MARINE TECHNOLOGY REPORTER

March 2015 www.marinetechnologynews.com

NOAA

Dr. Holly Bamford discusses NOAA's priorities & progress

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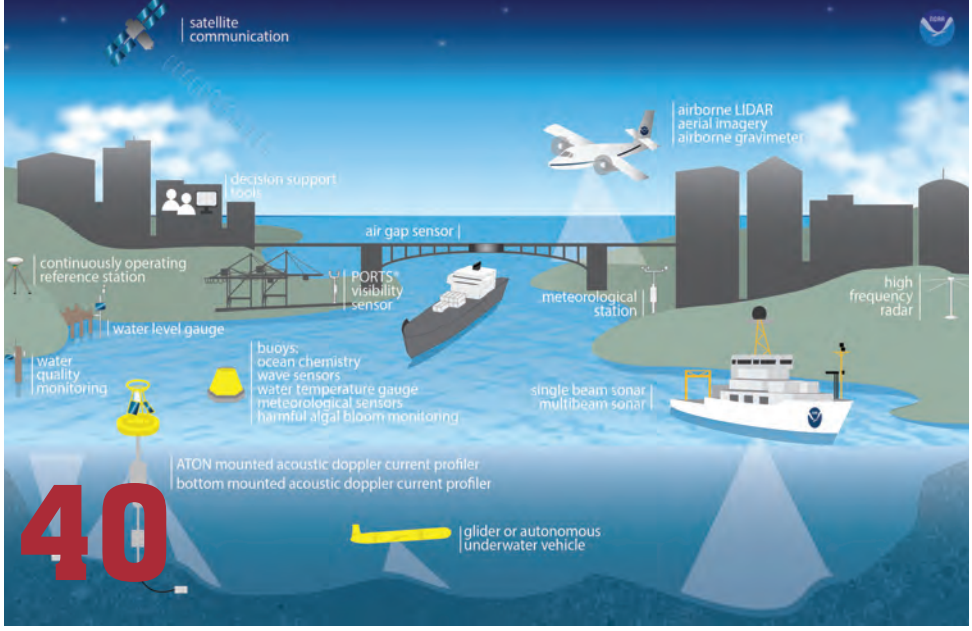

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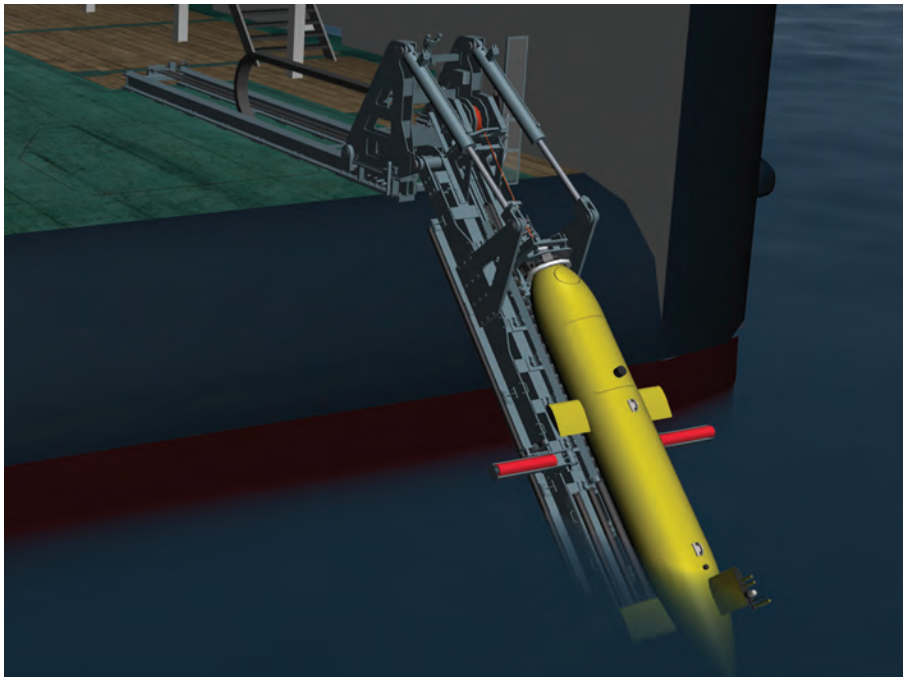

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Gregory R. Trauthwein
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Late last year at The Maritime Alliance's Sixth Annual Blue Tech & Blue Economy Summit in San Diego I had the good fortune to draw a seat next to **Dr. Holly Bamford**, NOAA's acting Assistant Secretary for Conservation and Management. Earlier that day she delivered a presentation to a packed audience outlining a number of NOAA initiatives, with specific insight on government, industry and academia working together to mutual benefit. From the line of industry executives trying to catch her ear after the presentation, I knew she would make an interesting article for our pages. And from that chance meeting on the "rubber chicken" circuit and a subsequent interview in her Washington, D.C., office evolved this month's cover story, starting on page 40.

For those of you not familiar with Dr. Bamford, she offers diverse credentials with a business degree, a PhD in environmental chemistry and more than a decade working for the government, a rare business/government/science 'hat-trick.' She is an engaging and informed interview, and I spoke with her at length regarding NOAA initiatives and objectives, as well as her take on emerging technologies in the subsea industry. It is an interesting read for anyone conducting business in this industry.

Starting on page 58 is "Part II" of our Newfoundland & Labrador regional report, continued from the January/February edition. As I have written many times in these pages, print and electronic, the subsea industry in Newfoundland & Labrador is a special cluster of innovation and knowledge, and I am proud to continue a close working relationship with individuals, companies and government to deliver unique updates and insights from this gateway to the Arctic.

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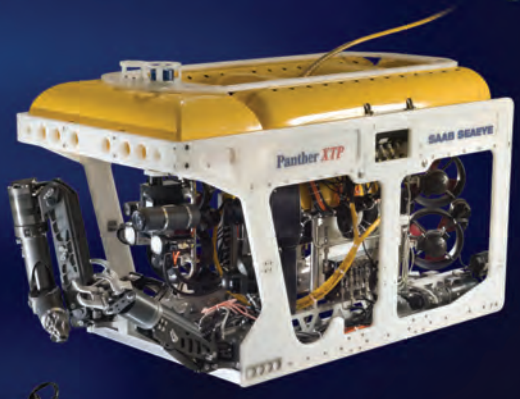

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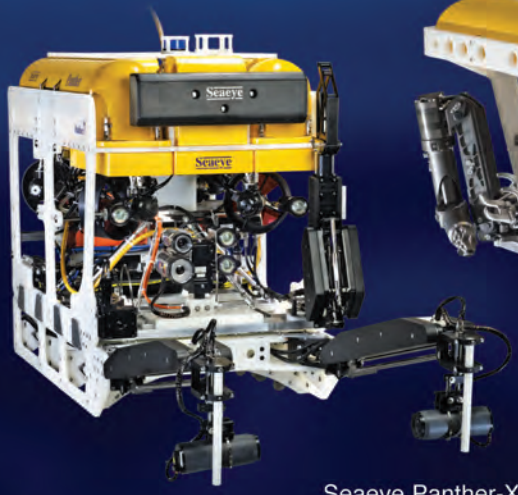

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Seaeye Leopard

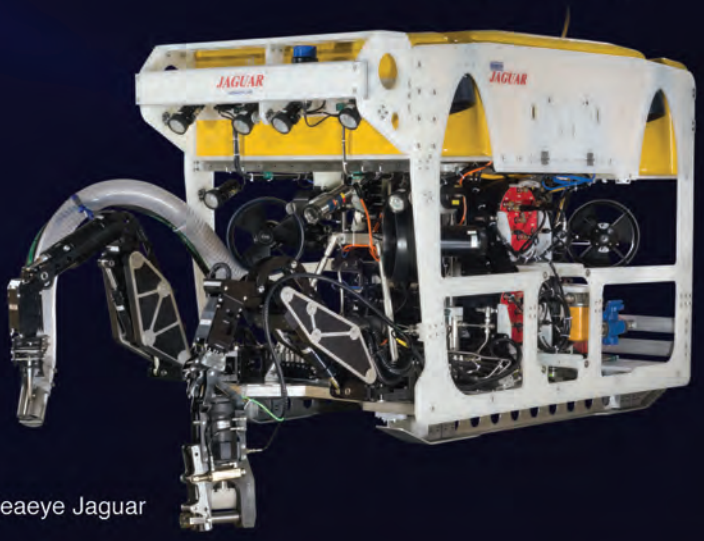

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Photo: JW Fisher

Orlinsky

Photo: Hypack

Thibodeaux

Photo: Fugro Chance

Ward

Photo: 2H Offshore

Obituary: Jack W. Fisher

Jack W Fisher, president of JW Fishers Mfg. passed away at home after a brief illness on February 20, 2015. He was 73 years old. JW Fishers Mfg. was started because Fisher, an avid diver, needed an underwater metal detector to use on a salvage project in the mid 1960s, and discovered there was no such device available. Over the next several years he designed and built his own underwater metal detector. JW Fishers Mfg. was formed and Jack began building and selling his detectors to other divers. Over the next 50 years the company developed into a enterprise by designing, manufacturing and marketing an extensive line of underwater search equipment. Over the past several years Jack cut back on his own responsibilities in the company while grooming and developing others to take over. Karen Fisher, Jack's wife of 30 years, will assume the role of company president. His son, Brian Smith-Fisher, will take on the responsibilities of Chief Operating Officer. Christopher Combs, who was previously Sales Manager and has been with the company for 43 years, will become General Manager.

