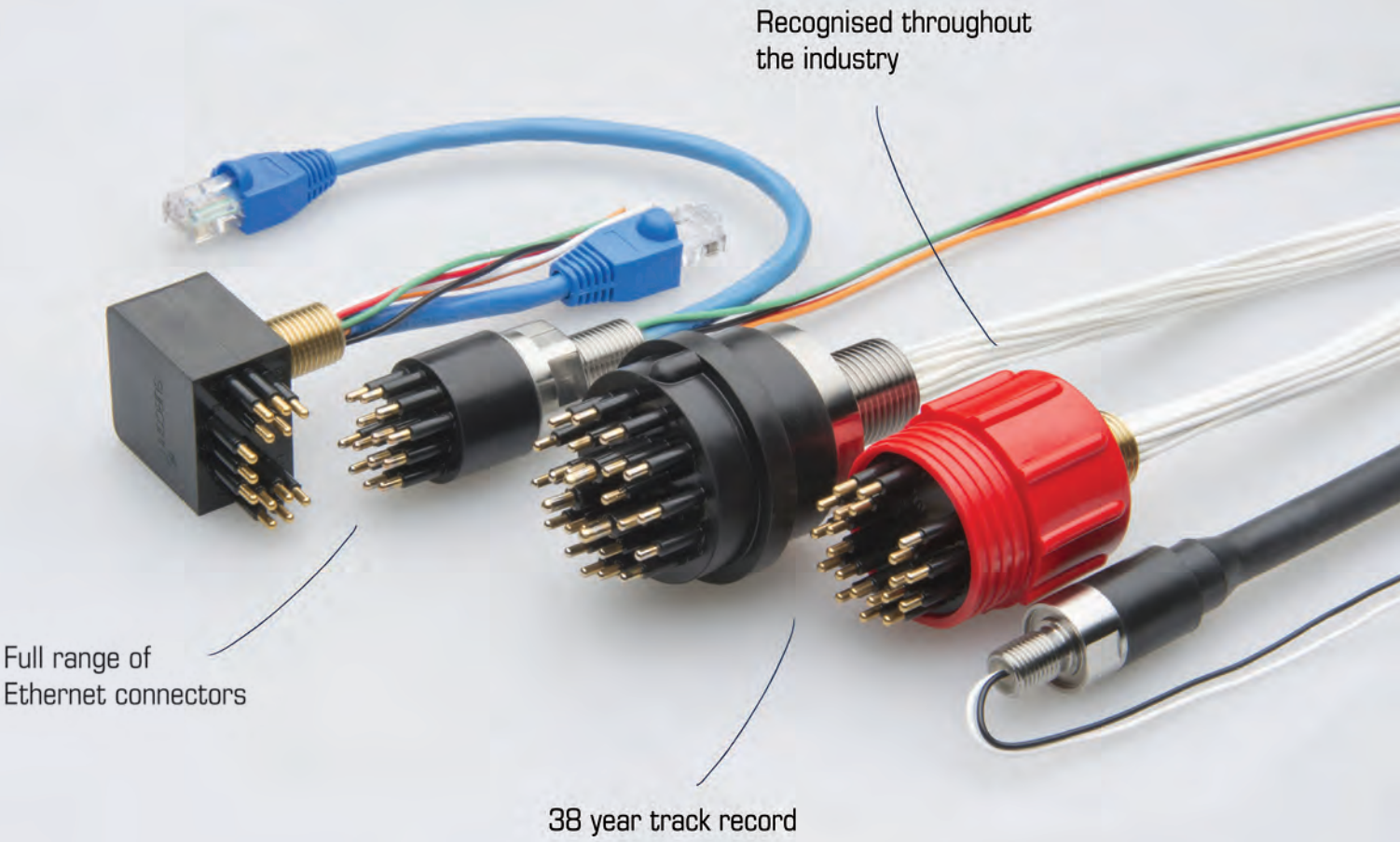

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NEW YORK
118 E. 25th St., New York, NY 10010
Tel: (212) 477-6700; Fax: (212) 254-6271

FLORIDA
215 NW 3rd St., Boynton Beach, FL 33435
Tel: (561) 732-4368; Fax: (561) 732-6984

PUBLISHER
John C. O'Malley
jomalley@marinelink.com

Associate Publisher & Editor
Gregory R. Trauthwein
trauthwein@marinelink.com

Managing Editor
Eric Haun
haun@marinelink.com

Contributing Writers
Kira Coley, United Kingdom
Capt. Edward Lundquist, USN (Ret.)
Tom Mulligan, Ireland
Claudio Paschoa, Brazil
William Stoichevski, Norway

Production Manager
Irina Vasilets
vasilets@marinelink.com

Production & Graphic Design
Nicole Ventimiglia
nicole@marinelink.com

Corporate Staff
Manager, Marketing
Mark O'Malley
momalley@marinelink.com

Accounting
Esther Rothenberger
rothenberger@marinelink.com

Manager, Information Technology Services
Vladimir Bibik
bibik@marinelink.com

Circulation
Kathleen Hickey
mtrcirc@marinelink.com

Advertising

Vice President, Sales and Marketing
Rob Howard
howard@marinelink.com
Tel: (561) 732-4368 • Fax: (561) 732-6984

Advertising Sales Manager
Mike Kozlowski
kozlowski@marinelink.com
Tel: (561) 733-2477 • Fax: (561) 732-9670

Editorial

"We March On"

Gregory R. Trauthwein
Associate Publisher & Editor
Email: trauthwein@marinelink.com

Coming off of the Ocean Business 2017 expo in Southampton, it is clear that the industry is still adjusting to the new reality of low oil pricing and all of the requisite budget tweaking that comes along with it. Don't get me wrong, Ocean Business once again was buzzing with activity and the National Oceanography Center (NOC) in Southampton again proved to be an ideal setting for business, boats and hopitality. To be perfectly honest, my most memorable moment this year was a personal one, as my colleagues and I took advantage of a mid-week home date for the local soccer club, Southampton FC, marking our first-ever Premier League game. Southampton FC won 3-1 that evening versus Crystal Palace and overall it was an awesome experience. In particular I was happy to walk away with a new favorite catch-phrase, the home team's motto: "We March On."

Walking the show floor and engaging in one-on-one conversations, the underlying stress among several companies is palpable as they search new markets for their solutions. But by and large they march on with product and service innovation that continue to make the matter of doing business underwater more safe and efficient. Some of those new developments can be seen starting on page 51, as well as in a series of video interviews we produced for our new *Marine Technology TV* brand (http://www.marinetechnologynews.com/videos), which included an insightful 20 minutes with **Professor Ed Hill**, Executive Director, NOC.

In this edition I think the the embodiment of my new pet phrase is the rapid evolution of Ireland's blue economy. I had the good fortune to meet with **Dr. Edel O'Connor** last year in San Diego at the Maritime Alliances's Blue Tech event in San Diego, and she was gracious in spending time with our **Tom Mulligan** recently to explain the drivers for the subsea business in her country. Our Ireland report starts on page 34.

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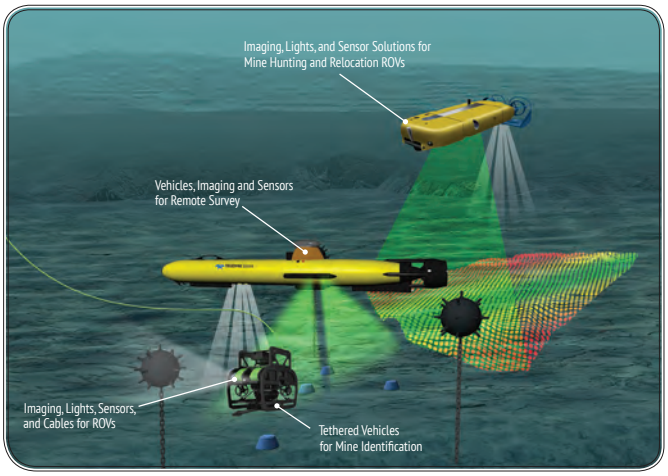
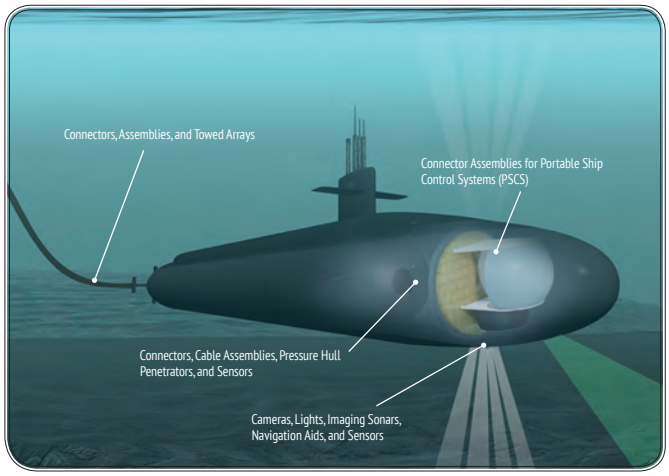
Proven Solutions
for Demanding Defense Applications

Mine Counter Measures



Submarine Systems



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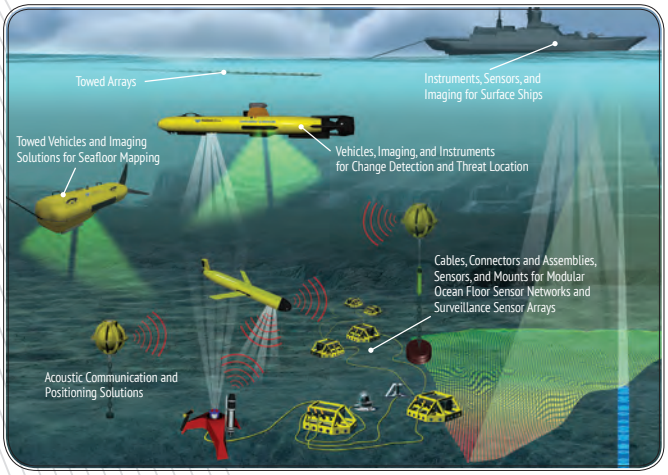
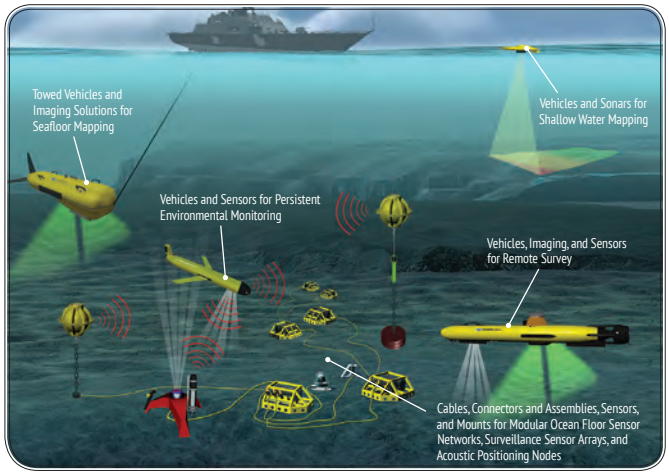


REA/Mapping and Terrain Navigation



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Coley

Haun

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Coley
Kira Coley is a freelance science writer and regular contributor to *Marine Technology Reporter*. She is a lecturer in science communication and a PhD researcher.

Haun
Eric Haun is a NYC-based journalist, the Managing Editor of *Marine Technology Reporter* and the web editor of *MarineLink.com* and *MarineTechnologyNews.com*

Mulligan
Tom Mulligan was born in London in 1958 and grew up in Manchester, England. His family moved to Arklow, County Wicklow in Ireland in 1972 where he completed his secondary education before entering university at Trinity College Dublin in 1975, graduating in 1979 with a BA Hons Degree in Natural Sciences (Chemistry). He now works as a freelance science and technology writer.

Photo: David Branigan, Oceansport © Marine Institute

Country Focus

All Eyes to Ireland

Dr. Edel O'Connor discusses Ireland's rapidly expanding subsea industry.

By Tom Mulligan

NAVIGATOR

A one man navigation and sonar reconnaissance unit

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The Navigator, a second generation Sonar Imaging and Navigation system, designed by Shark Marine primarily for MCM and SAR use.

Proven

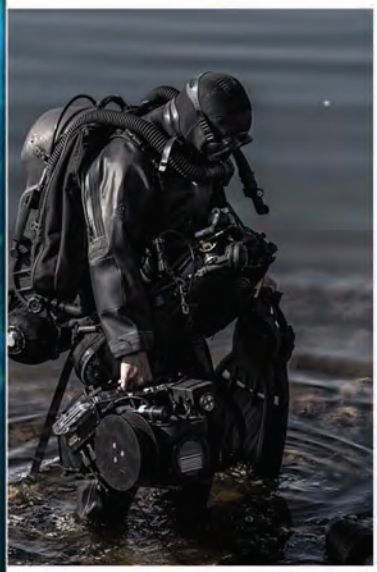
Tested and proven, the Navigator is the trusted choice of 17 Navies, as well as Law Enforcement, Search and Rescue Teams and Scientific Researchers spanning the globe. The Navigator has become a critical part of the Standard Kit and has reshaped SOPs. The modularity of the system and numerous advanced sensors available allow the Navigator be to become a force multiplier, enabling smaller groups to cover more ground efficiently with increased safety.

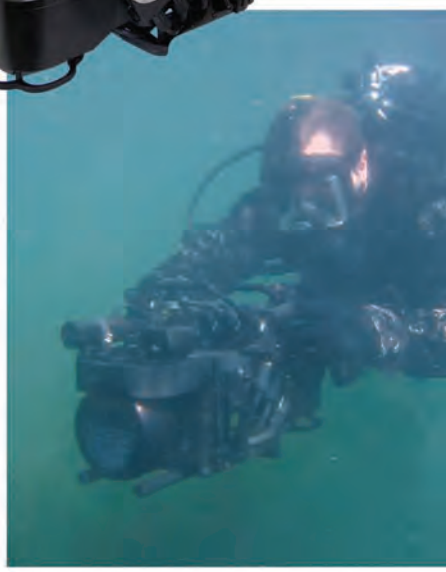
Mission Ready

The Navigator is the most modular system of its kind, enabling it to be quickly configured for any application.

Intuitive

Shark Marine's DiveLog software controls all operations of the navigator and its accessories, operators need only learn one software to master all their equipment.





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... In case you missed it, highlights from marinetechnologynews.com and the Marine Technology Reporter ENews ...

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Fish Tracked by DNA 'Finprints'

Scientists have tracked fish off New York by following the traces of DNA left in the water, a technique that could help gauge life in rivers, lakes and the oceans around the world, a study showed. ish leave bits of slimy skin, scales and excretions as they swim around – clues that let scientists detect 42 different species of fish including herring, bass and eels in water drawn from the Hudson and East Rivers off Manhattan.

http://www.marinetechnologynews.com/news/tracked-finprints-waters-547266

Searching for Wrecks in the Great Lakes

The Great Lakes are home to thousands of shipwrecks, more than 100 of which are yet to be discovered according to historical records. From April through August, researchers will lead teams using advanced technologies to push the boundaries of underwater archaeological survey and seek yet-to-be-discovered shipwrecks within Lake Huron's Thunder Bay National Marine Sanctuary.
http://www.marinetechnologynews.com/news/history-meets-technology-shipwreck-547197

(Photo: NOAA)

Australian Scientists Study the Antarctic

Geoscience Australia's Antarctic Geoscience program, which carries out marine and onshore research for the Australian government, has completed three Antarctic surveys during the 2016-2017 field season in hopes of helping to increase understanding of these environments to better manage and protect them.

http://www.marinetechnologynews.com/news/australian-scientists-study-antarctic-547192

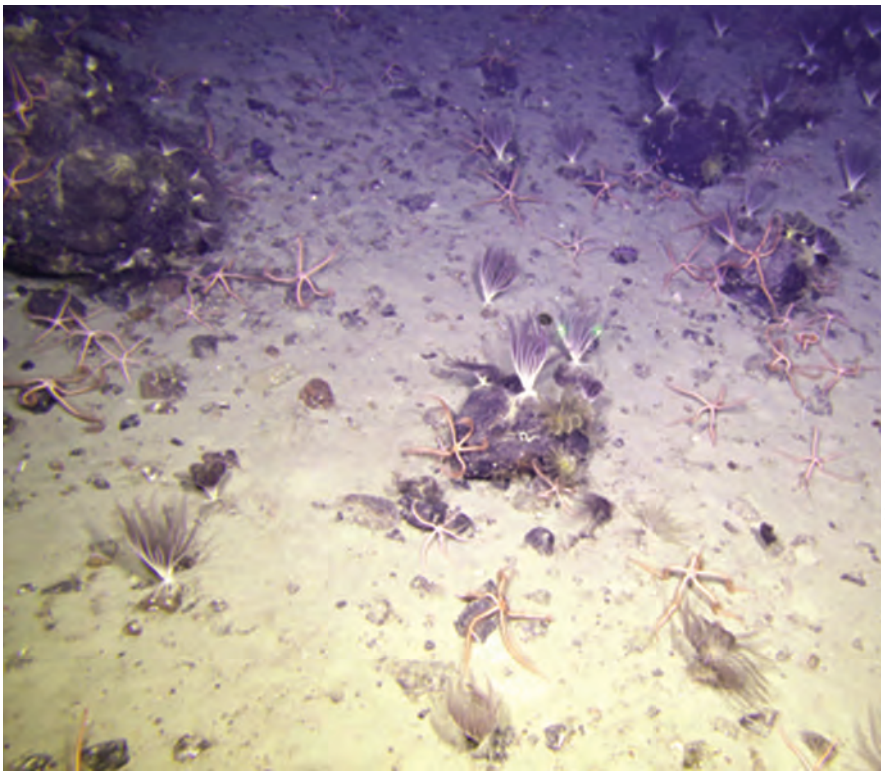


Photo: Marine National Facility/CSIRO

People & Companies


Next Geosolutions

Ranieri


MacArtney

Omann


MacArtney

Hedeager


M² Subsea

Hardey


Valeport

Harvey


U.S. Underwater Service

Nicholls

Next Geosolutions Acquires RMS Submarine

Next Geosolutions has acquired U.K.-based marine resource solutions company RMS Submarine Ltd. Following the acquisition, up to five new onshore positions and as many as 20 offshore roles are likely to be created in the next 12 months.