HYPACK Appoints Orlinsky President

Harold Orlinsky has been named president of HYPACK, Inc. Orlinsky began his hydrographic career as a NOAA field officer in 1989. He joined HYPACK in 2005 as a hydrographer on the support staff and has served as chief operations officer since 2008. Orlinsky's new duties will include long-term strategic planning to keep HYPACK at the forefront of the hydrographic software industry. Pat Sanders will continue to serve as the manager of the software development group and chairman of the board.

New President at Fugro Chance

Fugro Chance Inc. has appointed Blaine Thibodeaux to president. His responsibilities include Fugro's Gulf of Mexico and Arctic offshore operations, including marine positioning, offshore construction and subsea projects, and international services. Thibodeaux succeeds Glynn Rhinehart, who will retire this year after 19 years with Fugro.

Gilliam Named Greensea CMO

Marybeth Gilliam brings more than 25 years of experience to the position of Chief Marketing Officer at Greensea Systems, advancing sales and marketing for its unmanned navigation and control systems

2H Names Ward Director

Phil Ward has been appointed by 2H Offshore as a director in its Aberdeen office, a promotion from his current role as principal engineer.

Almeida Joins Ocean Sonics

Ocean Sonics Ltd. has appointed Pierre Almeida as its new sales and marketing coordinator.

Ocean Energy Names President

Ocean Energy Europe's board of directors has elected Rob Stevenson, Vice President of Alstom's Ocean Energy Business, as its new president. His appointment follows the election of six new directors on Ocean Energy Europe's board.

Brandtzæg Joins MMT Norway

Audun Brandtzæg has been appointed by MMT as managing director for MMT Norway.

Cavazzi Joins ENVITIA Team

ENVITIA has appointed Dr. Stefano Cavazzi to the role of Geospatial Intelligence (GEOINT) Consultant, responsible for providing expertise with respect to Spatial Data Infrastructures, INSPIRE, Cloud Computing for Government Solutions (G-Cloud), web services and GIS technology for environmental management.

Lange Leads Schottel Hydro

Niels Alexander Lange took over as managing director of the recently founded Schottel Hydro GmbH, a subsidiary of the Schottel Group comprising activities in three segments: Schottel Instream Turbines (SIT), semi-submerged Triton platforms and components, such as turbine hubs and drives.

Schottel Launches Hydrokinetic Energy Subsidiary

Schottel formed a new subsidiary - Schottel Hydro GmbH incorporating the company's hydrokinetic energy business. Schottel HYDRO comprises activities in three segments: hydrokinetic turbines, semi-submerged platforms and components, such as turbine hubs and drives. The new subsidiary is located in Spay,

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Newfoundland Labrador
CANADA

Almeida

Photo: Ocean Sonics

Stevenson

Photo: Ocean Energy Europe

Cavazzi

Photo: Envitia

Lange

Photo: Schottel

Germany. Schottel described its hydrokinetic turbines as lightweight, yet robust in-stream generators, with a rotor diameter between three and five meters. Depending on the current velocity, one turbine produces between 54 and 70 kW rated, grid-ready electric power. Higher power demands are met by combining several turbines in one installation. Each of the turbines is connected to a frequency converter feeding into a common DC bus installed on the tidal platform. The turbines can be implemented in rivers, sea straits and tidal races offshore in jetty, semi-submerged or submerged platforms in varying numbers. Together with the subsidiary TidalStream Ltd., Schottel Hydro offers the semi-submerged floating platform Triton. Triton platforms can be adapted to host turbines of different designs and sizes. Effective use of tidal energy in water depth up to 90 meters and a generating power of up to 10 MW in a single installation are feasible.

New Micro Field Buoy from OSIL

Ocean Scientific International Ltd. (OSIL) introduced a new, ultra compact buoy platform into its existing range of fully integrated systems. The Micro Field Buoy is just 0.3m in diameter, and weighs only 15kg (without instrumentation), meaning it is easy for one person to handle in the field, is suitable for airborne, vessel based or land based deployment, and yet can still transmit data to users in real-time, providing a rapid response to environmental changes. The buoy platform can accommodate a variety of instruments or environmental sensors.

Tritech for Student AUV

Tritech's Micron sonar was selected for an academic AUV. The acoustic design team at McGill Robotics, McGill University, Montreal, Canada, chose to incorporate a mechanical scanning sonar into their new build AUV. The team now plans to integrate the Micron sonar into its software system in order to assist close range positioning and detect objects in low visibility environments. The team has also updated its AUV with new thrusters and are carrying out modifications to the frame and the pressure vessels. The Tritech Micron sonar is part of Tritech's SeaKing range of mechanical imaging sonars; The Tritech Micron sonar, with a 75m range capacity, is designed to deliver exceptional clarity and resolution in miniature form, making it ideal for use by AUVs.

SCHOTTEL HYDRO

Photo: McGill

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Innova Acquires Stake in Neptune Oceanograhics

Innova AS has acquired a shareholding in Neptune Oceanograhics Ltd., a provider of specialized technology for subsea pipeline leak detection services for the offshore oil and gas industry.

Seatronics, 2G Robotics Sales Partnership

Seatronics, and 2G Robotics entered a sales and distribution partnership that will see the 2G Robotics line of underwater laser scanners to be available through Seatronics for equipment rentals and sales.

FarSounder Acoustic Test Tank

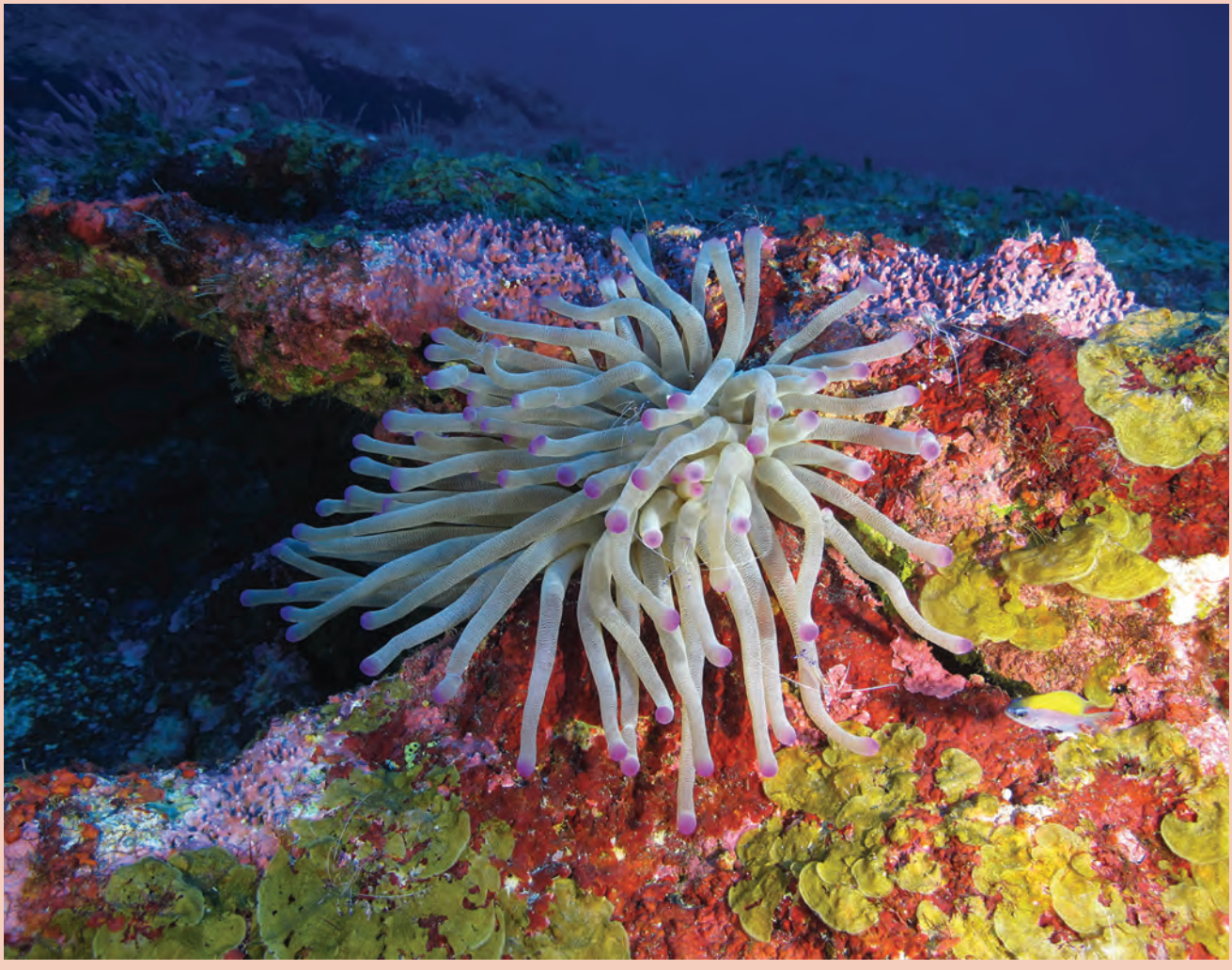
FarSounder opened its new acoustic test tank facility in Warwick, Rhode Island. The acoustic tank will be used primarily for production testing and calibration of FarSounder's sonar systems and will be available for FarSounder's R&D projects. "Our new acoustic test tank is deeper and larger than our previous test tank. This means that it is suitable for all of our production measurements. In addition, we will be able to use it for many R&D tasks that were limited by the size of our previous tank," said Matthew Zimmerman, VP of Engineering.

Nautronix Wins NASNet Order

Nautronix won an order to supply NASNet, an underwater positioning system, for Subsea 7. It will be used on the Aasta Hansteen field, located in the northern part of the Norwegian Sea approximately 300km west of Bodø, at 1,300m water depth. The field is developed by Statoil. Nautronix will supply 16 Large Stations and four complete vessel systems which will go on hire in March 2015 for approximately 200 days and will be deployed for the first time in Norwegian waters where the water depth is significant and the weather conditions can be challenging.

Picture Perfect: Underwater Image Winners Announced

Kongsberg Maritime selected the winners of The Full Picture Photo and Video Competition, choosing two joint winners. Jason White and Patrick O'Driscoll. Below is the winning image, submitted by Jason White, Operations Field Manager and taken with the Kongsberg Maritime OE14-408 Digital Stills Camera.



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By MacArtney

Virtual Aids to Navigation

Mark Research Equipment

Vesper Marine will provide its Virtual Aid to Navigation technology to the French company CGG, a geoscience company that provides geological and geophysical survey and analysis primarily to the oil and gas industry. In its ongoing quest to map the ocean's floors, CGG survey vessels tow an array of cables in the water at a up to a 50 ft. depth, an array of cables that contain seismic energy sources, usually a series of airguns that are fired at regular intervals as the vessel moves along predetermined survey lines. Energy reflected from beneath the seafloor is detected by numerous 'hydrophones' contained inside long, neutrally buoyant 'streamers' also towed behind the vessel.

A typical towed configuration is between 12 and 20 cables and streamers, measuring up to 5 miles long with a separation of 328 ft., a massive spread which equates to 3 square miles of equipment under the surface. Previously other ships had no way of knowing that this equipment was in the water, and there historically have been numerous collisions with the streamers resulted in a high loss of both equipment and productivity.

It is hoped that by using Vesper Marine's Virtual AIS Beacons to broadcast positioning data to other ships in the area, CGG will eliminate this loss.

What is VAtoN

A Virtual Aid to Navigation is created when a signal sent from a transmitter in an accessible location is used to mark a remote point. This mark is displayed as a special feature or hazard on a vessel's ECDIS, chart plotter or AIS display when within range. The ship's onboard equipment is then able to alert crews to the presence of and if they are on a collision course with the marked navigational hazard.

The Virtual AIS Beacon

The VAB1250 Virtual AIS Beacon is designed to continually broadcast the positions of the towed equipment via an interface to CGG's proprietary navigation software. The software provides the updated position of the equipment regularly to the VAB1250 identifying points at the front, middle and tail of the spread of streamers and on the outer cables. These points are then displayed on any AIS-equipped ECDIS, chart plotter and radar within a range of approximately 20nm.

"We began discussing this project with Vesper Marine in July 2013," said Matthieu Champenois, Field Support Engineer – Navigation & Positioning Department, CGG. "Jeff Robbins and his teams quickly

grasped our needs and developed a solution that was suited for this project." CGG currently has two ships outfitted with Virtual AIS Beacons and has made the decision to outfit all 13 vessels in its fleet. The first installation was completed in December, 2013 on the CGG Symphony. In step with Vesper, CGG developed its own software interfaces between the existing navigation and positioning systems and the beacon. The fully automated system shares an existing VHF antenna on the ship with the radio via a Vesper Marine AIS/VHF splitter.

"The second system was installed on the CGG Oceanic Challenger in May 2014 before a job in a location where the vessel traffic reached 120 vessel crossings per day," said Champenois. "As the broadcasted marks appearing on the displays presented an unusual situation for vessels in the area, their bridge officers contacted the Challenger's master in order have a clearer view of the situation and to avoid any collision. This was exactly the intended result."

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Greenland's New 32m RV

By Alan Haig-Brown

Greenland has an intense interest in maritime research and survey for the near coastal waters, thanks in part to a growing seafood sector, an extensive coastline and some 250 different species of fish. To meet the nation's emerging need, Greenland had a 32.3-m research vessel built at the Karstensen's Shipyard in Skagen, Denmark. The vessel was named R/V Sanna by Helle Siegstad, Head of the Department of Fish and Shellfish, in a ceremony at Nuuk, Greenland in April of 2012.

The R/V Sanna then went into service with the Greenland Institute of Natural Resources researching the Greenland halibut, crab, and cod stocks in Greenland's coastal waters and ice fjords. A larger vessel, the 1971-built stern trawler Pâmiut serves primarily to research shrimp and Greenland halibut in more open waters. The R/V Sanna, with a 10-meter beam and depth from main deck of 4.88 meters, is, under the command of Captain Rink Heinrich, capable of a wide range of research. The vessel is equipped for trawling, gillnets, long lines and pot fishing. Researchers have two wet and one dry laboratory with fume-hood, a chemical laboratory, cold and freezer laboratory and a -80 Celsius freezer. Designed by OSK-Shiptech in collaboration with the scientists from Greenland, the ship has accommodation for 16 people in a total of nine cabins. A Cummins K38-M Tier 2

Photo courtesy of Greenland Institute of Natural Resources

engine rated for 1000 HP at 1800 RPM, turning a variable-pitch Hundested propeller, provides main propulsion. Given the northern climate and long winters, the R/V Sanna works the west coast of Greenland only six months of the year. Between her launch and February 2015 she has put 7371 hours on her Cummins main without any problems. To meet the extensive electronic needs of multiple winches, bow thruster as well as laboratories and navigational equipment the R/V Sanna has a pair of Cummins QSM11D-powered generators to provide 220 kW of power. Given her quality build and strong service support by the Esbjerg branch of Granly Diesel A/S the research vessel can be expected to continue and an important asset to arctic fisheries research for many years to come.

Photo courtesy of Greenland Institute of Natural Resources

New DSV for N-sea

N-Sea has launched its third diving support vessel, the Edradour, representing a $2.2 million investment for the company to be immediately utilized in its inspection, maintenance and repair (IMR) operations in the North Sea, as well as in Holland and Germany.

Similar to its sister vessel, the Aberlour, the Edradour features added capability and redundancy, making it suited for restricted area access around offshore vessels, platforms and mobile offshore drilling units where diving support vessels have limited access for maintenance and surveys. Edradour will be used as a specialist diving and intervention craft for the inspection of subsea structure, light construction works, debris removal, special periodic surveys (SPS) and inshore harbor survey work.

(Photo: N-Sea)

Edradour with sister vessel The Aberlour. Inset: Roddy James, COO

Image courtesy of CTruk

New Survey Vessel for Port of London

The Port of London Authority (PLA) ordered a new purpose-built survey catamaran, a CTruk MPC19, due to enter service on the river Thames later this year. The vessel is will replace the PLA's Yantlet vessel as she reaches the end of her service life, continuing the PLA Hydrography team's survey work which facilitates safe navigation on the tidal Thames. As the U.K.'s busiest inland waterway, the river is a link for trade, travel and leisure and as home to the U.K.'s second largest port. Capt. John Pinder, port hydrographer, said, "This boat should be an excellent addition to our fleet. It offers more space to our busy crew and its fuel efficiency is a bonus that will help us keep costs down."

The CTruk MPC19 is a hydrodynamically optimized twin-hull design. It has a low draft for shallow water access and a low air draft. The boat can accommodate up to 12 people (two crew and 10 passengers) and is loaded with features including water-jet propulsion (for a high level of control and low draft), multi-beam sonar platform, a four-meter survey-capable Rigid Inflatable Boat (RIB), cruise speed of 18 knots, survey speed from two knots, fuel efficient to save operating costs, top-of-the-range echo sounding systems and ancillary survey equipment, deck that can take loads of up to one metric ton per square meter, and equipment including a Palfinger foldable knuckle crane.

Construction Vessel Delivered to Eidesvik

Eidesvik Offshore has taken delivery of Viking Neptun, an offshore construction vessel from Kleven Verft AS.

According to Eidesvik Offshore, TBN Viking Neptun represents its largest ever investment in the subsea segment. A long-term loan facility of $124 million has been drawn with Nordea and Eksportkreditt Norway/GIEK to finance the vessel. The vessel, equipped with Reach ROVs and manned by Eidesvik marine personnel and Reach ROV personnel and engineers, will begin a contract with Technip in March 2015. The fixed period was initially for 110 days with additional options, the first of which was exercised by Thechnip/Reach to extend the contract to 180 days. Viking Neptun has a length of 145 m and a beam of 31 m and is equipped with two offshore cranes of 400T and 100T respectively, and a carousel with a capacity of 4,400T flexible pipes. The vessel has classification ICE 1B which means she is prepared for operation in Arctic waters.

Photo: Eidesvik Offshore

Wind Farm Vessel Named

James Fisher Marine Services's (JFMS) multipurpose wind farm support vessel, Dart Fisher, has been formally named by the vessel's Godmother Maria McCaffery MBE, CEO of RenewableUK at a dedication service held at Griffon Hoverwork, Southampton.

The service marks the completion of significant investment program to increase Dart Fisher's operational capabilities and demonstrate innovative monitoring solutions to enhance safety and efficiency. These include: the addition of Hercules Hydraulics bow thrusters in each hull to increase low speed maneuverability and route following capability for survey operations; enhanced bow fendering system supplied by Manuplas, intelligent Fender System; a vessel impact and thrust load sensing and verification system developed by James Fisher group company Strainstall; VMMS system that reports on actual motions experienced by vessel and crew in real time; and a Palfinger Deck Crane to be used for ROV work and offshore equipment load/offload. After taking delivery of the first of type SMV 24 vessel from Supacat on April 14, 2014, Dart Fisher entered service on charter two days later.