MacArtney Names Omann CEO

Claus Omann has been appointed as the next CEO of the MacArtney Underwater Technology Group, effective August 1, 2017. Omann's technical and commercial background includes previous positions at LEGO, Viking Life-Saving Equipment and TRIAX in various senior management roles including technical director and most recently CEO. Current CEO Niels Erik Hedeager will take over as Chairman of the Board of Directors. Hedeager has worked at MacArtney for 28+ years.

M² Subsea Hires Hardey in US

The U.S. operation of M² Subsea has appointed Paddy Hardey as general manager and senior vice president of commercial. Hardey brings a wealth of experience in business management having held a number of senior level roles in the oil and gas industry. Most recently, he was commercial manager of Bibby Offshore's North American subsea division. Prior to this, he was commercial manager for Halliburton's Pipeline and Precommissioning business in Aberdeen.

Valeport Appoints Harvey

Valeport has appointed Phill Harvey to the new post of financial director. He joins the senior management team to oversee all financial aspects of the business. Harvey brings to the role more than 30 years' experience in the financial sector supporting many SME manufacturers and exporters. His commercial background includes roles at Handelsbanken and Lloyds Bank.

ADCI Elects Nicholls

Bryan Nicholls, president and COO of U.S. Underwater Services, LLC, has been elected president of the Association of Diving Contractors International (ADCI) at its annual conference.

The ADCI is a professional association that promotes best industry practice with respect to the health and safety of commercial divers and underwater operations. Nicholls has served on the board of the ADCI since 2009, and was second vice president and chairman of the Safety Committee from 2014-2017.

RED Engineering Wins Award

RED Engineering won a Queen's Award for Enterprise in Innovation in recognition of its approach to designing and delivering complex engineering challenges. The Queen's Award is one of the highest honors that can be bestowed on a U.K.-based company and is given annually to those who have realized outstanding success and achievement.

RED Engineering

(L-R) RED Engineering's Richard Kent, Joe Orrell and Toby Bailey on Newcastle's Swing Bridge celebrating their success in winning a Queen's Award for Enterprise.

ASV Global Opens Mission Control Center

ASV Global has opened its new state of the art Mission Control Center at its headquarters in Portchester, U.K., forming a hub for the company's ongoing development of its ASView autonomous vessel control system. The new center is capable of operating and monitoring the company's fleet of autonomous surface vehicles (ASV) all over the world using satellite communication links, and will also be used for operator training and simulation exercises.

ASV Global

ASV Global recently opened a new Mission Control Center.

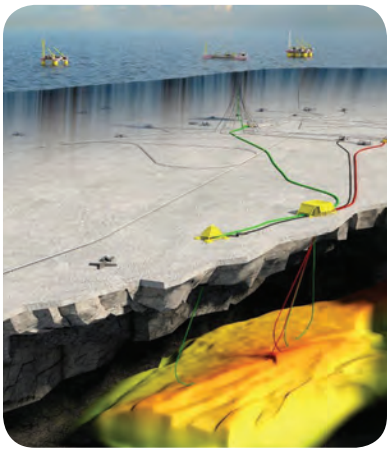
People & Companies


Aquabotix

Tavares & James

OPT

OPT Power Buoy


Statoil

Trestakk Statoil

Aquabotix's IPOs

On April 20, 2017, underwater robotics company UUV Aquabotix Ltd. announced that it was undertaking an initial public offering (IPO) on the Australian Securities Exchange (ASX). The maximum subscription under the IPO had been set at A$7 million (US$5.5 million). The maximum subscription was substantially exceeded in the IPO, the company reports.

Global Opens Alaska Office

Global Diving & Salvage, Inc. has opened a new office in Juneau, Alaska to support southeast Alaska through several of Global's primary service lines, including diving operations, marine construction, marine salvage and emergency response. Bill Akan, a longtime member of the Global team, will serve as Southeast Alaska Operations Coordinator for the new Juneau location.

OPT Relocates HQ

Ocean Power Technologies, Inc. (OPT) has announced plans to relocate its corporate headquarters and manufacturing center to support increased operational needs and allow for projected growth over the next several years. OPT's new, larger facility in Monroe, N.J. will offer approximately 56,000 square feet of manufacturing and office space, nearly doubling the size of its current facility in Pennington, N.J.

New Hires at FairfieldNodal

Mike Gilliam has joined FairfieldNodal as Vice President of Operations, Fairfield Seismic Technologies, and will oversee the operations project management and crewing functions for the Data Acquisition unit. With operational experience in the oil and gas industry, specifically in the marine environment, Gilliam will bring knowledge and insight to ROV operations. Richard Bottomley has joined FairfieldNodal as Strategic Account Director, Fairfield Seismic Technologies, and will be responsible for helping the company capture new available market share. Simon Hayter has joined FairfieldNodal as Vice President of Business Development, Fairfield Seismic Technologies, and will be based in London. Hayter will oversee international sales personnel.

Human-powered Sub Races

The fourth European International Submarine Races will take place from July 2-13, 2018, announced IMarEST , the organizer. Sponsored by defense technology company QinetiQ, the races are a unique sporting and engineering challenge which involve teams from universities across the world designing, building and racing human-powered submarines around a slalom course at QinetiQ's Ocean Basin, one of the world's largest indoor freshwater tanks in Gosport, U.K.

Norway OKs Statoil's Plan

Norwegian authorities have approved the Plan for Development and Operation (PDO) of the Trestakk discovery on the Halten Bank in the Norwegian Sea. Investments are calculated at NOK 5.5 billion ($646 million), almost half of the original estimate. Trestakk was discovered in 1986, and expected recoverable volumes are 76 million barrels of oil equivalent, mainly oil. Tied into the Åsgard A production vessel, Trestakk is expected to come on stream in 2019.

Swedish Hydrographic Office Implements CARIS

Teledyne CARIS' Hydrographic Production Database (HPD) has been implemented as the Swedish Maritime Administration (SMA) production system, replacing the legacy software previously employed by SMA for the management of spatial data.

Oceaneering Bags Anadarko Umbilical Contract

Oceaneering International, Inc. has secured a contract from Anadarko Petroleum Corporation to supply the umbilical for Anadarko's Constellation subsea tieback in the U.S. Gulf of Mexico. The contract is for a dynamic and static electro-hydraulic steel tube control umbilical, and associated hardware. Oceaneering plans to design and manufacture the umbilical at its facility in Panama City, Fla.

N-Seatec Bags Deepwater CTD Winch Order

N-Seatec has been awarded an order for delivery of a complete deepwater CTD winch system. The system will be an upgraded version of previous designed and delivered CTD Winch-058 units, but now suitable for 3,500 meters water depth. The scope of delivery will include electrical rotating davit device; winch mounted spooler device; cable counter, lighting system and remote control; and lifting wire and clump weight.

ECA Group ROV for China

ECA Group will provide a H300 ROV to the Guangdong Research Institute of Water Resources and Hydropower, in China, to aid in inspections of hydro-electric dams and related power plant.

General Atomics LiFT Batteries

General Atomics Electromagnetic Systems (GA-EMS) has been awarded a contract to provide its Lithium-ion Fault Tolerant (LiFT) battery system for the Semi-Autonomous Hydrographic Reconnaissance Vehicle (SAHRV), a small, portable underwater vehicle (UUV). GA-EMS is part of a team working with the U.S. Department of Defense to design, fabricate, deliver and conduct at-sea testing of the LiFT battery system for use on the SAHRV platform. SAHRV UUV is intended for shallow water surveillance to scan, detect and identify mines and obstacles.

Ocean Infinity Awards Software Contract to 4D Nav

Ocean Infinity awarded a contract to 4D Nav for InfinityView, a mission planning and monitoring software for its multiple autonomous vehicle systems. The software will optimize the mission planning for AUVs, USVs and the host vessel by applying deep learning technology. As the planned missions are being executed all of the autonomous vehicles and the host vessel will be tracked against their planned missions. If any deviations occur InfinityView will update the mission plan to allow corrective decisions to be made and executed.

By Edward Lundquist

Littoral Challenges in Colombia

Concepts and Technologies Examined at Sea and Ashore

Naval experts from around the world are meeting in Cartagena, Colombia, for the Operations and Technology (OPTECH) South 2017 conference. The event is being conducted by the U.S. Naval Postgraduate School's (NPS) Littoral Operations Center (LOC), supported by the Office of Naval Research-Global and the Colombian Naval Science and Technology Office and Swedish defense company Saab.

The littoral is the complex "near shore" environment where hydrography, geography, commerce, fishing, mining, boundaries, maneuver and sustainment issues converge, and which places exceptional demands on naval, aerial and land forces that must operate, fight and influence events there.

The LOC was created at NPS to promote the study of U.S. Navy and allied and partner nation policy, strategy and technology necessary to deal with conventional, irregular and criminal threats in these crowded and cluttered coastal waters and their adjacent lands; to build greater competence in the U. S. Navy for fighting in restricted waters such as the Baltic, Aegean, Arabian Gulf and China Seas; and to understand other nations' capabilities to compete in interactions between land and sea across a littoral coastline.

Previous LOC workshops and OPTECH conferences in the U.S., Sweden and Japan, have brought together other nations and industries around the world with similar interests in fighting where surprise attacks with missiles, aircraft, submarines, unmanned systems and mines would be frequent and deadly, as well as to gain familiarity with the different kinds of tactics and technologies needed to defeat transnational threats.

With the theme of "transnational threats and cooperation in the littorals," the objective of OPTECH South has been to develop cooperative and technologically advanced ways impede kidnappings, drug running and prevent other transnational threats and crimes in the Western Hemisphere that are afford-

Photo credits: Nicklas Gustafsson

able and sustainable. "We must cooperate against these new transnational threats and networks with teamwork: new ways to cooperate to find, seize or destroy them in order to maintain a stable order among the nations of the Western Hemisphere," said retired Capt. Wayne Hughes, dean emeritus at NPS and a founder of the LOC. "If we can advance the state of the art, the results will be effective in other regions of the world as well."

Keynote speakers included Vice Adm. Leonardo Santamaria Gaitan, Commander, Colombian Navy; Rear Adm. Brian Hendrickson, Director, Theatre Engagement (J7), U.S. Southern Command; Vice Adm. Ernesto Duran Gonzalez, Chief of Naval Operations, Colombian Navy's Strategic Direction; VADM Jorge Enrique Carre o Moreno PhD, President, COTECMAR, a public-private partnership that designs, builds and repairs ships and craft for navies and the maritime industry; and Almirante Bento Costa Lima Leite de Albuquerque Junior, Director General for Nuclear and Technological Development of the Brazilian Navy.

A tour of the COTECMAR shipyard was conducted prior to the conference.

Panel discussions focused on regional cooperation to address transnational threats; C4ISR and networks; disruptive technologies; surface operations and trends; underwater challenges and opportunities; and maritime security technologies across ashore, such as the challenges of mines and explosive remnants of war.

"There needs to be a paradigm shift to get rid of unexploded ordnance so communities can more quickly get back to a sense of normality," said retired British Army Lt. Col. David Leigh, now of Kareem Service Ltd.

"All the pieces are here – from ships to intelligence to the environment – for Columbia's Navy to build upon their ability to be dominant in their sovereign waters," said Dave Forster of General Dynamics Mission Systems, who delivered a presentation on underwater sensor networks.

"From the point of view of the LOC, we have always thought the experience of other nations was important because you have reason to focus on your own coastlines and nearby seas while the U.S. Navy has been used to either retaining sea control in the open oceans or projecting the power of U. S. air and missile strikes, Marines landings or Special Forces operations on the land side of the littorals. Therefore, we sponsor these conferences very much to listen and to learn," said Hughes.

A Breakthrough in

Hybrid Underwater Vehicles

A collaborative effort has produced a new generation in underwater systems, breaking with tradition by uniquely combining several underwater systems into a single platform.

The Fusion from U.S. manufacturer Strategic Robotic Systems is a breakthrough in hybrid underwater vehicles, combining AUV and ROV capabilities with diver navigation and propulsion – all in one system.

Essential to making this forward leap possible was Norwegian scientific instrumentation company Nortek AS and its Doppler Velocity Log (DVL), as crafty engineering and high-end bespoke sensors have helped to produce an underwater vehicle with efficient, capable and robust design.

Jesse Rodocker, President at Strategic Robotic Systems, emphasized the importance of Nortek's DVL innovations to making the Fusion possible: "Both the electronics and transducers are smaller and have a better form factor for the Fusion underwater vehicle. The higher frequency for increased accuracy is of huge value for aiding the Fusion's automated control and navigation system. The added dedicated altimeter provides more accurate altitude directly below the Fusion for better terrain following."

Nortek helped set up underwater vehicle Fusion's unique transducer arrangement.

The Fusion combines AUV, ROV and diver navigation and propulsion into one system.

Nortek's 1 MHz DVL is the industry's smallest DVL, and is easy to integrate and operate.

Nortek

Nortek's 1 MHz DVL has a bottom track that ranges from 20 cm to 50 m, and its housing is available with a 4,000 m pressure rating. Even when offering this capacity, it is the industry's smallest DVL, and is easy to integrate and operate, the manufacturer said.

The Fusion underwater vehicle has a unique in-line transducer arrangement and Nortek has been there to help with this design. Nortek's contributions included recommendations and minor tweaks to make the vehicle work optimally.

"The Fusion is a real first," Rodocker said, emphasizing that it is a true hybrid that has extended capability in all modes.

The Fusion breaks with tradition by combining the capabilities of several types of underwater systems into a single platform.

Rodocker explained, "There isn't a system on the market that combines the AUV, ROV and diver functionality in the same way. Fusion is also really the only system to be built from the ground up with a specific suite of sensors in such a tightly integrated package."

The specific suite of sensors refers to inclusion of a multibeam forward-looking sonar, side-scan sonar, USBL, DVL and AHRS. Most other platforms do not include these as standard and are certainly not integrated as tightly as in Fusion. This design makes the Fusion more efficient, capable and cost effective. For example, its design means reduced need for training and greater mission capability.

Strategic Robotic Systems was founded with the premise of developing the next generation in underwater systems by approaching this challenge from a fresh perspective. The company needed a partner with an equally fresh perspective as they were looking for navigation technology to be integrated in their new underwater vehicle.

"One of Nortek's clients recommended us to work with Nortek because of the new technologies in its portfolio and the company's ability to collaborate with partner companies. I was struck by Nortek's progressive, forward-looking thinking and soon found out we had common interests," Rodocker said.

"The collaboration has been fantastic. The team at Nortek has been very knowledgeable and responsive. There hasn't been a 'it can't be done' or 'too hard' or 'very expensive.'"

As Strategic Robotic Systems shifts into production and delivery of the Fusion, collaboration with Nortek will continue.

"Who knows what future products might be developed from this fruitful collaboration?" Rodocker concluded.

Creating Superior Buoyancy with Air

Hollow Glass Microspheres Under Microscope. (Image: Trellborg)

Many people may think of empty space or air as nothingness – space that's perhaps waiting to be filled with something useful – but scientists and engineers know that the voids are intrinsically valuable. They can fortify structures to make them stronger without burdening them with weight. The ability to manipulate that nothingness brings new opportunities to many fields, especially in deep sea exploration. Through the use of high–tech hollow glass microspheres (HGMS), the issue of weight for deep sea exploration vehicles can be overcome. By combining glass and air, manufacturers can incorporate high performance microspheres into a wide range of polymer and resin systems to create composite solutions such as subsea foam buoyancy, which meet demanding strength and weight specifications.

Hollow Glass Microspheres

HGMS may appear to the naked eye to resemble a fine, white, free-flowing powder. However, under magnification the near perfect spherical shape of these glass bubbles is revealed. Typically they are used as alternatives to conventional fillers and additives such as silica, calcium carbonate, talc, and clay.

The key properties of low density HGMS are their light weight and strength. Incorporating them into buoyancy products allows remotely operated vehicle (ROV) manufacturers to dramatically reduce the density and weight of a vehicle's buoyancy, while improving its dimensional stability and impact strength. HGMS have the potential to half or quarter the weight of buoyancy and with a proportionally higher volume compared to a solid filler, they can significantly reduce the weight of buoyancy without compromising its physical strength and integrity.

Customization for Buoyancy Applications

Thin walled, hollow glass microspheres can be customized via surface treatments, material chemistry selection, density specifications or particle size distribution, thereby being tailored to meet demanding strength, weight and electrical specifications for customers in a variety of markets. For buoyancy applications, HGMS can be incorporated into a wide range of polymer and resin systems and replaced or combined with other materials to create composites, many of which are used in demanding offshore environments.

The unique properties of HGMS can be modified to enhance specific properties of the buoyancy package a customer is looking for to achieve, for example, high strength to weight ratios, specific uplift targets or high temperature resistance. In addition, manufacturing syntactic foams with customized HGMS allows the surface chemistry of the microspheres to be enhanced. This has proven to show the benefit of improved adhesion properties within the matrix, adding performance value to the composite system by simultaneously increasing the composite's moisture resistance and strength.

With this in mind, most buoyancy manufacturers will offer several grades of buoyancy for deep sea exploration vehicles, which can be further customized to meet the specific needs of the customer.

Buoyancy Testing

When choosing a supplier for buoyancy for remotely operated vehicles, manufactures should look for a company that not only manufactures hollow glass microspheres but can also carry out testing of density, strength, moisture content and more, before the HGMS are incorporated into compos-

ite buoyancy systems. Following this, the finished buoyancy package should then go through its own testing to ensure the final product meets the density, weight and strength parameters for the project.

Typical buoyancy tests that should be performed on the final package include:

1. Hydrostatic testing of full cubic feet buoyancy blocks,
2. Cycle testing for 1,000 times,
3. Full testing to hydrostatic pressure on random samples,
4. 10% of manufactured blocks tested at service pressure for 24 hours.

Case Study

Trelleborg's applied technologies operation recently engineered and manufactured a custom syntactic foam buoyancy package for the Schmidt Ocean Institute for use on its new ROV, SuBastian.

The Schmidt Ocean Institute underwater robotic research program includes the design and development of a 4,500 meter robotic vehicle for use on research vessel Falkor. The ROV is outfitted with a suite of sensors and scientific equipment to support data and sample collection, as well as interactive research, experimentation, and technology development. The buoyancy package on SuBastian is made from Trelleborg's Eccofloat TG30, a high performance syntactic foam.

Bob Kelly, Managing Director within Trelleborg's applied technologies operation, said, "We are very proud to be part of this pioneering adventure and to work with Schmidt on developing a syntactic foam that met their requirements. One of the challenges with deep water syntactic foam is producing the lightest possible foam for a given depth which translates into maximum uplift or buoyancy for the vehicle. A high strength to weight ratio means our customers get the industry's maximum uplift or buoyancy per cubic foot, allowing them to design their vehicle with a lower volume buoyancy package, reducing costs and improving vehicle performance and handling.

"We were able to create the precise buoyancy package needed for SuBastian, ensuring success for the future commercialization of this project. The unique customizable design coupled with the selection of Trelleborg's proven Eccofloat material will provide many years of service with the flexibility to adapt to all future equipment and mission requirements."

The SuBastain ROV is designed to go to depths of 4,500 meters, which is deeper than the average ocean depth of 3,700 meters. Trelleborg's Eccofloat TG30 is designed for a service depth of 5,000 meters. The ROV will be suitable to support high resolution seafloor mapping, photomosaicing, video and image gathering, and collections of rocks, animals and seawater samples. It is equipped with a versatile array of power and

data interfaces to enable integration of a wide range of add-on deep sea instruments and samplers that oceanographers may need to support their deep sea research.

SuBastian recently completed its first expedition on newly discovered hydrothermal vent sites, possibly finding new species in the Mariana Back-Arc, an extreme deep-ocean environment. This is the first series of scientific dives for the ROV. Equipped with numerous cameras, including a high-definition 4K video camera, the dives were live streamed onto YouTube and watched by millions. The multidisciplinary team will continue to analyze the data and samples collected during this expedition to advance research on how life thrives on these extreme deep-sea hydrothermal vents. This research was supported by the NOAA Ocean Exploration and Research Program, the NOAA Pacific Islands Regional Office and the Schmidt Ocean Institute.

Conclusion

Microspheres are intrinsically valuable voids because they can fortify structures to make them stronger without burdening them with extra weight.

Through customization and testing of high–tech hollow glass microspheres, deep sea exploration vehicle manufacturers are able to meet their strength and weight specifications for each unique vehicle.

The ability to manipulate, customize and test buoyancy foams manufactured with enhanced HGMS for deep sea exploration vehicles is a critical part that must not be overlooked when specifying buoyancy packages for these vehicles. As such, vehicle manufacturers should look to work with suppliers that can manufacture and test these small, but essential, microspheres for use in their buoyancy.

Trelleborg syntactic foam buoyancy with customized HGMS.

(Image: Trellborg)

ROV SuBastian on Sea Trials.

(Image: Schmidt Ocean Institute)

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Maritime Reporter & Engineering News	63,864
World Energy News	51,176

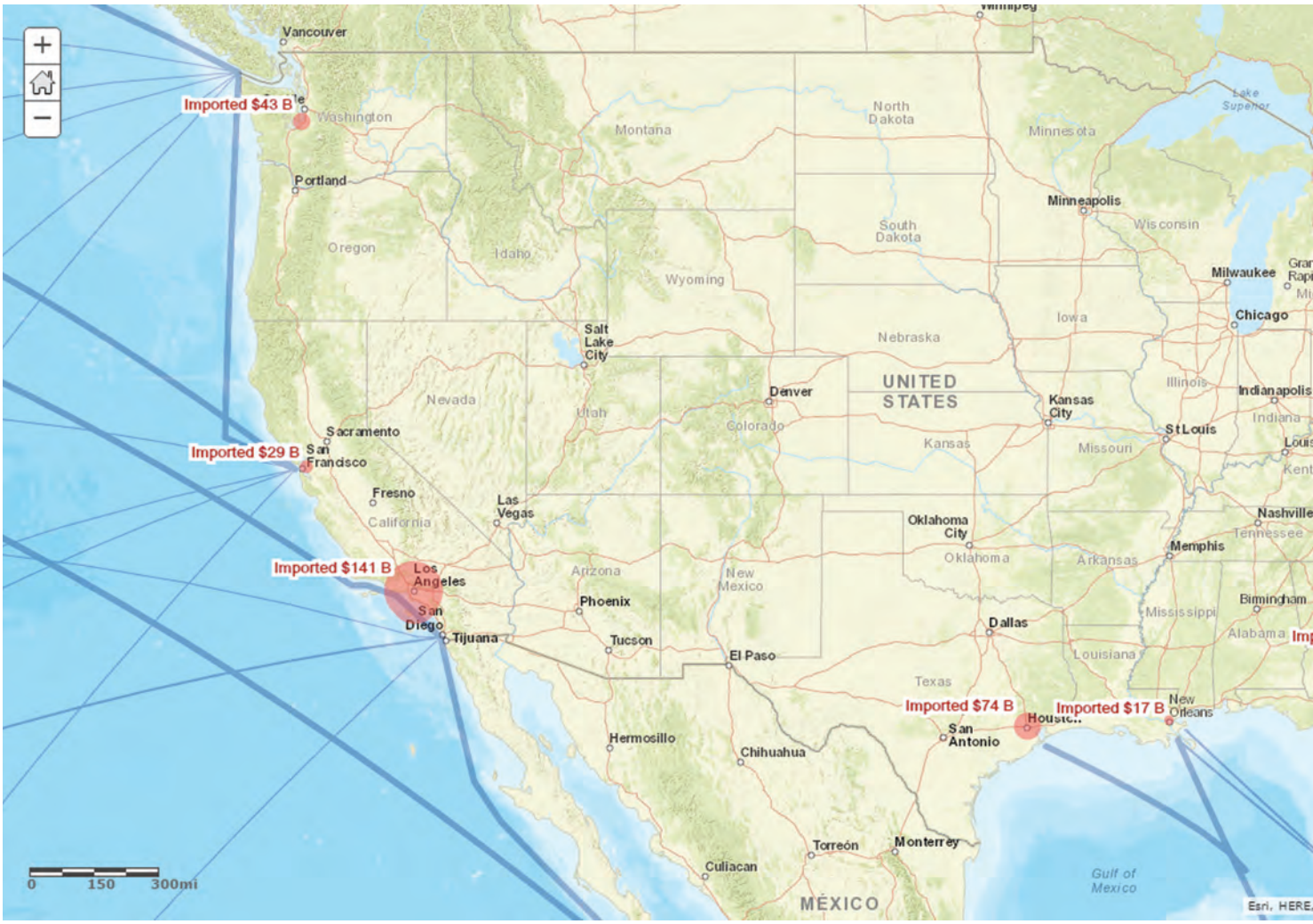
All stats from 02/14/2017

By Guy T. Noll, ESRI

A Location Strategy for

Funding Port Infrastructure

"When you've been to one port, you've been to one port." So goes a saying exemplifying the understanding among the maritime community that every port is inherently unique. Each port has an exceptional identity and, likewise, an exceptional way in which its problems must be presented, addressed and solved. Each port's challenges are location-specific, from the range of tide levels and other environmental conditions to governance by political jurisdictions. There are also economic drivers determined by location. And one of the most critical factors in U.S. cargo pricing is the Harbor Maintenance Tax (HMT), based on the value of cargo transiting ports, to pay for maintaining and operating navigational channels. This tax creates a fund that is used almost exclusively to support shipping in ports that have channels supported by the U.S. Army Corps of Engineers and require regular maintenance to improve underkeel clearance (UKC). The HMT has affected the cost of cargo at different ports in ways specific to their location. As we assess the changes in the way this tax has



been challenged and reaffirmed over the years—culminating in the latest, the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016—it is clear that imports from deepwater West Coast ports act as the primary funding for the improvements in underkeel clearance along the Gulf of Mexico and East Coast ports.

The revelation that ports are contributing funds disproportionately generally results in discussions of how to best attain full usage of money by more equitable distribution. This is an American Association of Port Authorities talking point, and it is a positive step toward ad-

The value of imports at major U.S. shipping ports for the year 2014.

Image: ESRI

dressing the myriad needs of our marine transportation system beyond mere channel dredging. Harbor berths, for example, need to be deep enough for the water level at every stage of the tidal cycle to accommodate the loading of ships. However, if ports and their stakeholders continue to look at these issues only from a local or regional context, they miss the opportunity to address the greater challenge of national port resiliency within the HMT funding structure.

Three scenarios, all assuming the fully funded Harbor Maintenance Trust Fund (HMTF) is still in use by 2020, highlight the need to look at ports as a unified structure for national economic security.

Scenario 1—Winners Keep Winning

The HMTF is primarily used as an appropriations offset for UKC management to continue funding U.S. Army Corps of Engineers dredging operations. These funds will enable the continuation of building capacity for Neopanamax freight traffic as well as deepening berths alongside in the major ports. Continued HMT and cost-share revenue will provide sufficient funding under WIIN to complete the projects. For the ports that cannot create the perceived need for these investments, no substantive change will occur, and larger traffic is going to pass them by. Not only that, but the ability to create short sea shipping routes from the "winner ports" to the lesser ports will be impacted by both the cost of protectionism of

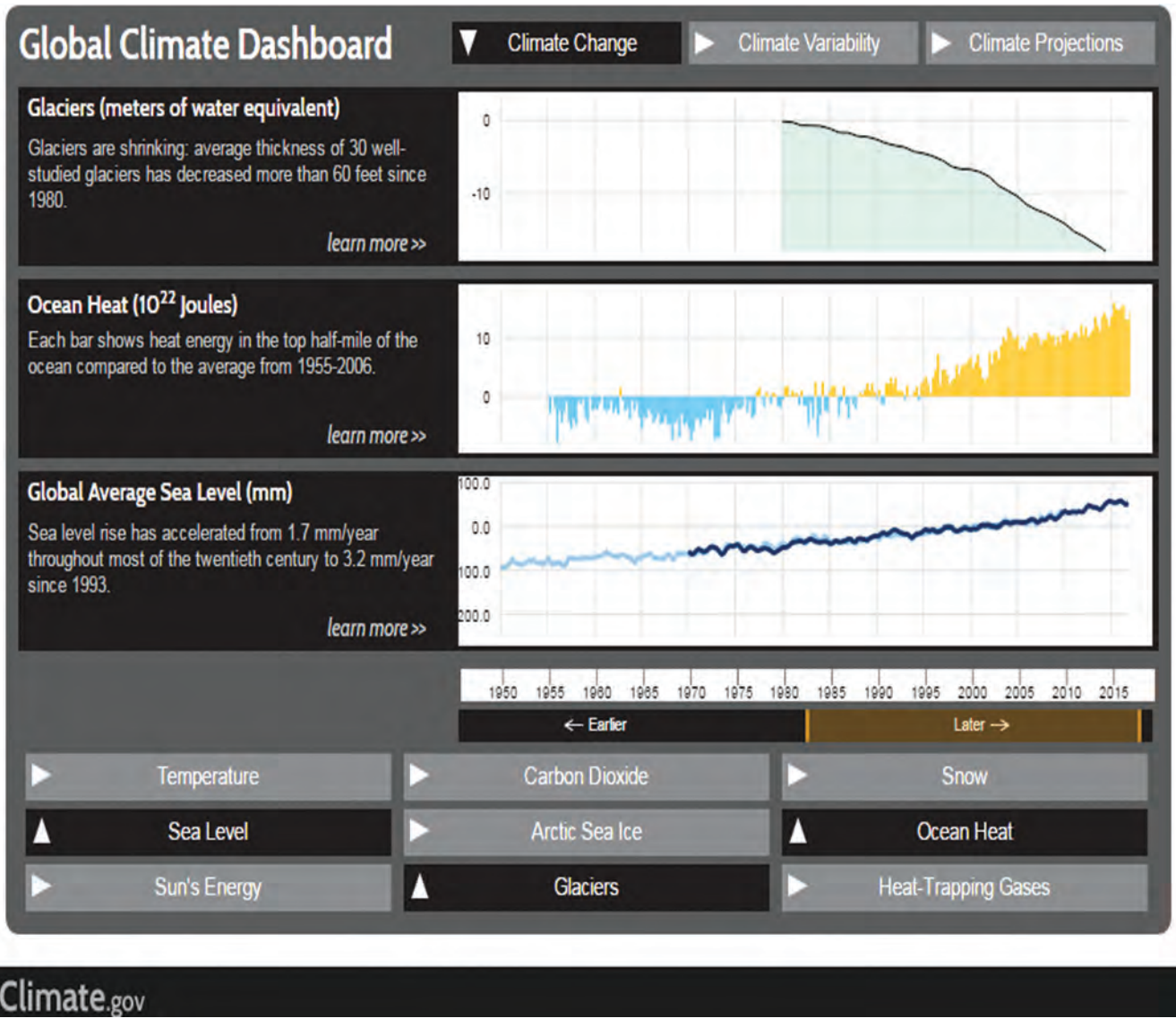


Image: NOAA

reimporting containers or semiprocessed bulk goods, and the complex and opaque rules governing HMT rebates.