(Photo: JFMS)

Chris Compton, Jim Hey, Adrian Went, Maria McCaffery, Sue Blacthford and Arthur Todd.

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gliders

(Silently) Making O&G Ops Cheaper, More Efficient

By Sean Halpin Global AUV Manager, DOF Subsea

At Ocean Business 2015, DOF Subsea will launch its Skandi Explorer service to the European Market. Previously used in academic studies, this technology is new to the oil and gas market.

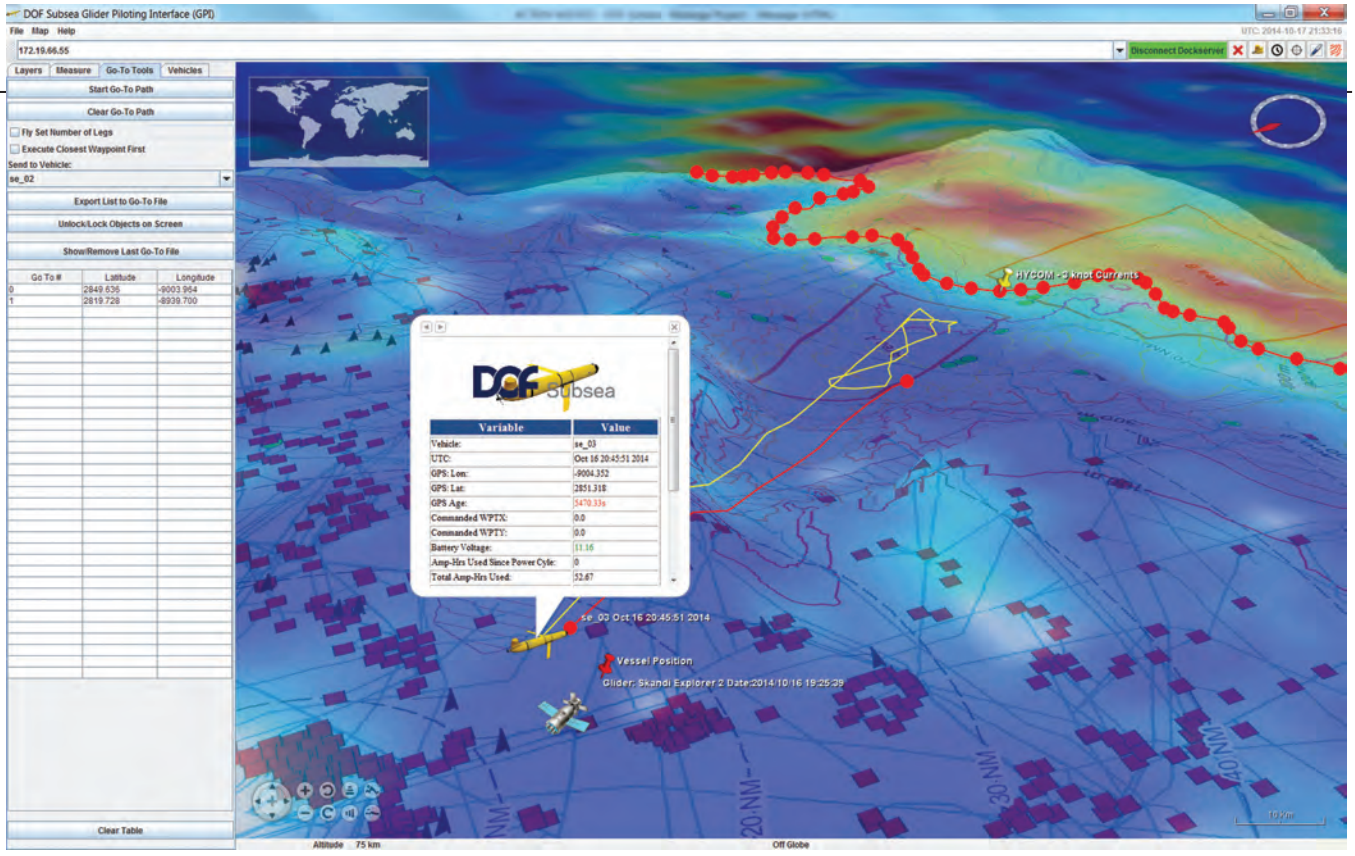
The recent and sudden contraction of the Offshore Oil and Gas market has compelled operators to cut costs, while maintaining the high safety standard required in the industry. During these events in the past the Oil and Gas industry has innovated, implementing high-tech autonomous technology to deliver safer and more cost effective solutions. We believe that a new wave of technology can once again provide considerable cost and technological benefit to our industry.

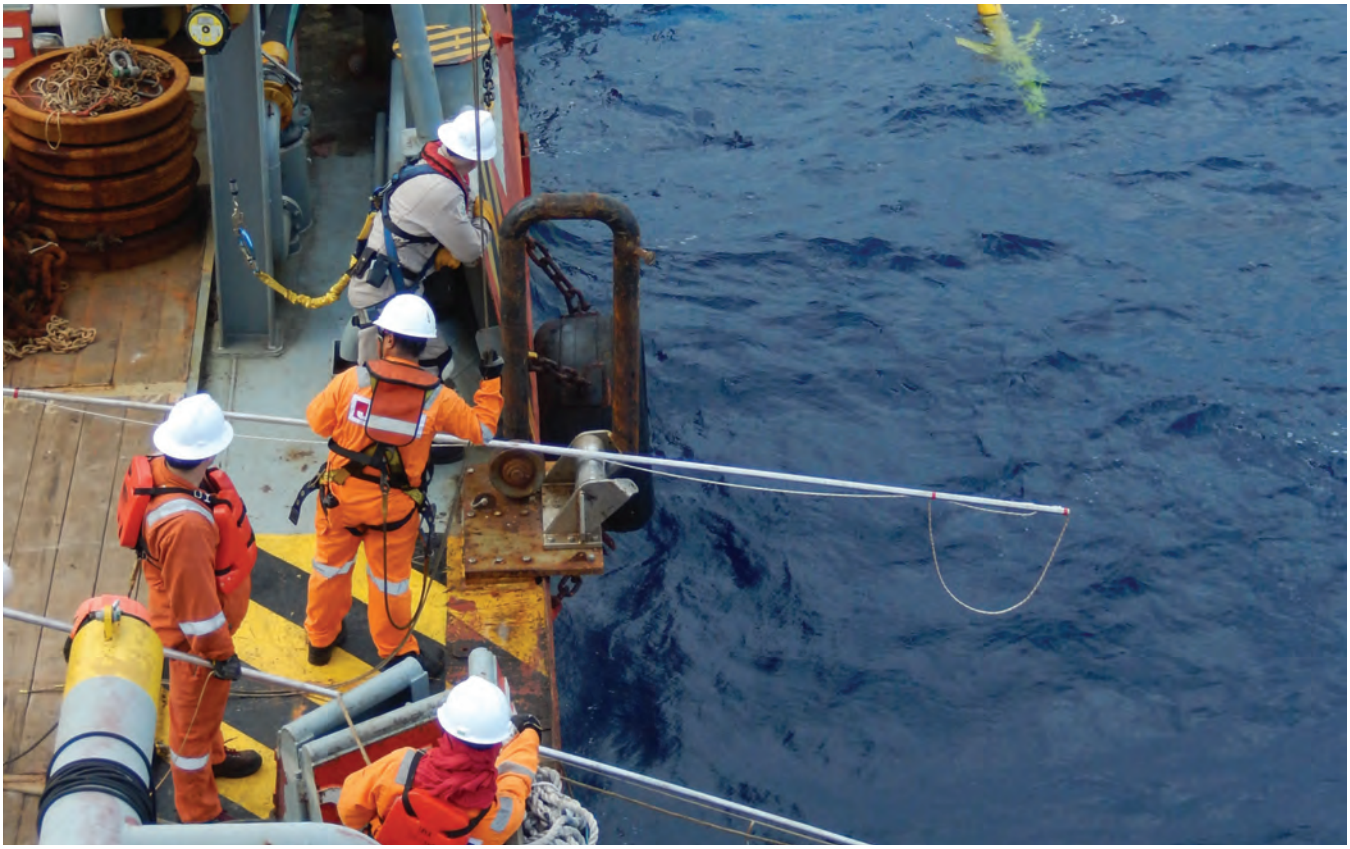
In mid-2014 we launched the Skandi Explorer program in our North America region to further our use of Subsea Autonomy in the Oil and Gas industry and provide a brand new type of autonomous service to Oil and Gas companies. The Skandi Explorer program was built around the Teledyne Slocum Glider vehicle, leveraging this unique autonomous robot's ability to stay at sea for extended durations while being remotely managed by technicians onshore. Unlike the survey class HUGIN AUVs that DOF Subsea operates, the gliders seek to quantify properties of the water column, not the seabed. Additionally, the gliders move through the water column in a vertical seesaw pattern (called a 'yo') due to the fact that the primary propulsion is buoyancy-change driven. Gliders only move propulsion motors at the top and bottom of a yo. These motors are internal to the vehicle and are not connected to propellers. After moving the motors required to change the vehicle pitch and buoyancy, the system takes advantage of free energy motion all the way to the bottom (or top) of the yo. This propulsion type dramatically reduces the energy consumption of the vehicle, allowing it to stay offshore for extended durations. The buoyancy engine of a glider provides an ultra-efficient, acoustically quiet way to navigate the water column.

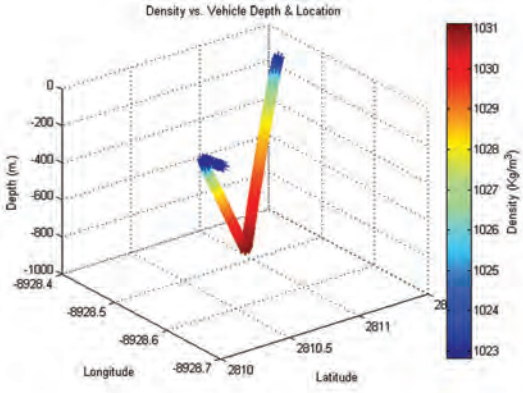
At the ocean surface, the vehicles call in to servers onshore via an iridium modem. During this time the gliders interact with human operators, transmit data, and receive new instructions. This operational control of the vehicles can be performed from anywhere on the globe with a secure, stable internet connection.

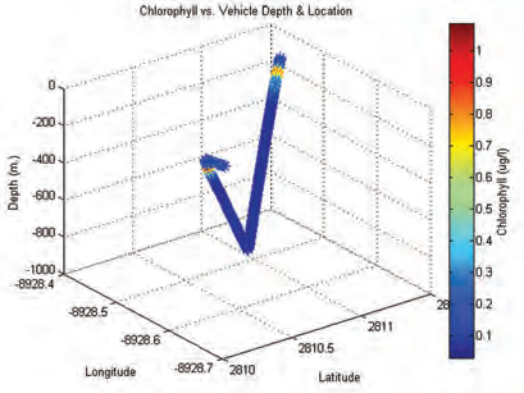
There have been hundreds of these vehicles built previously, yet these systems don't come out of the box ready to work in the Oil and Gas industry. A considerable effort was made to commercialize the technology. This started with the development of an integrated, web-enabled GIS piloting system which pulls in public domain and proprietary piloting data from the internet and local sources. Piloting gliders from thousands of miles away can be a challenging task. The software we built, named GPI, reduces operational risk by providing near real-time data to pilots about the environment, ships in the vicinity, and the location of any surface or subsea infrastructure.

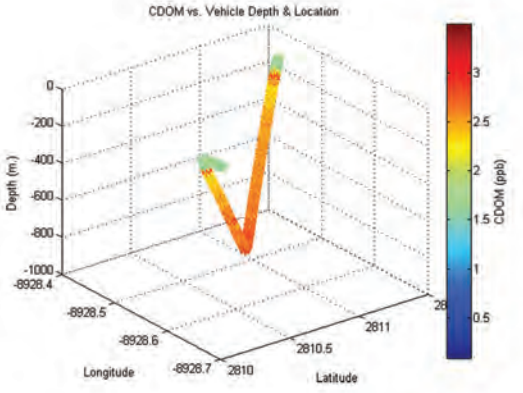
Many improvements were also made to the launch and recovery methods for the systems, ensuring the vehicles' field operations comply with Oil and Gas Operator regulations.

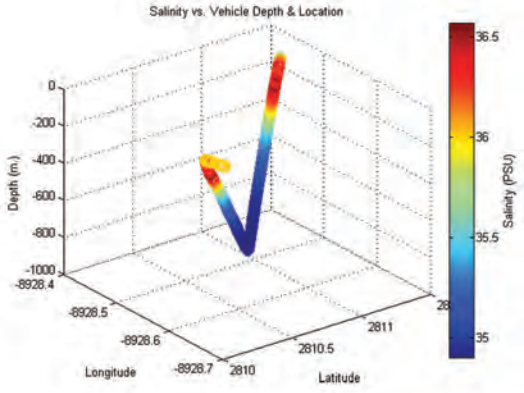

DOF Subsea Glider Piloting Interface (GPI)
File Map Help
172.19.66.55
Disconnect Dockserver
Layers Measure Go-To Tools Vehicles
Start Go-To Path
Clear Go-To Path
Fly Set Number of Legs
Execute Closest Waypoint First
Send to Vehicle:
se_02
Export List to Go-To File
Unlock/Lock Objects on Screen
Show/Remove Last Go-To File
Go To # Latitude Longitude
0 2849.636 -9003.964
1 2819.728 -8939.700
Clear Table
HYCOM - 3 knot Currents
DOF Subsea
Variable Value
Vehicle: se_03
UTC: Oct 16 20:45:51 2014
GPS: Lon: -9004.352
GPS: Lat: 2851.318
GPS Age: 5470.33s
Commanded WPTX: 0.0
Commanded WPTY: 0.0
Battery Voltage: 11.16
Amp-Hrs Used Since Power Cycle: 0
Total Amp-Hrs Used: 52.67
se_03 Oct 16 20:45:51 2014
Vessel Position
Glider: Skandi Explorer 2 Date:2014/10/16 19:25:29
20 NM
Altitude 75 km
Off Globe




Density vs. Vehicle Depth & Location
Depth (m.)
0
-200
-400
-600
-800
-1000
Longitude
-8928.4
-8928.5
-8928.6
-8928.7
Latitude
2810
2810.5
2811
Density (Kg/m³)
1031
1030
1029
1028
1027
1026
1025
1024
1023


Chlorophyll vs. Vehicle Depth & Location
Depth (m.)
0
-200
-400
-600
-800
-1000
Longitude
-8928.4
-8928.5
-8928.6
-8928.7
Latitude
2810
2810.5
2811
Chlorophyll (ug/l)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1


CDOM vs. Vehicle Depth & Location
Depth (m.)
0
-200
-400
-600
-800
-1000
Longitude
-8928.4
-8928.5
-8928.6
-8928.7
Latitude
2810
2810.5
2811
CDOM (ppb)
3
2.5
2
1.5
1
0.5


Salinity vs. Vehicle Depth & Location
Depth (m.)
0
-200
-400
-600
-800
-1000
Longitude
-8928.4
-8928.5
-8928.6
-8928.7
Latitude
2810
2810.5
2811
Salinity (PSU)
36.5
36
35.5
35

Traditional surface vessels are expensive, but are often tasked with measuring properties of seawater or monitoring environmental conditions. These are functions for which gliders were originally designed and which they can accomplish at a fraction of the cost.

Recently in the Gulf of Mexico, we deployed three of the glider systems into a loop current eddy to prove that the vehicles were capable of simultaneously navigating and collecting useful data in challenging environmental conditions. The vehicles experienced surface currents in excess of 3.5 knots but were able to effectively navigate once below the effect of the eddy. Every 4 hours the vehicles would call back to the Houston-based flight control center. The gliders provided data about the eddy water mass and, more importantly to the operation, actionable information about the speed and direction of the current. In the past vessels have been used to monitor the current in challenging areas. By using glider vehicles clients may save tens of thousands of dollars per day or enable water current observations that were previously outside of the budget.

During the three week test, the vehicles were also collecting fluorometric data including backscatter and Colored Dissolved Organic Matter (CDOM). These data may be used as a marker for the presence of hydrocarbons in the water column, allowing gliders to remotely monitor drilling operations or pipelines for spill event markers. Indeed this method of observation has already been used by government researchers during the Deepwater Horizon / Macondo oil spill incident.

Overall, gliders are another good example of how autonomous technology can provide enormous commercial, operational, and environmental benefits to an industry which has extremely high safety requirements and shrinking budgets. Gliders can not only collect environmental data, but can provide the operational support that surface vessels provide now, all at a fraction of the cost.

Market forces and technological advancements are converging to where glider technology may soon become a mainstay of the Offshore Industry for data-aided operational decisions and environmental incident response.

Seafloor Mapping

Helping to make subsea opts more safe & efficient

By Tom Peters

The world's oceans are getting busier. They are being inundated with oil and gas exploration projects, installation of underwater energy and communications cables, pipelines, windmill installations, increased fishing fleets and power generating turbines. And all of this and more generates a greater need to protect the marine life habitat, help better understand the oceans and their bottoms and accentuates a requirement for solid, sustainable conservation measures. The science of bathymetry, or seafloor mapping, is one of the tools used to help determine areas for safe underwater exploration and equipment placement plus vital to protect and track marine life.

"For any kind of management, at the end of the day, you are putting maps in the hands of managers or companies interested in resource exploitation," said Dr. Craig Brown, research scientist in the Applied Oceans Research Department, Nova Scotia Community College (NSCC). "It could be oil and gas. It could be fisheries. You need that information to make decisions on whether this is going have impact or how do you manage an area."

Brown, a marine biologist with a background in sea floor mapping, noted there are a lot of marine protected areas so it is important "to know what's down there. You have got to map it and got to understand it."

With a goal of finding better ways to map the sea floor in mind, Brown and the NSCC's oceans technology branch, are teaming with Quality Positioning Services BV (QPS Canada Inc.) to do just that in a six-month project.

Oceans technology is one of five divisions of applied research at the college, which has a mandate to serve industries in the province and support them in terms of training highly qualified people for workforce and applied research. It also addresses novel needs and innovation and works with industry to improve business practices.

QPS, with an office in Fredericton, New Brunswick, is headquartered in Zeist, The Netherlands. An independent software design company, QPS is focused on system integration of survey sensors and the development of software applications used for hydrographic surveys, sea-floor mapping, portable pilot units and Electronic Navigation Charts (ENC) production.