Scenario 2—Lake Wobegon

Much like Garrison Keillor's fictional town Lake Wobegon, "where all the children are above average," HMT revenue continues to grow while the sharing behavior to ensure equity is somehow achieved. This would occur only as major and favored port UKC projects are replaced by other port requirements, continuing to the midtier ports and maybe even some of the harbors of refuge and subsistence ports under some scoring criteria that would manage to prioritize regionalism. Such criteria would need to be transparent to achieve this outcome.

Scenario 3—A Broken System

Suppose a long-term, national challenge to the ports system occurs. The frame of reference for such an impact would be something even greater than the 2012 port clerks strike in Los Angeles/Long Beach, which cost the region $8 billion, and more substantive than the trucker strike of 2015. While these shutdowns can be mitigated through port-to-port agreements, an environmental crisis would be beyond that level of control. What if, for example, global water levels increase due to melting of Greenland and Antarctic ice sheets? In some models, such increases could occur rapidly, like the observed changes in glacier thinning in Alaska, Nepal and Patagonia. Such a discontinuity in the historic record of sea level would create wide-ranging impacts for the nation, including waterfront parcel loss, reinsurance losses and coastal pollution. It would also imperil the infrastructure at many ports, from laydown areas to wastewater facilities.

Charting the Route through Future Challenges

Port infrastructure investments will be put at greater risk with sea level rise, and mitigation of these risks will require rebalancing HMTF usage from deepening channels to shoreside facilities management. This will have higher differential impacts at the smaller ports with less robust connections to shore transportation hubs, but it may also show some local resiliency as changes are made over a decade or so.

What can be done? Ports need to become active in managing these infrastructure risks. Per WIIN, key steps must be identified: assess current infrastructure with a focus on risks due to flooding at key shipment transfer points; monitor local changes through actively measuring the trends at the port; create regional failover points for transshipment activity, similar to the ways that strikes have been mitigated in the past; develop an environmental consequence plan for ports that mitigate the impacts from non-point-source pollution, flooded laydown areas, storage tanks and pipeline corridor damage; and develop plans for ballast water management. Now is the time to create dialog with U.S. Maritime Administration (MARAD), National Oceanic and Atmospheric Administration (NOAA) and other agencies and stakeholders to develop scenarios for the high-risk/lower-probability environmental or other sea level changes that could have national impacts on the HMTF funding stream, and determine how to maintain the revenue for improving infrastructure. Shipping involves more than simply carrying goods from point A to point B. A successful port strategy is about safely and sustainably carrying the right goods to the right place by the right time for the right price. The information to mitigate shipping risk must be sensitized to where the shipment is headed, or the national shipping framework may fail when challenged by the large environmental changes that affect the shore. A resilient shipping system means making location and time the centerpiece of port infrastructure planning.

National Oceanic and Atmospheric Administration (NOAA) Climate.gov dashboard showing sea level, glacier thinning, and global average sea level.

Photo: CMRE

Hidden under the vast crystal blues of the Pacific, a submarine is hunted from above. A centuries-old game of cat and mouse drives the technological advancements in the ongoing race to conquer the undersea realms. Today, enhanced capability in both anti-submarine and anti-surface technology is transforming anti-submarine warfare, known as ASW.

BY KIRA COLEY

Anti-Submarine Warfare

Unmanned Future

Modern submarines are not only quieter than their ancestors, but they are also better equipped to deal with the threats that shadow them from above. For now, submarines are ahead in the race. But, with the emergence of unmanned autonomous technology there is the tantalizing possibility that in the future we will be able to detect, localize and track submarines across huge distances more effectively and at lower cost. As we enter into a new era of ASW operation, we take a look at the challenges in unmanned solutions remaining to be overcome before the tide is turned against those hidden under the waves.

The ASW industry is an endless conveyor belt of innovation, battling to develop the next game-changing technology. NATO navies already field impressive ASW capabilities, including modern frigates deploying low-frequency active sonar and advanced location devices on new modern submarines. Air assets such as specialized planes known as Maritime Patrol Aircraft, or MPAs, can deploy and monitor passive or active sonobuoys fields, and helicopters, MPH, can deploy sonobuoys and/or active dipping sonar.

While manned assets are a vital part of ASW operations, reductions in funding and new advances in submarine technology has led countries around the world to begin to develop unmanned systems for ASW. Although today's unmanned

CMRE engineers ruggedize AUV technologies in the Center's Lab.

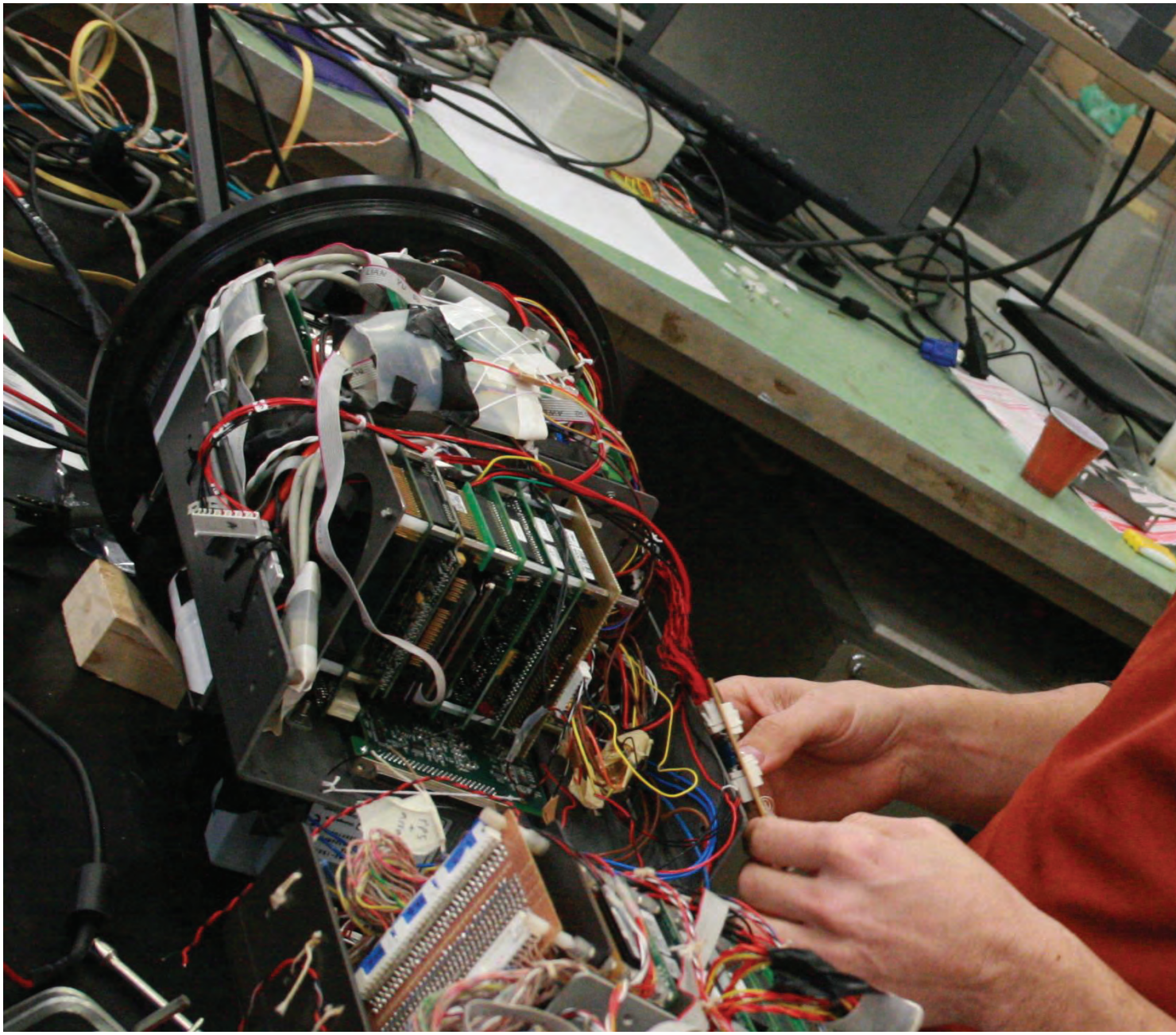


Photo: CMRE

technology has a lower-performance payload than manned, these systems offer an enormously cheaper alternative that, as a team, offer the potential to cover vast ranges while delivering covertness that may carry great tactical advantages.

"Anti-submarine warfare is a highly asset-intensive process that requires significant numbers of highly capable platforms deploying a variety of sensors. To operate these platforms and sensors at their potential, requires a cadre of trained and skilled human operators, as well as an appetite for risk, as the submarine is an increasingly dangerous adversary," explains Dr. Kevin LePage, ASW program manager at the NATO Science and Technology Organization (STO) Centre for Maritime Research and Experimentation (CMRE) in La Spezia, Italy.

The STO-CMRE is the NATO innovation hub for developing underwater technologies for a range of maritime applications, including minesweeping

and ASW operations. Their objective is to deliver innovative and field-tested Science and Technology (S&T) solutions to address the defense and security needs of the Alliance.

CMRE operates two research vessels that enable S&T solutions to be explored and developed at sea. The largest of these vessels, the NATO research vssel Alliance, is an ice-capable global class vessel that is one of the world's quietest ship, allowing for precision acoustic studies to be conducted in environments operationally relevant to NATO. The operational experimentation being conducted from this platform has as its goal the development of cheaper, smarter solutions to give the nations a greater range of options in setting requirements for future ASW capability.

Two of the CMRE's most valuable assets are their sophisticated autonomous underwater vehicles (AUVs), capable of operating with a degree of independent decision-making abilities. The CMRE is working to give the AUVs the capability to listen, to evaluate and to signal the presence of submarines to operators in the command and control center.

Like the increasingly used unmanned vehicles for air and land, AUVs can operate more and more flexibly in the littoral and open oceans. And, as further systems are introduced into the mix, the way potential enemies have been used to working underwater will begin to be challenged.

LePage said, "ASW has for years relied on certain remote-controlled, monitored or unmanned sensor platforms, such as the sonobuoys deployed by Maritime Patrol Aircraft and Helicopters, and permanent or deployable sensing arrays. More recently, we have seen the increased use of unmanned autonomous vehicles (UAVs) for intelligence, surveillance and reconnaissance (ISR) missions, mostly for visual confirmation. However, the fully-fledged use of unmanned systems either as an organic or standalone capability for ASW is just beginning to emerge. One example is the ACTUV, a 40-meter long-endurance unmanned ASW platform being developed by DARPA and ONR in the U.S."

The ASW Continuous Trail Unmanned Vessel (ACTUV) is an unmanned vessel designed by the Defense Advanced Research Projects Agency (DARPA). The state-of-the-art vessel is built specifically to track quiet diesel-electric submarines, at

Deployment of OEX AUV on board NRV Alliance.

Photos: CMRE

a fraction of their size and cost.

The project also seeks to advance unmanned system autonomy so that maritime operators are able to deploy platforms capable of crossing thousands of kilometers and undergoing missions for months at a time with minor supervision.

Another example of advancements in unmanned technology for maritime security is the Seagull unmanned surface vessel (USV) developed by Israel's Elbit Systems. At 12 meters long, the USV is claimed to be a first-of-its-kind maritime robot designed for missions in underwater mine hunting, mine clearing, anti-diver and ASW operations. The Seagull USV uses electro-optic and infrared sensors along with various sonars to search for underwater threats.

NATO at the Core of ASW Innovation

"At CMRE we have been working under NATO Allied Command Transformation, or ACT, to develop Autonomous Security Networks for ASW. This effort is divided into three projects: (1) Maritime Unmanned Systems for ASW where we engage in spiral S&T development of an autonomous ASW network based on unmanned underwater vehicles. We deploy these yearly into National and NATO ASW exercises; (2) the UWNet project, where we develop technology for military digital underwater communications networks, which is actually a critical enabling capability across all the maritime warfare domains; and (3) the Decision Support project. This final project is where we engage in ASW operations research and analysis to develop candidate tactics and decision support tools for both human operators and robots," explains LePage.

After years of research and development in unmanned ASW networks, CRME has come across several technological hurdles that still need to be surmounted, such as the development sufficiently effective autonomous sensing, processing, classification and tracking algorithms to arrive at the required probability of detection and false alarm.

Parallel studies are being conducted to refine algorithms for advanced collaborative robotics to allow autonomous vehicles to provide adequate area coverage, barrier performance and ability to trail a target. Work is also ongoing to develop higher throughput secure underwater communications links to enable collaboration of unmanned underwater assets and provide connectivity to command and control (C2). A final piece has been the development of effective on board environmental awareness and robotic decision support.

João Alves, Underwater Communications project lead at CMRE, said, "We have made significant strides in all these areas, but there is much work that needs to be done. One recent development we are especially proud of is the promulgation of the JANUS digital underwater telephony standard, STANAG 4748. It has been developed by CMRE with the collaboration of stakeholders across NATO, the nations and industry. This is an achievement with a great impact on NATO, non-NATO, civilian and military subsea communities. We have, for the first time, the conditions to break the interoperability barrier that still stands in underwater digital communications. STANAG 4748 is the absolute first internationally promulgated standard on digital underwater communications."

Since 2011, the CMRE have been testing their robotic network at sea against submarine targets. While they were not able to go into the details of their findings, it was clear that these types of unmanned ASW networks hold promise to deliver the next increment in ASW capability of the nations.

Challenges of Unmanned Systems in ASW Ops

For years unmanned systems have been used for ASW operations in various forms. But, there are four fundamental challenges to overcome before these systems are able to reach their full potential in maritime security. The first is to develop the concept of operations, or CONOPs, where decisions need to be made in how to deploy unmanned platforms, in what mix and for what missions.

The second challenge is to determine how these systems will be integrated together with existing platforms under a common command, control and communications (C3) architecture so that they can add value to an ASW task group. To do this, the CMRE believe the industry will have to make unmanned systems interoperable – to define standard communications protocols and message sets so that they can collaborate and share information, with the objective to provide cues to operators that can be trusted, finding subs when they are present while not flooding the system with false alarms.

The third challenge is the S&T challenge. Mainly, discovering how to make unmanned systems intelligent and able to learn from their surroundings, how to form teams and undertake ASW missions. First, there need to be improvements in the technology's sensors and communications links – especially underwater. Also, unmanned platforms must be imbued with the ability to learn, plan, collaborate and act to maximize effectiveness, working initially under the supervision of manned assets, but with the goal of reducing as much as possible the workload to the operators. Since unmanned systems will not in general have the luxury of constant and reliable communication with operators, the CMRE is striving to develop the science and technology required to one day allow these vehicles to become truly autonomous.

The fourth and final challenge is to develop the engineering solutions that will allow maximum freedom of use of unmanned systems. This challenge includes developing energy solutions for maximum speed and endurance; heavy weather launch and recovery for maximum flexibility in operations; communications and energy infrastructure technology; underwater navigation to increase the precision of detection and cueing; and maneuverability, stability (for sensors) and seakeeping.

The Unmanned Game of Cat and Mouse

"A cornerstone of ACT and CMRE's approach has been to engage in operational experimentation and demonstration with a continually improving unmanned ASW demonstrations. By engaging with the operational community in ASW exercises, we can capture requirements for a future unmanned ASW capability and incorporate updates for testing in the next

seagoing cycle," explains Christopher Strode, the ASW Decision Support project lead at CMRE.

"Some significant potential for new capability in operations analysis based on our ASW planning and analysis tools certainly exists, and the ASW commander in NATO task groups could certainly gain by having a tool which would allow him to optimally deploy the ASW assets at his disposal – whether legacy systems or autonomous systems. For digital underwater communications, we see significant interest in providing situational awareness to submarines, whether the surface white picture, METOC or other information for ASW. Also, CMRE's digital underwater communications technologies have captured the submarine rescue exercise community."