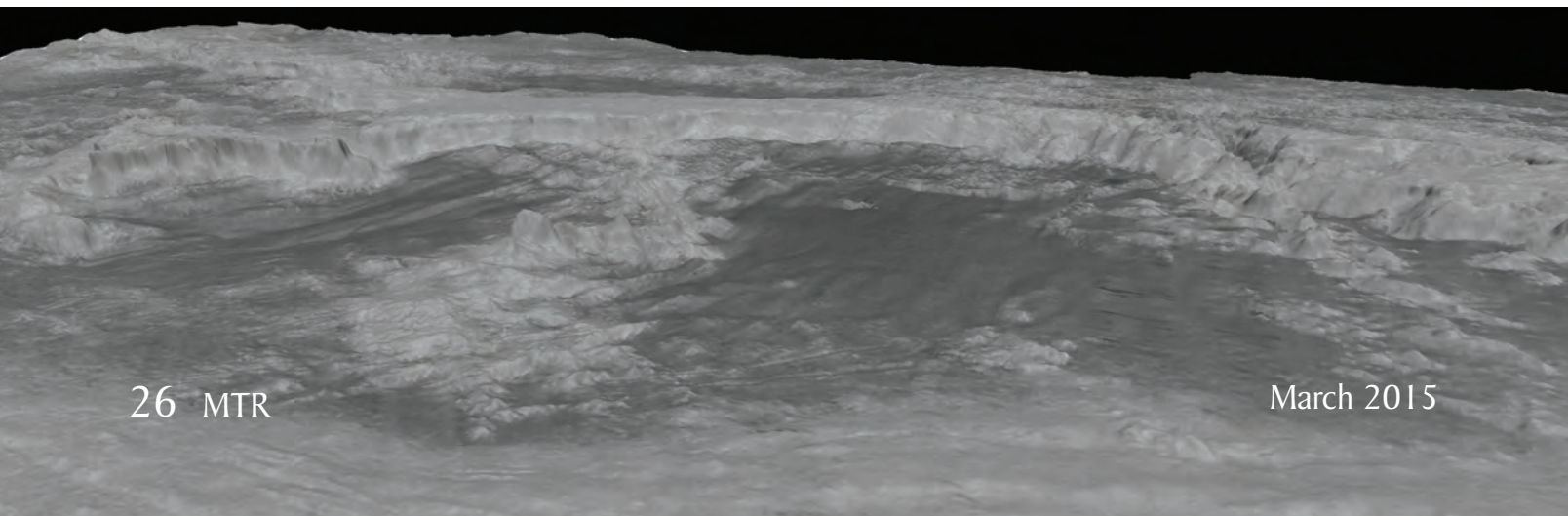
Brown said multi-beam echo sounder mapping technology is the focus of the collaborative research.

"This project is focusing specifically on backscatter which is a signal that comes back from a multi-beam system looking at the reflectivity of the signal from the sea floor. Traditionally, multi-beam systems kind of came about for bathymetric systems," he said.

He explained that multi-beam systems occurred in the very late 70s and early 80s and in 90s became more mainstream.

"Pioneering work was done through a few key research institutes. Bedford Institute of Oceanography (BIO in Halifax) being one of them. The Canadian Hydrographic Service did a lot of work with early multi-beam systems plus there were

10 km Across



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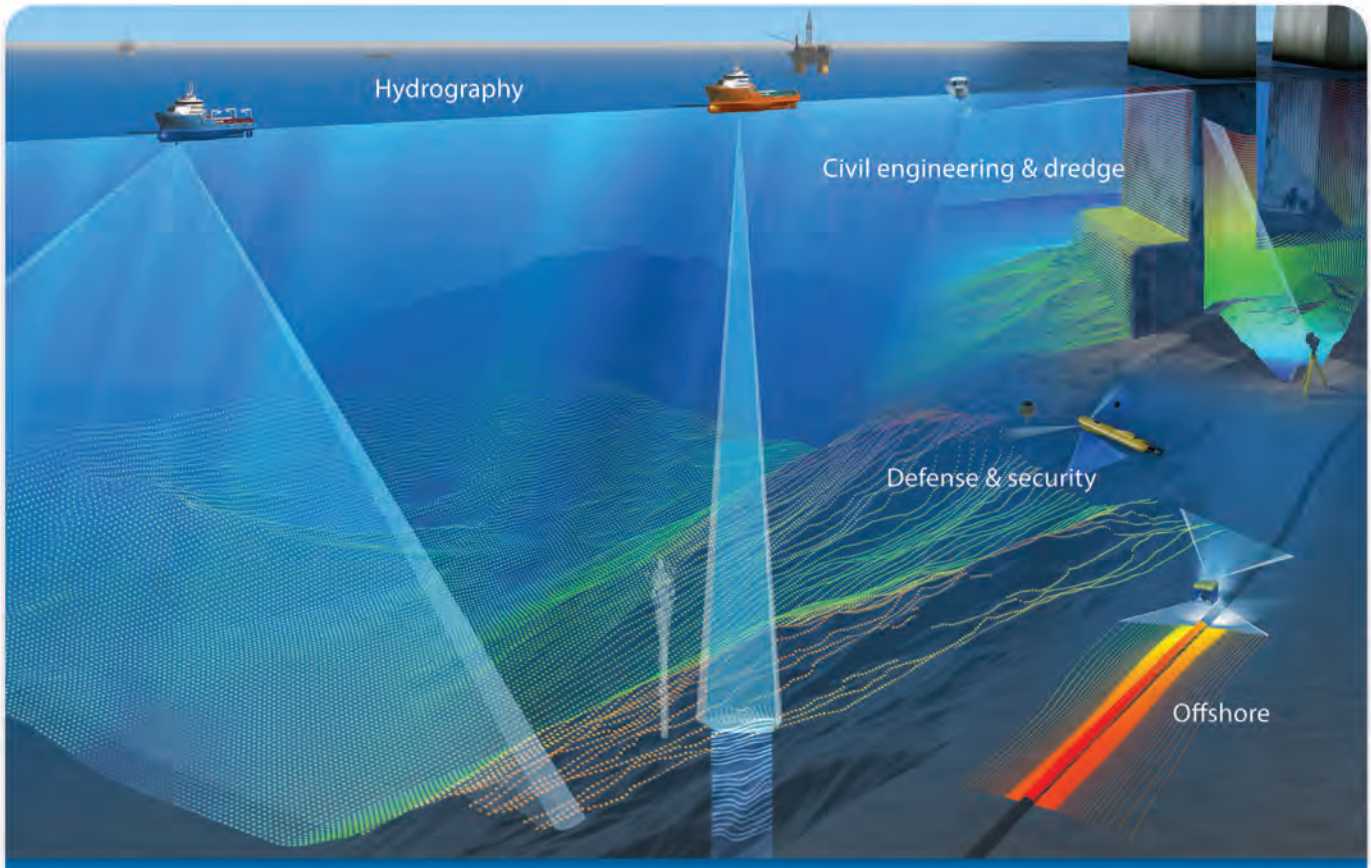

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Dr. Craig Brown, research scientist in the Applied Oceans Research Department, Nova Scotia Community College (NSCC)

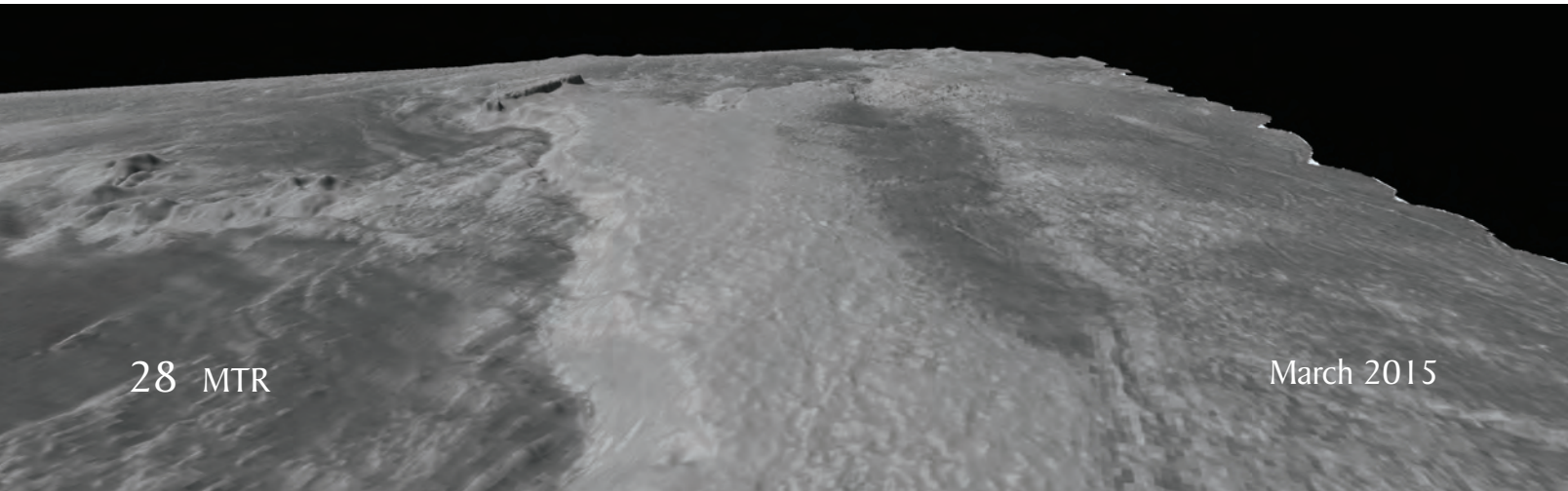
groups in the U.S. and France as well," he said.