The CMRE will deploy their unmanned ASW network into the Dynamic Mongoose 2017 – the second annual NATO-led maritime ASW interoperability exercise, scheduled June 26 to July 8, 2017. This network will include powered UUVs towing arrays and surface and underwater gliders. The systems will provide a communications backbone and oceanographic characterization to assist the UUVs in working together and with C2 to make optimal decisions.

Dr. Alessandra Tesei, project leader for operational experimentation at CMRE explains, "In the past, we deployed this same network into the Proud Manta 2012 and 2013, as well as Dynamic Mongoose 2015, so we are starting to generate a track record in this regard. But our vision for the future is that unmanned technologies will significantly aid the Alliances ASW mission by putting scalable, flexible, cost-effective, long-endurance high-performance unmanned ASW sensing networks at the fingertips of ASW commanders, leading to much-increased flexibility and effectiveness in ASW operations."

The future will entail a shift in the approach to ASW operations. Maritime security is moving from a small number of expensive platforms to an unmanned alternative, capable of unleashing vast numbers of platforms over great distances at low-cost. This innovative technology hails the start of a new kind of game of cat and mouse. As these systems grow and advance at an exceptional rate, submarines grow nervous under the rolling waves that once promised refuge.

Acknowledgements

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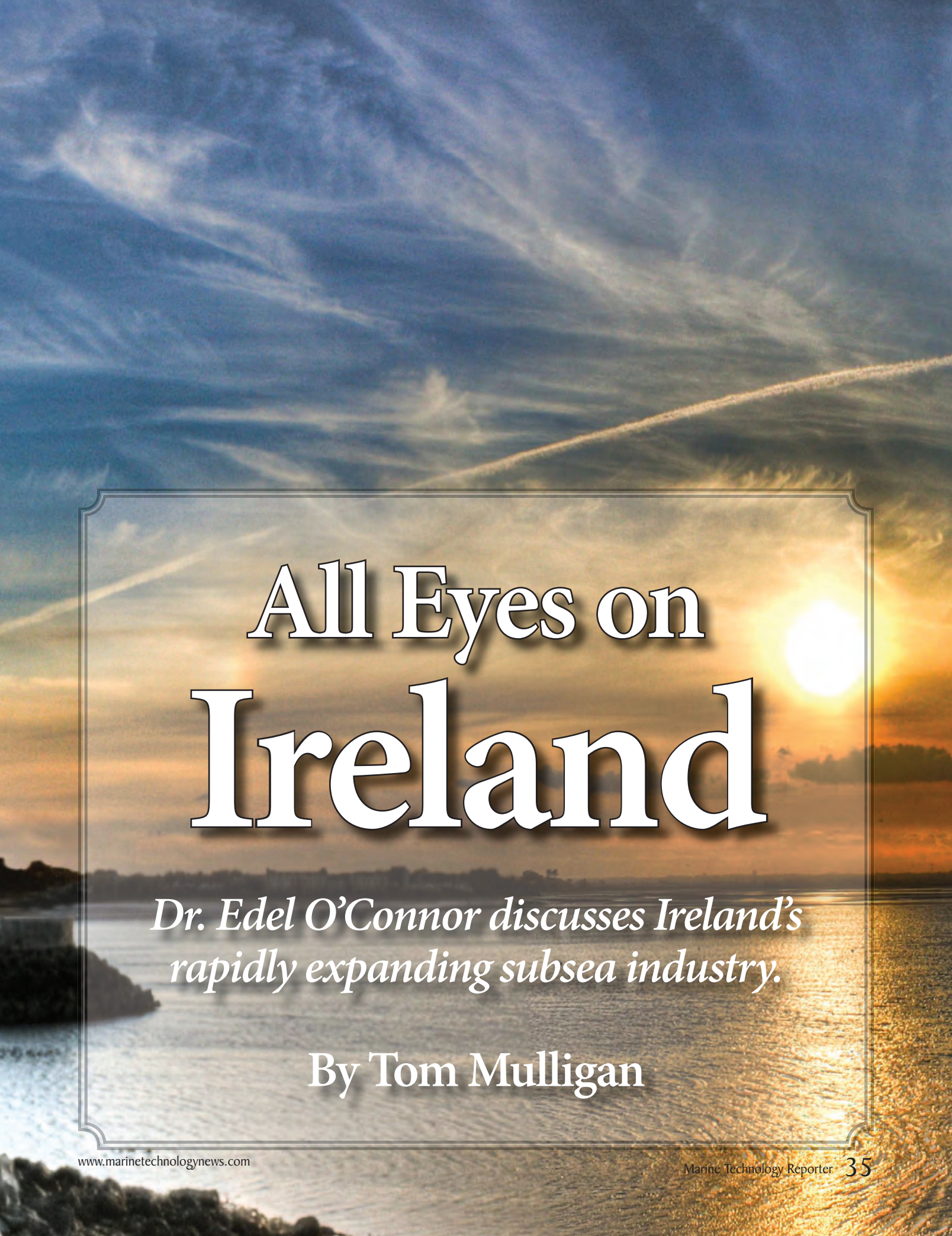
CMRE scientist at work in the Main Lab on board NRV Alliance.

Photos: CMRE



All Eyes on Ireland

Dr. Edel O'Connor discusses Ireland's rapidly expanding subsea industry.

By Tom Mulligan

Ireland's ocean economy is a growing and vibrant part of the overall Irish economy, with up to 9% blue growth reported over recent years. The vision set out in the Irish Government's 'Our Ocean Wealth' strategy has ambitious targets to increase the turnover from the country's ocean economy to exceed 6.4 billion by 2020 and to double the value of its ocean wealth to 2.4% of GDP by 2030.

Ireland's GDP from the marine sector at 0.8% represents significant opportunities for growth given that the international average is about 2% and Ireland is a maritime nation with significant marine resources. The Our Ocean Wealth strategy has a target to grow this to 2.4% of GDP by 2030 based on economic analysis and identified opportunities for growth across a broad range of industrial and related sectors.

Key economic trends identified by the Socio-Economic Marine Research Unit at one of the country's leading universities, NUI Galway, are that the ocean economy is performing better on average than the general economy. Growth in GDP was up to 5% between 2010 and 2014, while growth in the ocean economy was up to 9% in the same period. Over the period 2010-2012, the sector experienced an increase of 33% in turnover and a 5% increase in employment. The indirect effects of growth in the ocean economy on the growth of other sectors are also significant: for every 100 turnover from Ireland's ocean economy, a further 78 is created in other sectors as a knock-on effect, and for every 100 marine jobs, a further 75 jobs are created indirectly in other parts of the economy.

From tourism, to bioresources, to transportation

The top three marine sectors in terms of employment and turnover are marine tourism and leisure; seafood and bioresources (fisheries, aquaculture, seafood processing, biotech/seaweed); and shipping and maritime transportation (including international shipping services). However, R&D-intensive industries such as high-tech marine products and services and ocean energy saw substantial increases over the period 2010-2012. In addition to the people directly employed in marine industries, a further 13,000 are employed indirectly across the wider economy, providing an additional 3.3 billion in turnover to the economy in the established industries alone. Hence the direct and indirect value of Ireland's ocean economy is a turnover of 7.4 billion with employment of more than 30,000 and GDP of 1.3%.

Taking its seabed area into account, Ireland is one of the largest EU states, with sovereign or exclusive rights over a 220-million-acre marine resource and a coastline of 4,650 miles. However, the country has always seen the land as the primary provider of food and fuel and has often overlooked its ocean wealth. In 2010, following a period of severe national and global economic downturn, the Irish Government reviewed Ireland's existing assets and explored sectors that represented significant opportunities for growth. During this period there was a realization of the significant national asset that existed off the coast with the potential to be harnessed sustainably in new ways to tap into a trillion euro global market for marine products and services, including seafood, tour-

"Ireland has invested heavily in building research and innovation capacity in ocean observation to underpin a dynamic and growing blue economy, nationally and internationally"

Dr. Edel O'Connor

Business Development Manager, Irish Maritime Development Office

Photo: Edmund Ross Photography

ism, shipping, oil and gas, renewable ocean energy and new applications for health, medicine and technology.

Determined to demonstrate Ireland's real ambitions and intent and recognizing significant opportunities for growth, an interdepartmental Marine Coordination Group set up by the Irish Government launched an integrated marine plan called 'Harnessing Our Ocean Wealth'. The Group consists of senior representatives across a number of Government Departments and is chaired by the Minister for Agriculture, Food and the Marine, is convened by the Department of the Taoiseach (Ireland's Prime Minister), and now oversees the implementation of the strategy. Hence the strategy is being driven from the highest levels of Government and represents a unique and joined-up approach for growing the country's blue economy. It is a coordinated approach with specific actions outlined for growing more established sectors of the marine economy such as aquaculture, fisheries and tourism, while also recognizing Ireland's unique value proposition across a number of emerging marine sectors such as marine renewable energy, marine biotechnology, marine ICT and maritime commerce.

"Our most recent move has been the launch of a Marine Development Team to put into effect measures to realize the business development and enterprise ambitions of the strategy," stated Dr. Edel O'Connor, Business Development Manager at the Irish Maritime Development Office. "This team will have dedicated resources to work with all the relevant government agencies and organizations to support the implementation of a strategic framework for delivery that will strengthen established marine sectors and also 'marinize' sectors outside the marine area where Ireland has existing strengths, including ICT, life sciences and financial services.

"Ireland already has expertise across a number of the key enabling technologies required to develop products and services that will support growth in emerging areas of the global blue economy while creating efficiencies and supporting sustainability across more established markets. For example, expertise in areas such as sensors, platforms, communications, robotics, informatics, computer vision and advanced materials can be harnessed in new ways to drive innovation in global marine markets with high growth potential. The international links and supporting mechanisms are being put in place so that technology companies, entrepreneurs and researchers will use Ireland as a test-bed to develop, test and validate these technologies through leveraging its geographical location, world-class expertise and infrastructure," she said.

First steps

In 2008, Ireland began to make key investments in these areas in the context of 'Sea Change: A Marine Knowledge, Research and Innovation Strategy for Ireland 2007-2013'. One of the priority areas was marine sensors and communications systems for the marine environment: the National Centre for Sensor Research (NCSR) at Dublin City University (DCU) was awarded 2.4 million as part of the Beaufort Marine Re-

Helicopter rescue service drill on the Marine Institute's research vessel Celtic Explorer.

Photo: David Branigan, Oceansport © Marine Institute

search Awards and the DCU consortium developed national capacity in areas such as biosensors, analytical science, remote sensing, high-speed separations, optical sensors, biochip platforms, video imaging, image processing and information extraction. A number of follow-up investments have since been made by the Marine Institute through both joint national and EU funding calls.

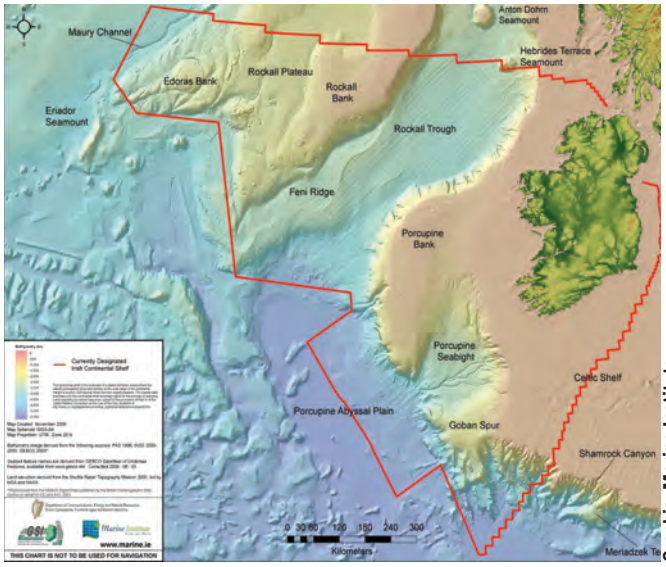
In addition, the SmartOcean innovation cluster was established consolidating Irish expertise in 'ICT for the Sea' and the Irish Maritime and Energy Resource Cluster (IMERC) established its partnership and world-class campus which coordinates expertise and infrastructure from University College Cork (UCC), Cork Institute of Technology (CIT) and the Irish Naval Service. Most recently, the Entrepreneur Ship was launched on the campus as the world's first blue-tech incubator. Significant national physical and digital infrastructure has been put in place to support and drive innovation. The SmartBay national test and demonstration infrastructure was established to support the test and validation of novel marine technologies and marine renewable energy devices in a real-world environment in Galway Bay and a subsea cabled observatory has been deployed as a significant addition to the existing infrastructure available on the site for academic researchers and industry. The Marine Institute has also put a team in place to develop its Digital Ocean data platform to collate data from a number of public sector sources and support the development of innovative products and services.

"In recent years, the Irish Government has made significant targeted investments in research and innovation expertise and infrastructure across the spectrum of Internet of Things (IoT) technologies that is being leveraged to develop critical marine IoT capacity in Ireland," said O'Connor. "Since 2012, Science Foundation Ireland has invested in multi-institutional and multi-disciplinary research centers of scale that are at least 30% funded by industry. These centers operate in addition to and complement industry-led research centers in the areas of sensors, embedded systems, mechatronics, data analytics, photonics and composites materials."

Ocean observation and seabed mapping

Significant investments have been made in the area of ocean observation and seabed mapping. The Marine Institute and the Geological Survey of Ireland operate INFOMAR, the largest civilian seabed mapping program in the world. Ireland is also significantly involved in ocean observation and seabed mapping initiatives in an EU and broader international context: in particular, the Galway Statement, signed in 2013, established a formal Atlantic Ocean Research Alliance (AORA) between the EU and its Member States, the US and Canada and other partner countries that builds on existing initiatives and programs to increase cohesion and coordination of ocean research cooperation.

One of the priority areas that has been identified is seabed mapping in the Atlantic Ocean. The Marine Institute research vessel, the Celtic Explorer, has conducted a number of sea-



Graphic: Marine Institute

The 'Real Map of Ireland' was developed using information gathered as part of a major program to map Ireland's entire seabed territory.

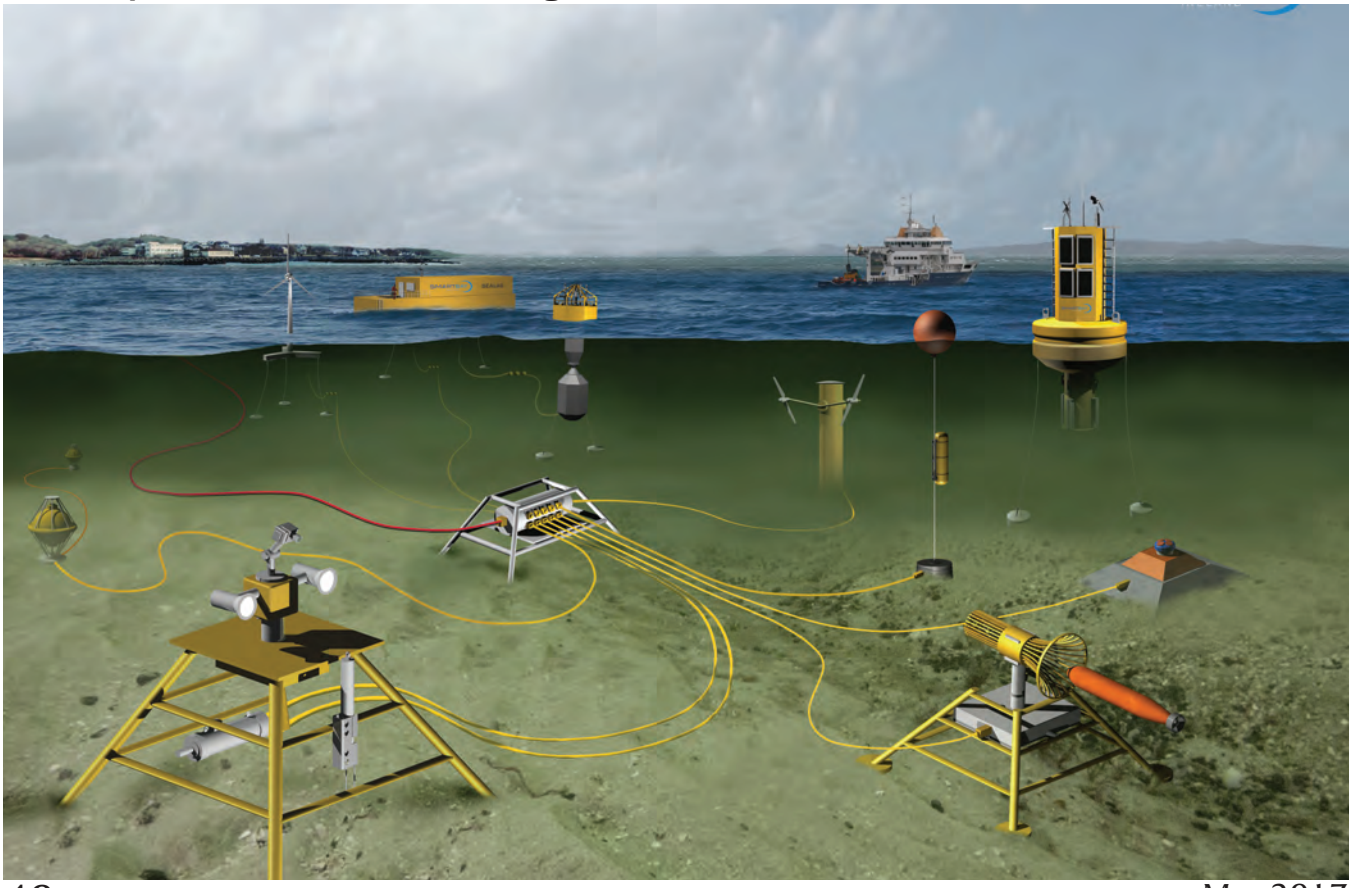
bed mapping transects across the ocean in collaboration with European, Canadian and U.S. scientists, and the Institute is leading a consortium of European Research partners, the Atlantic Ocean Coordination and Support Action, to support the implementation of the Galway Statement on behalf of the European Commission.

"It can be seen that Ireland has invested heavily in building research and innovation capacity in ocean observation and other areas in order to underpin a dynamic and growing blue economy both nationally and internationally," commented O'Connor. "This is complemented by government investments in other key areas where Ireland has significant existing capabilities and competitive advantages that can be leveraged into the marine. "The Harnessing Our Ocean Wealth strategy and its associated vision and ambitions create the urgency and vision required to mobilize relevant stakeholders and resources and, by recognizing the continued need to communicate this vision, a number of national initiatives dedicated to ensuring that it reaches the widest range of stakeholders possible have been taken. For example, in the past three years, a large-scale national annual conference and festival dedicated to the blue economy, called 'SeaFest', has taken place, supported and funded in the context of the strategy. SeaFest was held in Galway last year and attracted a large number of business professionals to various events. SeaFest 2017 will be even more ambitious attracting a national and international audience across a number of sectors: more than 90,000 people are expected to attend. An industry event and trade show focused on opportunities in the Digital Ocean will take place on June 29 followed by the Marine Industry Awards that evening. The Our Ocean Wealth Summit takes place on June 30 and will be followed by a weekend of activities in Galway Harbour.

Growing the blue economy

"Recently, the IMDO has started to act as a base for the Marine Development Team," said O'Connor. "This is a significant development that puts into action the Irish Government's ambitions for extensive growth in Ireland's blue economy. It is a specific-purpose government-funded taskforce established to work in collaboration with a number of development agencies and other parties with interests in the marine economy in Ireland and will provide a joined-up approach across agencies to support investment and growth in the blue economy. The Marine Development Team will be tasked with delivering on two primary objectives – increasing the value of the marine industry to Ireland's economy and job creation."

SmartBay is Ireland's national marine test and demonstration facility for the development of innovative products and services for the global maritime sector.



Graphic: SmartBay

The Marine Development Team will act as an entry and contact point for businesses with interests in any area of Ireland's marine economy and will channel suitable business prospects to the relevant development agencies. The team will also have a role in supporting the development of very-early-stage start-up businesses with a marine interest up to the point at which they are prepared to engage further directly with agencies in terms of accessing funding and other supports.

Existing and future activities that the Marine Development Team, the Irish Maritime Development Office and the relevant agencies will be engaged in include mapping and consolidating existing expertise across the research and enterprise landscape; developing critical capacity in key areas through the development of national networks, clusters and incubation programs; developing dedicated funding programs; and creating knowledge-sharing opportunities and running a series of events to coordinate resources and activities in key areas.

"Other activities will include developing a 'Marine Ireland' brand and online portal and marketing message that will promote and facilitate access to opportunities in Ireland's blue economy," said O'Connor, "as well as supporting and developing flagship projects of scale that can really deliver the jobs and economic growth required to meet targets. There will also be participation in international trade shows and conferences, as well as international trade missions, and a focus on developing opportunities for international collaboration.

"A number of activities are well underway or at the planning stages," she added. "At the end of 2016, Enterprise Ireland and relevant agencies launched the Irish Marine Industry Network and there will be a series of networking events launched this year, including the opportunity to participate in an Ireland Pavilion at international trade shows such as Nor-Shipping. We also attended Oceanology North America as a follow-up to San Diego Blue Tech Week hosted by The Maritime Alliance last November."

Finding the money

"Under the new European Maritime and Fisheries Fund Operational Programme, new dedicated funds of 10.6 million targeted at integrated maritime policy initiatives have supported the establishment of the Marine Development Team to operationalize the enterprise and business development aspects of the Harnessing Our Ocean Wealth strategy," said O'Connor. "In addition, the Marine Coordination Group pro-

Brexit & the Irish Marine Economy

The full extent of the potential implications of Brexit remain unknown. As the U.K.'s largest trading partner, Ireland has experienced knock-on effects in terms of the devaluation of sterling, but the wider implications will only become clear following the formal notification of intention to withdraw by the U.K. and new trade discussions between the U.K. and the EU begin.

The re-imposition of borders and customs controls, for example, will likely negatively impact bilateral trade flows between Ireland and the U.K., and the movement of goods from Ireland to wider locations through the so-called U.K. 'land bridge.'

Ireland's marine economy could also be affected due to the fact that overall Irish GDP may suffer in the period after the U.K. leaves the EU. This may impact demand for Irish shipping services in the areas that are most exposed to Irish consumption, such as RoRo and LoLo traffic.The IMDO is working closely with Ireland's shipping industry to identify any likely impacts and ensure that industry is prepared.

Conversely, it may also present opportunities for Ireland. For example, Ireland's existing reputation in international financial services may prove attractive to businesses involved in maritime commerce wishing to continue to avail of EU passport rights for ship finance and marine insurance services. Ireland has also established itself as a leader in aircraft leasing, an expertise that is transferable to ship leasing. There is also potential for the country to become more successful in attracting other new supply chains in the post-Brexit European marketplace as buyers seek to avoid paying higher tariffs and associated customs charges.

vides the joined-up approach required to operationalize initiatives across Government Departments. Since the launch of the strategy, the Industrial Development Authority of Ireland, the body responsible for attracting inward investment to Ireland, has established a marine pillar to its strategy as part of its 'new forms of investments' team.

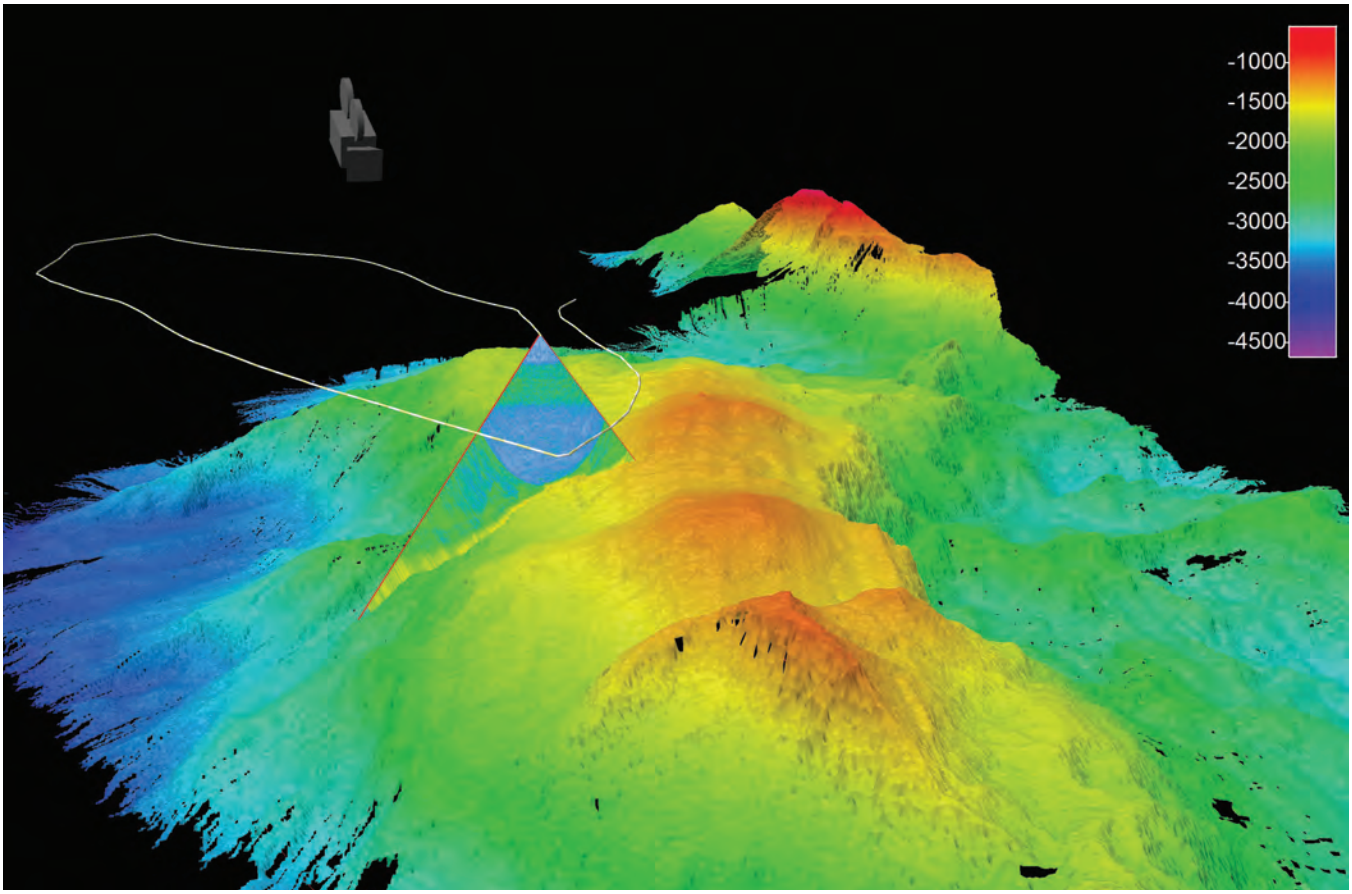
"This partnership approach, with the support of the Marine Development Team, ensures that suitable projects will move more smoothly from concept to reality for international businesses and local enterprises through having the best team available drawn from the different organizations and with the required expertise. These business opportunities are also being underpinned by a new marine research and innovation strategy as outlined in Harnessing Our Ocean Wealth and the new national innovation strategy – Innovation 2020 – supporting Ireland's ambitions to be a world innovation leader. This identifies the interventions required to build research and innovation capacity across key areas based on a maturity model of expertise in the identified sectors," she said.

Horizon 2020

At EU level, there has been considerable support for Irish researchers and SMEs involved in the marine sector through Horizon 2020 (H2020), the financial instrument that is implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. In 2016, based on the latest information available, Irish researchers and SMEs obtained almost 6.7 million in funding for marine-related H2020 projects ranging from algal biorefineries, tidal turbine technologies, marine technology co-funds and shared access to marine renewable facilities across Europe.

"Irish researchers won 3.6% of the available funding for Blue Growth topics in the 2015 results announced by the European Commission for Horizon 2020 Societal Challenge 2, and this rises to 4.6% when marine-related topics in sustainable food security are considered. This is becoming a consistent pattern, with Irish marine researchers winning more European competitive funding than would be expected from a country our size. Ireland also has the highest success rate

A multi-national team of European, Canadian and U.S. ocean exploration experts led by Thomas Furey of the Marine Institute has revealed previously uncharted features on the Atlantic seabed. The expedition crossed the Charlie-Gibbs Fracture Zone on the Mid-Atlantic Ridge, creating a 3D visualization of a 3.7km-high underwater mountain.



Graphic: INFOMAR and the Marine Institute

in Europe for the Horizon 2020 SME Instrument with a 16% success rate compared to a European average of 6%. In total since the beginning of H2020, Irish innovative SMEs have received 26.2 million from the SME Instrument which places Ireland first in Europe for successful participation in this part of Horizon 2020," stated O'Connor.

Irish researchers are also leading Coordination and Support Actions in areas such as the Atlantic Ocean Research Alliance and in strategic marine renewable infrastructure projects such as Marinet 2 and Marinerg-i, hosted by the SFI-funded Marine and Renewable Energy Centre in Cork. Expertise in algal biorefineries is funded though the GENIALG project, with researchers in NUI Galway and Aqua TT participating. Under the Fast Track to Innovation instrument, companies such as Open Hydro have had success in developing tidal turbine industrial capability.

"2017 will be a pivotal year for Ireland's marine economy, with core elements of our national marine plan, Harnessing Our Ocean Wealth, coming together to create an unprecedented collaborative drive to transform our ocean economy," asserted O'Connor. "We are determined to demonstrate on a world stage that Ireland's marine economy is very much open for business, and that we have the expertise, infrastructure and business environment to offer a compelling case for international businesses across the marine sector to look more closely at Ireland as a partner for growth."

For further information visit the following websites:

www.imdo.ie
www.marine.ie
www.ouroceanwealth.ie
www.smartocean.ie
www.imerc.ie

Deployment of the Cable End Equipment (CEE) forming the main node of the SmartBay Subsea Observatory in August 2015.

Photo: Aengus McMahon ©Marine Institute

Renewable Energy

Photo: © malp / Adobe Stock

Five Minutes with

Jim Bennett

Chief for the Office of Renewable Energy Programs, BOEM

Two years ago James F. ("Jim") Bennett was named Chief for the Office of Renewable Energy Programs (OREP) at the Bureau of Ocean Energy Management (BOEM), the program responsible for overseeing offshore renewable energy development on the Outer Continental Shelf (OCS). Bennett has a long career of experience in dealing with OCS issues as they relate to energy, with experience in oil and gas and now renewables. He recently spent some time with Marine Technology Reporter *to discuss the current and future role of offshore renewable energy in the United States.*

By Greg Trauthwein

You have vast experience in the offshore energy environment, both oil and gas and now renewables. Is there a compare and contrast between the two?

There is a compare and contrast; there are a lot of similarities, but there are many differences too. First, it's not really the 'other side' because our Bureau is all about ocean energy, and that includes both oil and gas and renewable energy. A main difference is the renewable program is relatively new, established in 2005 with the regulatory regime in 2009, whereas the oil and gas program goes back decades. There is much more on the ground experience with the program in the oil and gas side, whereas there is a lot of new things being dealt with on the renewable side.

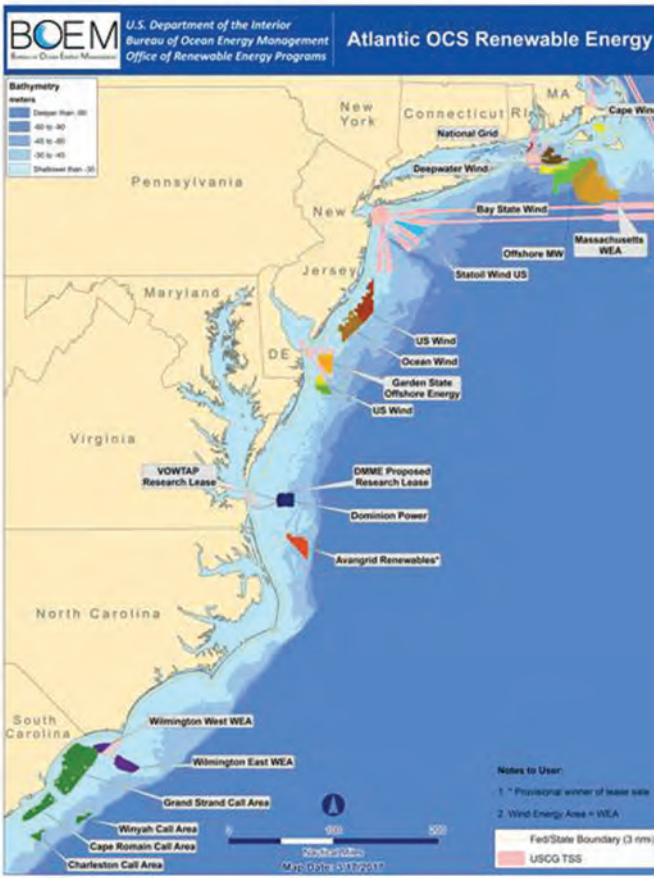
What specifically is BOEM's role in helping to bring forward renewable energy projects offshore?