In the late 90s multi-beam systems became more sophisticated in the detail they reflected with the use of a number of echo sounders measuring the returns from multiple beams in a swath rather than just getting a single measurement from beneath the vessel, Brown said. Covering more of the seafloor in one pass was attractive for hydrographic chart production "so a lot of the hydrographic offices around the world recognized you could create much better nautical charts," he said. And by getting continuous coverage sweeping the sea floor, "you don't miss any shallow spots and for safety navigation that is paramount," Brown said, adding, it also a way to see the sea floor in 3D.

However, the international scientific community continues to examine how sea floor reflectivity data or backscatter collected by these systems is measured and processed.

"Using passive sonar reflective technologies, we will work with QPS to investigate ways to calibrate sea floor scatter data sets in the field. This is the first stage to developing post-processing software tools for the correction and mosaicking

8 km Across



“Using passive sonar reflective technologies, we will work with QPS to investigate ways to calibrate sea floor scatter data sets in the field.”

Dr. Craig Brown, Nova Scotia Community College

of multi-beam backscatter data sets. We believe results from this research will offer benefits to a wide cross-section of end users looking for improvements in the quality of backscatter data sets for the production of better sea floor maps,” Brown said.

Dr. Jonathan Beaudoin, with QPS, said his company will work with NSCC and produce the mapping software from data collected during the project. Beaudoin said plans are to use a calibration target called sonarbells developed by Subsea Asset Location Technologies Inc. in the UK.

“If you ping at it, it gives you a certain type of tone back that you can identify and this particular device is good for finding things on the sea floor,” he said.

“We are looking at using the echo strength not just to tell how deep the water is but how strong the echo is and that is an indicator of what the sea floor might be, rock or mud or sand. A map of that reflection strength tells you something about the sea floor more than just the depth alone,” he said.

Brown said these devices haven’t been used in this context in the past so the plan, in the next few months, “is to go over a site where we know the sea floor. We have sampled it, we know the grain size, we know the geology. We will put on one of these devices and run over the site and see if that approach can be used to help correct the intensity levels of the backscatter mosaic.”

Several industries working in the oceans rely heavily on accurate sea floor maps.

Fundy Ocean Research Center for Energy (FORCE) realizes the importance of sea floor mapping and will continue to rely on it as it pushes for with harnessing energy from the powerful tides of the Bay of Fundy between Nova Scotia and New Brunswick.

“Mapping the sea floor has been critical to every decision we’ve made: where to lay power cables, where to locate turbines, how to operate safely, and where we can expect the most powerful currents. As the industry expands from single turbines into arrays, mapping will guide our way forward,” said Tony Wright, FORCE general manager.

Clearwater Seafoods, a major international seafood company in Halifax, NS, has been using sea floor mapping to find marine habitat and create a more efficient and environmentally friendly fishery.

Catherine Boyd, Clearwater's manager, sustainability and public affairs, said Clearwater, like many fishing companies, has been using multi-beam mapping for several years.

"We were certainly one of the proponents advocating for it," she said. An initiative started in the late 90s helped improve the harvesting of scallops. She said 3D images of the ocean bottom were overlaid with habitat information and baseline geography of the area which created multi-dimensional maps that allowed Clearwater to target the area where it felt was the prawn scallops habitat.

"It was an excellent initiative and the environmental benefits were twofold. We shrunk the footprint of the fishery and additionally we were using less fuel to collect the quota.

It made harvesting in that fishery more efficient and more environmentally friendly and if better maps are produced we will use that information as well," she said.

Carl Makrides, Director of Resources, Canada-Nova Scotia Offshore Petroleum Board, which regulates all of the oil and gas drilling of wells offshore Nova Scotia, said as part of the authorization process for companies seeking to drill wells, they must submit a full seabed survey or a geo-hazard report that which at times includes multi-beam data.

He said before a well is drill the company must collect seismic data, the most commonly used is 3D seismic data because it provides high resolution images of the area to be drilled "and the geological target you are chasing."

"The precursor too that would be something called 2D seismic data. It tells you a little bit about a very large area while 3D seismic tells you lot about a small area but more concentrated and with high resolution," he said.

However, Brown indicated that the type of data used often depends on the needs of the proponent.

"Often the seismic surveys come first to identify the resource, and then more detailed surveys - which more times than not include multi-beam mapping surveys are done at the drill site locations to identify geo-hazards and characterize seafloor geology/environmental characteristics," he said.

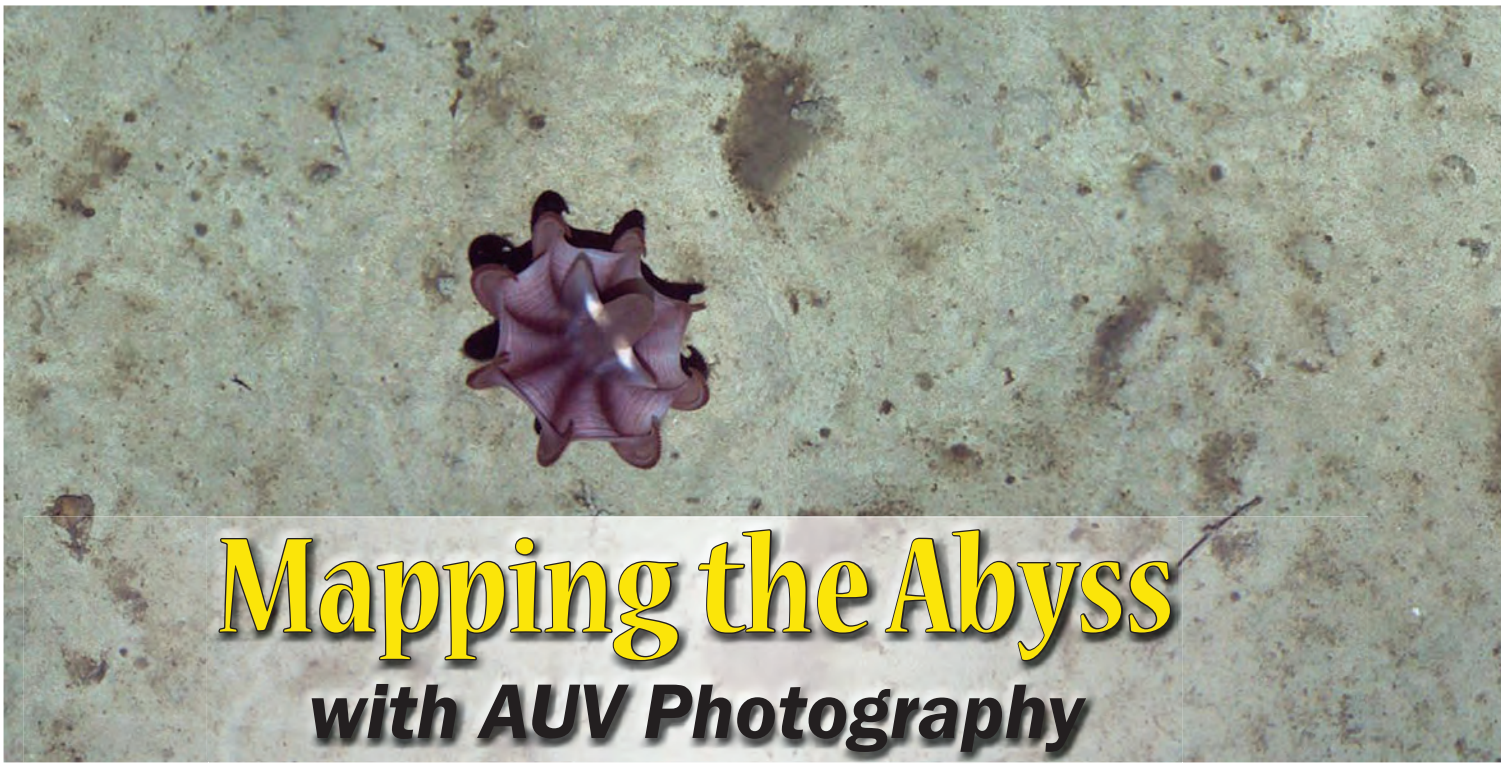
The various data sets are used to determine if there is any risk to the drilling operation.

Another way the data is used, said Makrides is for exploration purposes.

"An oil company looking for hydrocarbons will sometimes identify what they call gas escape or pockmark structure which look like cylinders or cylindrical features on the seafloor. If the quality is good enough those cylindrical features, assuming they are large enough to be imaged, can actually indicate the escape of natural gas or hydrocarbons in the formations," he said.

The data is also used to determine the stability of the sea floor where a drilling rig will be located to ensure nothing in the area will cause problems.

"So the data sets gets used on the hazard side and the exploration side depending on quality of the data," he said.



Mapping the Abyss with AUV Photography

Despite being one of the largest habitats on Earth occupying around 60% of the surface, the deep-sea environment remains largely enigmatic. It was only in the late 1960's that the abyssal plains were recognized to contain rich, complex habitats and play an important role in global carbon cycling. The technological and operational challenges that come with studying deep-sea environments have previously restricted research into the inhabiting species and ecosystem structure. The development of a novel photographic method for deep-diving Autonomous Underwater Vehicles (AUV), hails major advancements in deep-sea research, enabling scientists to map entire communities of benthic megafauna on remarkable scales.