The agency's role is to essentially provide access. The law is set up so that the private sector is given opportunity on a competitive basis to move into the offshore environment and commercially develop the resource for the benefit of the public. Our role is to make sure that the development is expeditious and orderly, with appropriate environmental safeguards and fairness throughout the process.

In looking at its development, by region can you discuss investment actions that have been taken, and progress that has been made in making offshore re-

"I think we have turned a corner in the offshore wind industry and we may be looking at a very high level of activity in offshore wind in the future."

Jim Bennett, Chief for the Office of Renewable Energy Programs, BOEM



newable energy closer to reality?

Sure. I'm going to focus on the Atlantic because that's where most of our work resides. The Atlantic Northeast is the most promising areas (for offshore renewable energy development); the factors simply come together … the market is there, the demand is there, the technology for shallow water (offshore wind) is possible and there is a wind resource. We've been focusing on that area and since 2009. We have had seven competitive leases and a couple of noncompetitive. In that process we have worked very closely with the states, and we're now in a position where we have 13 leases (the most recent in North Carolina is still awaiting full execution). In essence we have 13 leases, with at least one lease in every state from Cape Hattaras up to Cape Cod. That is a good foundation to build the program into the future. Our last two sales – one off of New York and one off of North Carolina – were very promising. The bids were substantial to say the least, based on our expectations, and it indicates that there is very strong industry interest in moving forward in a commercial basis offshore. (In mid-March it was announced that a Wind Energy Area of 122,405 acres offshore Kitty Hawk, N.C., received the high bid of $9,066,650 from Avangrid Renewables, LLC, the provisional winner. Also participating in the lease sale were Wind Future LLC, Statoil Wind US LLC and wpd offshore Alpha LLC.)

Our discussion really has focused on offshore wind, and obviously there are other offshore renewable technologies (wave and tidal) that are in differing states of development. Can you put all of the offshore renewable energy modes in perspective in terms of maturity?

Our responsibility is to ensure that we provide access with environmental safeguards. We have had some hydrokinetic and some wave energy pilot projects, but wind is very much coming of age and turning the corner in terms of commercial competitiveness.

Obviously there are other world regions that are further along the curve in generating energy from renewable sources. Are there any lessons learned that BOEM has sought to incorporate into its program.

Yes, I'll mention a couple. One is communication and stakeholder involvement, which is not necessarily a lesson learned from Europe, but certainly they have let us know it's an important thing and it is something we have found out as well. In terms of specific items, one of the things that we are pursuing that comes from European experience is the design envelope, an effort to provide enough flexibility to developers from a regulatory and review process standpoint to keep projects moving along with required environmental analysis and support without having a process that is so restrictive that we run into long delays every time there is a change. I'm over-simplifying a little bit, but this is something they (Europeans) have done that we are trying to incorporate here in the U.S.

U.S. offshore wind has gained momentum in recent years How has the new Administration impacted that momentum?

We've gotten some very positive indicators from the Administration. The Administration has clearly identified national interest in regards to energy generation, and they very specifically include renewable sources. That's a positive. We also had, after our last sale last month in North Carolina which was higher than anticipated, Secretary (of Interior Ryan) Zinke noted that this was a 'big win' and that it fits very well with the overall strategy, noting that 'it was a big win for collaborative efforts with state, local and private sector partners.'

The current energy markets, specifically oil and gas, are interesting to say the least. In a low-price energy environment, how does that interact and balance with renewable energy offshore?

Despite the fact that we are in a low-price arena for fossil fuels, the offshore wind industry seems to be going very well. The last two sales in New York and North Carolina provide very strong indicators of viability. We are now going out and seeking input on additional areas that might be appropriate for leasing opportunities. I think we have turned a corner in the offshore wind industry and we may be looking at a very high level of activity in offshore wind in the future.

What are the long term plans, projects or projections that estimate the role of offshore renewables in the future of U.S. energy – 5, 10, 20 years down the line?

We think it is very strong. Long term, on the East Coast, we anticipate a number of projects over the next few years in the shallow water sector. We expect to have additional leasing. But the big player for the long term is floating technology. There are areas in deeper water, and floating technology is coming along so that the long term prognosis is it will play a very big role, possibly here on the Atlantic side but more so out in the Pacific Ocean where there is no shallow continental shelf to build on. So the mid-term looks good, and long-term, with the technology changes, looks very good.

Meet Jim Bennett

James F. ("Jim") Bennett has 35 years of federal service and has served in a variety of capacities around the Department of the Interior and the Bureau. Most recently, he served as the Chief of the Division of Environmental Assessment overseeing BOEM's compliance with the National Environmental Policy Act and other environmental laws focusing on the Federal Outer Continental Shelf programs, including oil and gas, sand and gravel and renewable energy.

He is a graduate of the Departmental Manager Development Program and has earned two Master's degrees – one in Environmental Planning from the University of Virginia and the other in Computer Systems Management from the University of Maryland.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MARINE TECHNOLOGY REPORTER

South Bay Cable Celebrates 60

In 1957 gas was 24 cents/gallon, a loaf of bread cost 12 cents, ***Dwight D. Eisenhower*** *was President of the U.S. and South Bay Cable opened its doors. A lot has changed since 1957, however the basic company principles have remained steady; innovation to meet customer requirements.*

From humble beginnings, founders Gordon and Joyce Brown designed and laid up customer specific cables in their garage in Southern California. These first cable products consisted of standard off-the-shelf electrical components that were readily available. By arranging various elements together, a cable specific to the customer's needs, could be built.

The demand for specialty cables quickly grew and more than garage space was needed. In September 1957 the company relocated to an industrial facility in Gardena, Calif. By the late 60s South Bay Cable had outgrown the Gardena facility and in 1970 the company relocated to its present location in Idyllwild, Calif. Idyllwild is a small mountain town approximately 100 miles southeast of Los Angeles. In 1986 a second manufacturing facility was opened in Temecula, Calif. The two facilities are located within 50 miles of each other and have complimentary capabilities.

Cable Advancements

The earliest cable constructions consisted of different types of military specification wire and specialty electrical components, which were designed by South Bay. These components included electrical conductors for power distribution, signal pairs for voice and data transmission and coaxes for video. Many of these early cables were used by the U.S. Military and aerospace industry. Some of these early programs included the ground support cables for the Atlas silos, Americas' first intercontinental ballistic missile; the second generation of the Minuteman program's intercontinental ballistic missiles and Surveyor, the United States' first robotic spacecraft, designed to test soft landings on the moon.

Requirements continued to become more demanding, and the cables became more complex. These cables covered a broad spectrum of uses, which included a wide band of temperature ranges, electrical characteristics and mechanical requirements. Many of the cables were being used in harsh environments and included both above ground and underwater applications.

Working underwater presented a unique set of challenges including designing to withstand external hydrostatic pressure, water migration, fish bite protection and mechanical requirements. South Bay's engineers identified materials which were best suited for this diverse product range, and their production department refined the manufacturing processes.

By the early 1970s South Bay Cable was designing and building cable for many of the pioneering companies in underwater technology. South Bay provided the interior and exterior cables for the U.S. Navy deep-dive personnel transfer capsule, created Sea Plow's umbilical cable for the installation of transoceanic telephone lines and tether and umbilical cables for the then-emerging remotely operated vehicle market.

As technology improved the push was on to build deeper systems, which needed longer cables. Conventional steel reinforced cables were simply too heavy, many of these longer cables were designed using new light-weight, high-strength synthetic materials. Synthetic strength members presented their own unique set of manufacturing challenges which required extensive prototyping, testing and building of specialized equipment. Today, South Bay Cable operates numerous production lines that can produce synthetic cables with strengths ranging from a few hundred pounds up to a quarter million pounds. The advent of fiber optics allowed the elimination of heavy signal and communication components which also helped further reduce cable weight. These advancements in materials and processing allowed South Bay to design and produce cables suitable for operation at full ocean depth in lengths exceeding 10 kilometers.

Today, South Bay Cable continues to focus on highly engineered cables for use in dynamic applications including remotely operated vehicles, side scan sonar, tow systems, minesweepers, pipeline inspection, airborne aerostats and numerous military programs.

From the drawing of the copper rod to the jacketing of the finished cable South Bay Cable has the production capabilities to perform nearly all manufacturing operations in-house. With a dedication to continually pushing the envelope through innovative engineering, ever expanding production capabilities, combined with thorough testing the possibilities are endless.

This broad product base and commitment to quality and customer service, allow South Bay Cable to experience steady growth. With increased production capabilities and strong footholds in both commercial and military markets, South Bay looks forward to future challenges.

New Products

Ocean Business 2017

Ocean Business 2017 took place at the National Oceanography Centre (NOC) in Southampton, U.K. from April 4-6, 2017. At the heart of Ocean Business was a three-day exhibition which brought together manufacturers and service providers from across the industry to showcase the latest technological developments.

Echologger

A lighter version of ultra compact scanning sonar, MRS900L was launched through Ocean Business 2017 in Southampton last week. MRS900L weighs 410g in air and 190g in water, lighter than its predecessor by 30% in air and 50% in water. It can work at depths up to 1,000m. This ultra compact/light device is designed for navigation of underwater vehicles, search and recovery underwater inspections and diver-held devices with its outstanding sonar images and high scanning speeds.

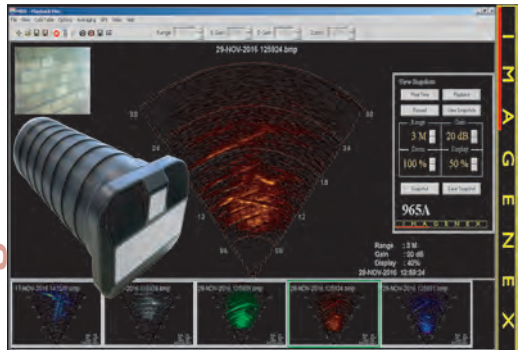
www.echologger.com

Hydromea

Swiss-based designer and manufacturer of small autonomous underwater vehicles (AUV) Hydromea exhibited its swarm-capable Vertex AUV along with the LUMA250LP optical modem, a Mini FT-07 fast temperature sensor/logger and the DiskDrive underwater thruster (pictured). The LUMA 250LP is a compact 100 x 50 x 40mm optical modem for fast underwater communication, up to 250kbit/sec, down to 6,000m depth. Its very low standby power consumption makes it ideal for battery-powered infrastructure and video-streaming for mini-ROVs. It also displayed its Mini FT-07 fast temperature sensor/logger as well as a running DiskDrive thruster. Hydromea said it has dramatically increased DiskDrive's performance, quadrupling the thrust compared to last year's model.

www.hydromea.com

Imagenex



At Ocean Business 2017, Imagenex featured a selection of multibeam, sidescan and mechanical scanning sonars. Imagenex showcased the next generation in multibeam imaging sonar, the Imagenex Model 965A, an advanced, high-speed, high-resolution system that has been designed to provide fast, reliable and accurate underwater images. The 965A is available in a variety of frequencies and depth ratings.

www.imagenex.com

Kongsberg

Kongsberg Maritime showcased a number of new, innovative technologies at Ocean Business, including new subsea monitoring capabilities for the cNODE transponder series, a cNODE Micro miniature subsea positioning transponder for divers and shallow water ROVs, the new GeoSwath Compact Survey Vessel (CSV), HiPAP portable acoustic positioning system for ultra-deep water operations, and for the first time ever in the U.K. the snakelike Eelume underwater robot.

www.km.kongsberg.com

New Products

Maritime Robotics

With a footprint of only 181 x 91 cm and a weight of 60 kg, Maritime Robotics' turnkey and easily deployable OTTER is the newest addition to its range of unmanned surface vehicles (USVs). Electric propulsion and a tightly integrated bathymetric survey system makes this system a cost-efficient solution for bathymetric surveys in sheltered waters such as smaller lakes, canals, rivers, ponds and harbor areas.

www.maritimerobotics.com

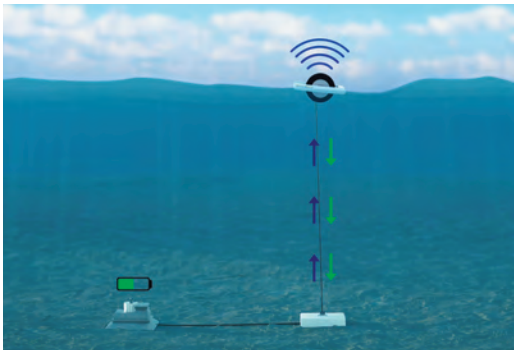
Maritime Robotics

Resen Waves

A new buoy from Resen Waves harnesses wave energy to provide continuous power and real time data connectivity to autonomous instruments and machinery in the oceans as a plug and play solution. The buoy powers a battery pack on the seabed through the mooring line, and the battery pack feeds power to the various instruments and machinery in the sea. The buoys require an average wave height between and 0.5m and 2m and can be installed in water depths from 10m and up to 200m as standard. Special versions are available can be installed in up to 3,000m of water.

www.resenwaves.com

Resen Waves



Soundnine Inc.

Soundnine (S9) displayed its new Ulti-Buoy turnkey real-time T-chain buoy system at Ocean Business. Ulti-Buoy is economical and easy to use, and delivers high accuracy temperature profiles in real time for long maintenance-free deployments. It consists of a small spar buoy with solar powered buoy controller, cellular or Iridium modem, GPS, mooring wire and XTP temperature, pressure (optional) and tilt sensors.

www.soundnine.com

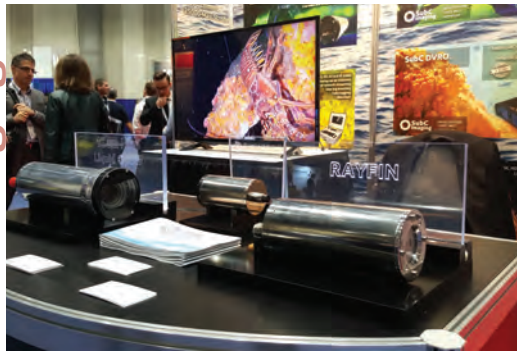
Soundnine Inc.

SubC Imaging

SubC Imaging exhibited its latest generation of cameras and lights, including its soon to be released machine vision underwater camera. The AUV friendly device features very low power consumption and the ability to seamlessly interact with onboard sensors, and its Ethernet video output also makes it easier to integrate. The demand for high efficiently underwater lights rises as subsea missions tend to go deeper into the ocean, in respond to this demand SubC has developed a new high intensity underwater light which can reach up to 25,000 lumens as a strobe.

www.subcimaging.com

SubC Imaging



STR

Subsea Technology & Rentals Ltd (STR) continue to grow its rental equipment inventory with the addition of the new automated sound velocity profiling system developed by Teledyne Oceanscience using Valeport's RapidSV Profiler. Teledyne's rapidCAST and Valeport's SVT Probe, purchased during the recent Ocean Business exhibition in Southampton, U.K., will be the latest products to join STR's range of sensor deployment and handling systems.

www.str-subsea.com

STR

Subsea Housings

Bellamare

Bellamare

San Diego based Bellamare offers custom subsea enclosures design services for client requests ranging from full ocean depth titanium enclosures to very shallow plastic housings. The company has CNC machining and fabrication capabilities for materials such as plastic, aluminum, stainless steel and titanium. ictured are two welded aluminum enclosures, 10” ID, fitted with sapphire viewports mounted at a 10 degrees angle.

www.bellamare-us.com

Blue Robotics

Blue Robotics

Blue Robotics’ new aluminum tubes for the 3 Series and 4 Series Watertight Enclosures now offer greater depth ratings, better heat transfer to the water and a hard anodized black finish, according to the manufacturer Both tubes are bored out from the inside for optimal wall thickness and to reduce the enclosure weight. The 3 Series tube is rated for 500 meters (1640 ft) and the 4 Series is rated for 400 meters (1312 ft).

www.bluerobotics.com

Develogic

Develogic

develogic subsea systems offers a wide range of pressure housings, including off the shelf standard and customized designs. One of the company’s specialties is the design of housings with integrated optical components including large flat and dome shaped viewports with depth ratings down to 20,000 psi. It is able to manufacture in house subsea housings up to 500mm in diameter and 2,000mm length in all common materials with a focus on Titanium Grade 5. Quality control is supported by vibration, temperature and pressure testing facilities (up to 14,500psi).

www.develogic.de

Greenaway

Greenaway Marine

Greenaway Marine Ltd of Swindon produces the SUBSEA MODULES Housings, which accommodate scientific equipment, underwater camera units, data loggers, cable junction etc, manufactured, tested and finished in house to suit the client’s specification. SUBSEA MODULES can be built with rated depths from 100 to 4,000 meters, and are manufactured in aluminum, 316 stainless, acetal and titanium.

www.greenawaymarine.com

Prevco

Prevco Subsea Electrical Switch

Prevco subsea have developed a new diver/surface operated subsea electrical switch. The switch has several positions allowing for the control of up to 10 different functions with a 4 position switch being standard. There are many customizable options for the switch including material, number of switch positions and hand held or attachment options and they are all rated to 6,000m. The switch is a complementary addition to our underwater switch capabilities, demonstrated by the Prevco ROV/diver switch.

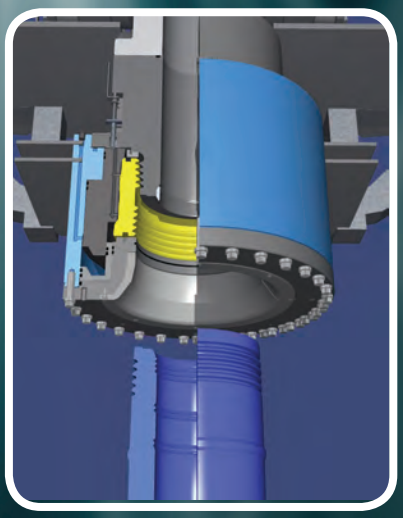
www.prevco.com

OTC's Spotlight on New Tech Awards

Founded in 1969, the Offshore Technology Conference's (OTC) flagship event is held annually in Houston, where offshore energy industry professionals from around the world come together to advance scientific and technical knowledge for offshore resources and environmental matters. OTC's Spotlight on New Technology Awards, which showcase the latest and most advanced hardware and software technologies from exhibitors, will be given this year to 17 technologies that have been selected based on the following criteria:

- **New and innovative:** less than two years old; original and groundbreaking
- **Proven:** through full-scale application or successful prototype testing
- **Broad interest:** broad appeal for the industry
- **Significant impact:** provides significant benefits beyond existing technologies

"Innovative companies like the 2017 Spotlight Award winners are putting the energy sector on their shoulders and are propelling it to new heights," said Spotlight Award Committee Chair Eric Foell. "These technological advances are helping to make our industry safer, friendlier to the environment and more efficient, and are the epitome of OTC."



Dril-Quip
DXe Wellhead Connector

Dril-Quip BigBore-IIe
Wellhead System

Halliburton
HCS AdvantageOne

Halliburton
EcoStar

Company: Dril-Quip, Inc.
Product: DXe Wellhead Connector

The BigBore-IIe is a fully qualified wellhead system consisting of a DXe connection profile, integral high-capacity hanger lock-down, superior system fatigue and high-capacity running tools. The BigBore-IIe provides drilling cost savings by reducing the number of trips into the well, elimination of drilling/production lock-down equipment and allows for reduction of casing strings.

Company: Dril-Quip, Inc.
Product: BigBore-IIe Wellhead System

Dril-Quip's DXe wellhead connector, suitable for HPHT and severe cyclic load environments, has a highly engineered locking profile and gasket design providing high structural capacity and high fatigue-resistance resulting in longer service life. The technology of this critical connection is validated beyond API-16A-PR2/API-TR7 requirements with both structural and fatigue physical testing.

Company: Halliburton
Product: HCS AdvantageOne Cementing System

The HCS AdvantageOne offshore cementing system addresses the complexities of deepwater with the versatility for use in all offshore environments. This intuitive system enables remote operations, has an integrated liquid additive system for precise slurry blending and predictive maintenance capabilities with shore based monitoring to help preempt equipment-related nonproductive time.

Company: Halliburton
Product: EcoStar

The Halliburton EcoStar Electric Tubing-Retrievable Safety Valve is the world's first electric downhole safety valve (e-DHSV). The valve eliminates hydraulic fluid to enable a fully electric completion system with zero risk of exposing electronics to produced wellbore fluids while retaining the same failsafe mechanism as today's conventional safety valves.

Spotlight on Tech

Samoco Oil Tools
BOP Testing Tool

SBM Offshore
FPSO Turret Mooring Syst.

Schlumberger
OptiDrill

Schlumberger
Pressure Drilling Integrated Solution

Company: Samoco Oil Tools,
Product: One-Trip Universal BOP Testing Tool

In collaboration with Shell Offshore Engineering, Samoco Oil Tools has engineered, manufactured and tested OneTrip, a BOP testing tool. Samoco's OneTrip can conduct required BOP tests in one trip, eliminating the need for multiple trips along the stack and reducing a rig's idle time by a minimum of 50%.

Company: SBM Offshore
Product: Stones FPSO Turret Mooring System

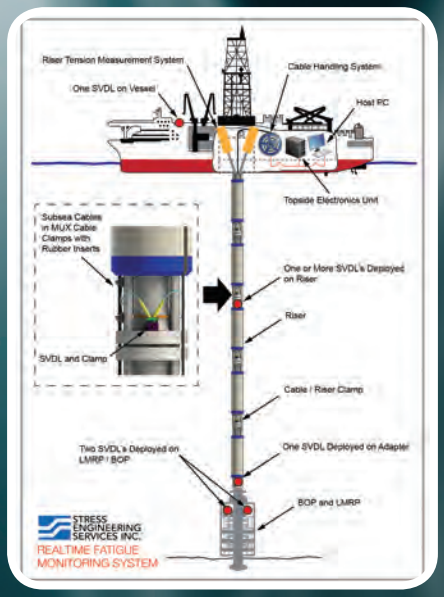
Stones FPSO's innovative Turret Mooring System (TMS) incorporates a series of enabling technologies to become the deepest mooring system of any floating production unit, and the first disconnectable TMS to support steel risers. These new technologies will facilitate future developments in ultra-deep water, and of high pressure high temperature reservoirs.

Company: Schlumberger
Product: Pressure Drilling Integrated Solution

The Schlumberger managed pressure drilling (MPD) integrated solution is the industry's first complete, all-OEM, reservoir-to-flare-stack deepwater MPD system. When MPD design, engineering, manufacturing, system integration, well engineering and onsite well delivery services are delivered from one platform and from a single supplier, operators minimize rig footprint while maximizing drilling efficiency and versatility.

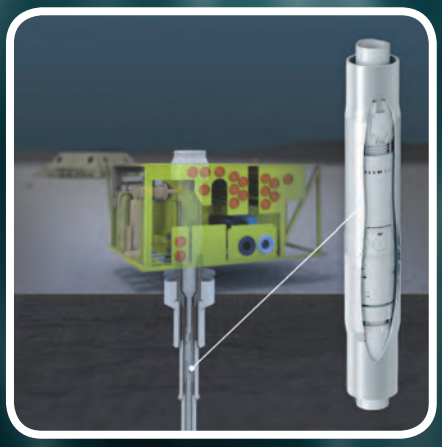
Company: Schlumberger
Product: OptiDrill Real-Time Drilling Intelligence Service

The OptiDrill real-time drilling intelligence service enables continuous real-time condition monitoring by integrating a comprehensive set of drilling dynamics and mechanical information. The service mitigates drilling risk and improves performance by providing actionable information to continuously identify hazardous drilling dynamics events and trends and recommending safe operating parameters.



Stress Engineering
Fatigue Monitoring

Sulzer
cMIST



Techni
BAMSE

TechnipFMC
HPHT Subsea Choke

Company: Stress Engineering Services
Product: Realtime Fatigue Monitoring System

A Real Time Fatigue Monitoring System (RFMS) has been developed to provide fatigue damage of drilling riser, and wellhead systems. The wellhead is the last pressure containing barrier between the well and environment. Managing the loads ensures that system integrity is not compromised, and protects the environment from hydrocarbon discharge.

Company: Sulzer,
Product: cMIST

ExxonMobil Upstream Research Company's new Compact Mass transfer and Inline Separation Technology (cMIST) replaces conventional TEG towers and associated separator vessels to meet pipeline dewpoint specifications. cMIST achieves this goal with reduced weight, footprint and cost. cMIST for dehydration is licensed to SULZER for onshore and offshore applications.

Company: Techni
Product: BAMSE

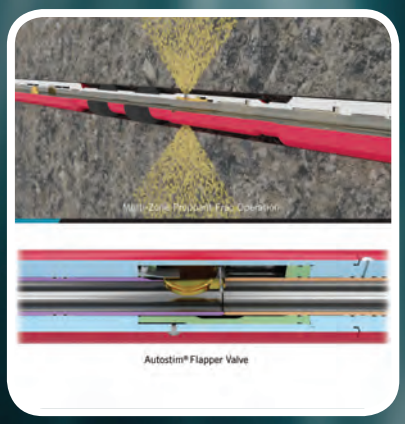
BAMSE (B-Annulus Monitoring System) is a pressure and temperature sensor for installation in the B-annulus of oil and gas wells. The BAMSE system uses no active electronics in the inaccessible B-annulus and is designed for life-of-well reliability.

Company: TechnipFMC
Product: 20k HPHT subsea choke

TechnipFMC 20k HPHT subsea choke is designed to withstand life-of-field fatigue in high-pressure, high-temperature oil and gas production environments without the need for hydraulic fluids. It meets, or exceeds, API 17TR8. Its plug-and-cage design leverages proprietary HPHT sealing technologies and TechnipFMC's G2i electric actuator, providing increased controllability over traditional hydraulic actuation technology.

Spotlight on Tech

Weatherford AutoFrac



WeST Drilling Products CDU

Wild Well Control DeepRange Plug & Abandonment

Company: Weatherford
Product: AutoFrac RFID-Enabled Stimulation System

The AutoFrac system enables efficient stimulation in open-hole sections of extended-reach offshore wells where traditional technologies have often failed to provide adequate reliability. The system enables remote operation of lower completion tools and provides several options for tool communication that do not rely on control lines or mechanical actuation.

Company: WeST Drilling Products AS
Product: Continuous Drilling and Circulation Unit

The Continuous Drilling & Circulation Unit (CDU) – is the heart of the CMR Technology, offering the world's first continuous drilling operation, and is also the world's first fully robotized circulation unit. The CDU substantially (up to 50%) reduces the overall time of drilling operations because it eliminates down-hole problems associated with differential sticking and pressure fluctuations and reduces safety risk by removing all personnel from the rig floor during the drilling operation.

Company: Wild Well Control
Product: DeepRange Plug & Abandonment Tool

Wild Well's DeepRange intervention tool delivers a ground-breaking plug and abandonment solution in a riserless package. The robust ROV-driven technology offers a minimally invasive solution that maintains wellbore integrity while providing a cost-effective yet high-quality option that will change the way subsea P&A operations are done for years to come.

Additionally, for a third year, OTC will support and recognize the innovative technologies being developed by small businesses with the Spotlight on Small Business Award. In addition to meeting the above criteria, a small business honoree must be independently-owned and operated or a not-for-profit concern and have no more than 300 employees for the 12 months preceding the application deadline. The two award recipients in this category are featured on page 59.

Spotlight on **Small Business Winners**

Company: Fuglesangs Subsea AS
Product: OMNIRISE MINIBOOSTER

The Omnirise miniBooster is the world's first barrierfluid-less and seal-less pump intended for permanent subsea applications down to 3,000 meters. The system includes a unique subsea electric Variable Speed Drive, and was qualified as part of NOVs' Active Subsea Cooler system in partnership with Statoil, Shell, Chevron, Total and GE.

Company: WiSub
Product: Torden High Power Pinless Subsea Connector

The Torden High Power Pinless Subsea Connector is WiSub's next-generation product developed in collaboration with NOV to increase connection reliability between BOP and LMRP. This innovation is further standardizing AUV and ROV connections, combining patented high-speed data transfer with highly-compact resonant power transfer. Torden delivers improved mating tolerances and reliability.

MARINE TECHNOLOGY REPORTER

2017 EDITORI

	FEATURE	MARKET	TECH
JAN/FEB AD CLOSE 1/20	Underwater Vehicle Annual: ROV, AUV, and UUVs	HD Cameras & Sonar for Vehicles	Underwater N
	MTR White Papers: Oceanographic - February 2017 Bonus Electronic Edition Publication Date: February 27, 2017		
MAR AD CLOSE 2/28	Oceanographic Instrumentation: Measurement, Process & Analysis	Fiber Optic Connectors & Slip Rings	Ocean Bus Southampt
APR AD CLOSE 3/30	Offshore Energy Annual	Subsea Engineering: Subsea Field Architecture	Buoyancy Tec
MAY AD CLOSE 4/28	Underwater Defense	Offshore Renewable Energy: Wind, Wave & Tide	Magnetomete
JUN AD CLOSE 5/25	Hydrographic Survey	Comms, Telemetry & Data Processing	GPS, Gyro Co Motion Tracki
JUL/AUG AD CLOSE 7/28	THE MTR 100 - The 12th Annual Listing of 100 Leading Subsea		
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SEP AD CLOSE 8/25	Ocean Observation: Gliders, Buoys & Sub-Surface Networks	Research Vessels	Seafloor Engi Operations
OCT AD CLOSE 9/22	AUV Operations	Harsh Environment Systems for Arctic Ops	ROV Technolo Micro System
NOV/DEC AD CLOSE 12/1	Acoustic Doppler Sonar Technologies ADCPs & DVLs	Fresh Water Monitoring & Sensors	Offshore Insp Maintenance
	MTR White Papers: Unmanned Marine and Subsea Vehicles - November 2017 B Publication Date: November 7, 2017		

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avigation	Scientific Deck Machinery	The Atlantic Canada Subsea Cluster	Oceanology Intl North America Feb 14-16 San Diego, CA Underwater Defence & Security March 6-8, 2017, Portsmouth, Uk TUSEXPO Amsterdam, Netherlands
			Delivered to Over 30,000 Recipients Worldwide
siness 2017 ton, UK	Sonar Systems & Seafloor Mapping	Southern California Subsea Cluster	Ocean Business Apr 4-6, Southampton,UK Sea-Air-Space Apr 3-5, National Harbor, MD
hnology	Work class ROV's & Seafloor Trenchers	The Norwegian Subsea Cluster	OTC May 2-5, Houston, TX AUVSI XPONENTIAL May 8-11 Dallas, TX USA
rs & Streamers	Subsea Housings	Subsea Mining: The Time is Now	UDT 30 May- 1 Jun, Bremen, Germany MAST Asia Jun 12-14, Tokyo,Japan
mpasses & MEMS ng	Interconnect: Underwater Cables & Connectors		Oceans 2017 Jun 19-22, Aberdeen, Scotland

n Companies

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gy: Workclass to s	Underwater Tools & Manipulators	The Southeast U.S. Subsea Cluster	OTC Brazil Oct 24-26 Rio De Janeiro,Brazil
ection, & Repair (IMR)	Underwater Imaging: Lights, Cameras & Sonar	The 2018 Subsea Market Planner	Underwater Intervention 2018

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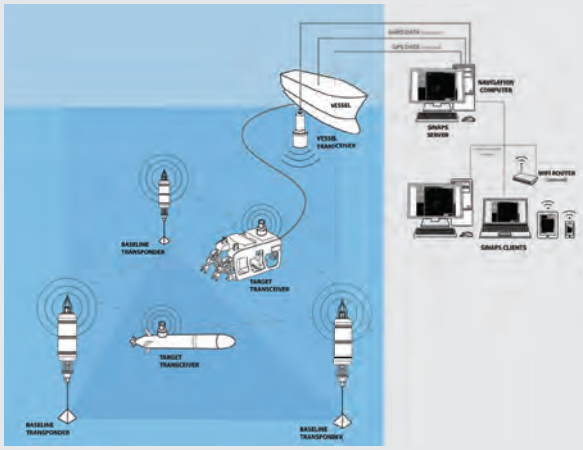

EvoLogics GmbH
Ackerstrasse 76,
13355 Berlin, Germany

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

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