By Kira Coley

The evolution of underwater vehicles and imaging technology has amplified efforts in seafloor mapping over the last decade. Only in recent years has more significance been placed on the location of species and the factors that influence ecosystem dynamics and biodiversity.

The intensification of industrial movements within the deep-sea setting creates the potential for loss in species abundance and many ecosystem services. Additionally, climate change can cause unexpectedly large changes to the deep-sea environment. As such, research into how these factors will impact deep-sea ecosystems has become a priority for many scientists. This can only be achieved however by understanding how these habitats work at present, which is critical for the ability to manage and conserve deep-sea environments in the future.

"If we wish to understand how the oceans work and what impact climate change may have on the function of the oceans, it is vital we understand the abundance, distribution and biodiversity of animals in the deep-sea," said Dr. Kirsty Morris, Seabed Image Analyst at the UK's National Oceanography Center (NOC) and the lead author of this research, published in 'Limnology and Oceanography: Methods.' "Only by knowing this, will we be able to begin to understand what impact climate change may have on the oceans productivity and carbon sequestration ability as a whole. It will also allow us to assess the impact of human activities such as deep-sea mining, oil and gas exploration, and the increasing presence of litter."

Deepsea Survey Methods

Conventional methods for the study of deep-sea megafauna include trawl sampling and photographic and video surveys. Deep-sea trawling has often been used to assess diversity and density of species, but this method poses some technical issues and can only be used over a relatively small area. Scientific trawling can also be time consuming and does not provide spatial information on how the individuals were distributed. Furthermore, some species can be destroyed altogether in the process and often considerably under represented.

Towed cameras have much the same issues. While off-bottom towed cameras are able to provide within-transect spatial data, the tethered systems can be effected by swell causing difficulties in controlling the position, altitude, and speed of the camera. On-bottom towed camera sleds do have better stability but can damage the seabed and consequently the induced turbidity can cause issues with the image quality.

Remote Operated Vehicles (ROVs) are seeing an increasing use in deep-sea underwater exploration, and can now reach depths of up to 6,000 meters. ROVs are valuable in deep-sea studies as they are able to retrieve samples and provide researchers with high resolution imagery. The limitations however are that they once again cannot be used for large survey areas and require a lot of dedicated ship time, limiting the other science that can occur in conjunction.

AUVs can act as stable imaging platforms and cover large survey areas with little environmental impact in the form of noise pollution and disturbance. Additionally, AUVs do not

Example tile including the famous 'dumbo octopus' (Grimpoteuthis sp) and the sea cucumber Psychropotes longicauda.

(Credit: AESA project NERC)

Science team of the cruise which collected this data.

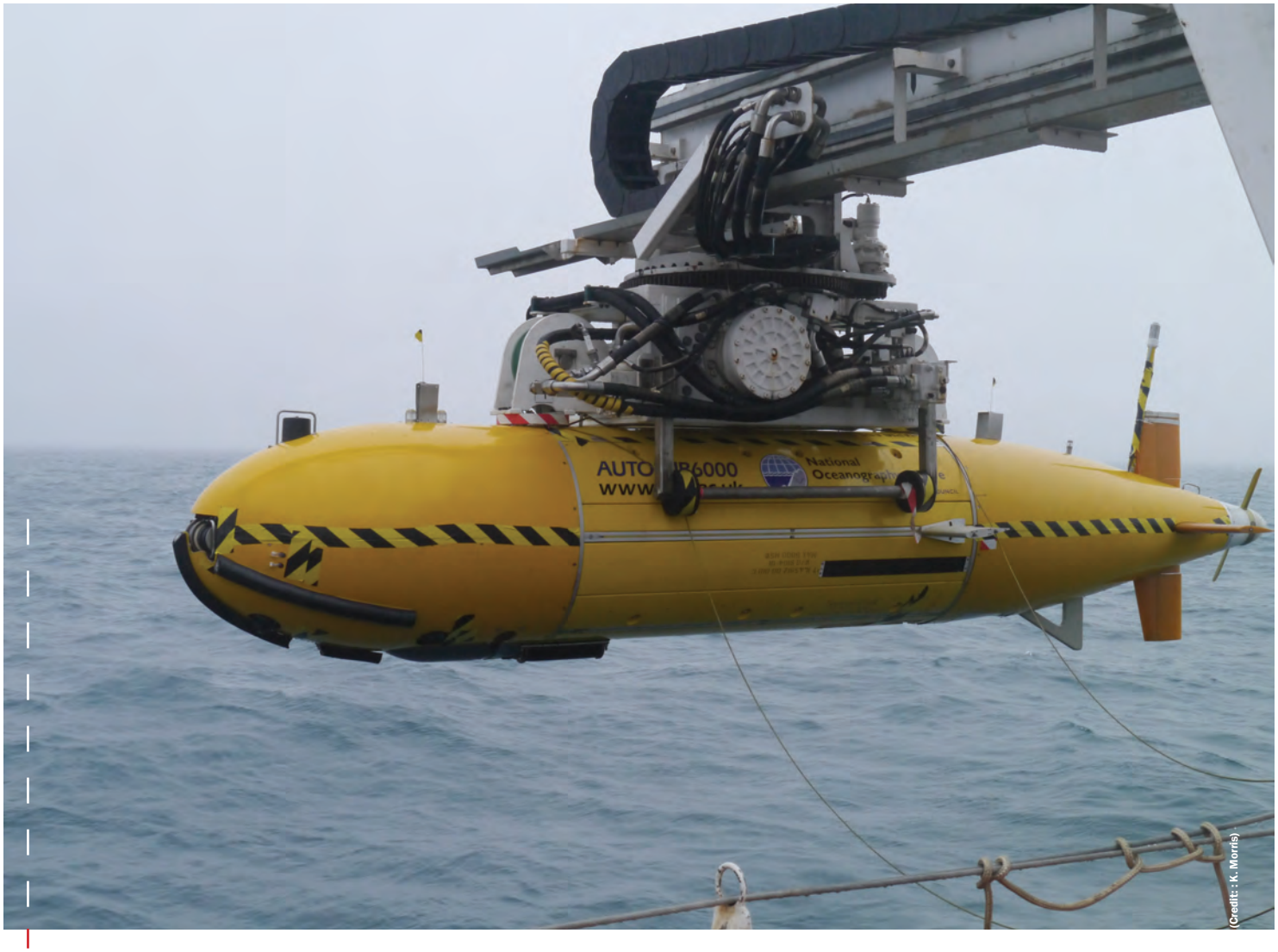
require continuous lighting and can also collect large volumes of data efficiently without consuming ship resources. The species that are regularly under represented by other sampling methods can be observed and identified. At the same time, local environmental data such as habitat and resource availability can be recorded along with spatial and quantitative data. As such, it is recognized that AUVs have the potential to unlock previously inaccessible areas and rapidly increase our knowledge of species distribution across survey areas reaching up to landscape scales.

New Method for Deepsea Mapping

A new photographic processing technique developed by scientists at the National Oceanography Centre (UK), used a camera on the Autosub6000 AUV to enable them to take a continuous stream of high resolution photographs of life on the sea floor. This method was developed and tested as part of the NERC funded AESA (Autonomous Ecological Surveying of the Abyss) project and revealed a tenfold increase in the precision of deep-sea ecosystem diversity estimates, relative to the use of scientific trawling.

"We have developed a method where we are able to take a continuous image of the seafloor over scales not previously achieved. This was done by using an AUV to take images every 0.87 seconds with an overlap between each of the images," said Dr. Morris. "This data can then be used to create maps of the seabed, detailing how many animals are present, where they are present in relation to one another and in relation to any features on the sea-bed, such as hills."

Dr. Kirsty Morris was part of the team of scientists who developed an automated program where each of the images were corrected for non-uniform illumination (where one side of the image is darker than the other). A color correction also had to be applied where the red, blue and green light was 'lost' through the water column from the AUV to the seafloor. Each image was then geo-referenced using the heading, pitch and



The NOC Autosub6000 being recovered onto the deck after a successful mission.

roll, recorded from the vehicle and re-scaled so that each pixel within each image represented the same area.

Using the positions of the images, it was then possible to work out the overlap and place them together in 10 image segments called tiles. Once these tiles were annotated for the presence and size of animals, the positions, length and identification of individual animals were recorded, creating a map of biodiversity on the seafloor.

"This technology is important because it allows us to create an image of the deep-sea over large areas, almost like a google street view. This is done in a cost effective manner using the AUV, meaning that the ship can be collecting other samples at the same time," Dr. Morris said. "From these images, we get an insight into the deep-sea environment on scales not previously possible, which will enhance our understanding of that environment and our impact on it."

The Future of AUV Photography

As climate change and growing human activity intensifies the pressure on seafloor resources, it is increasingly important to better document deep sea marine biodiversity and ecosystems. Technological advances such as deep-sea ROV and AUV systems have allowed us to begin accessing areas which were previously not possible. As these systems advance, there is an increased ability to cover even larger areas and develop more advanced mapping tools.

"It is hoped that there will be an increase in automation both in the image processing and in the image annotation. Automated annotation is something that would allow us to process the images and obtain results quicker; this is currently being worked on by some colleagues in Germany," said Dr. Morris.

While this technique was developed to map the distribution and biodiversity of remote deep-sea communities, there are many

applications which would benefit from AUV photography, with the potential to increase along with improved automation.

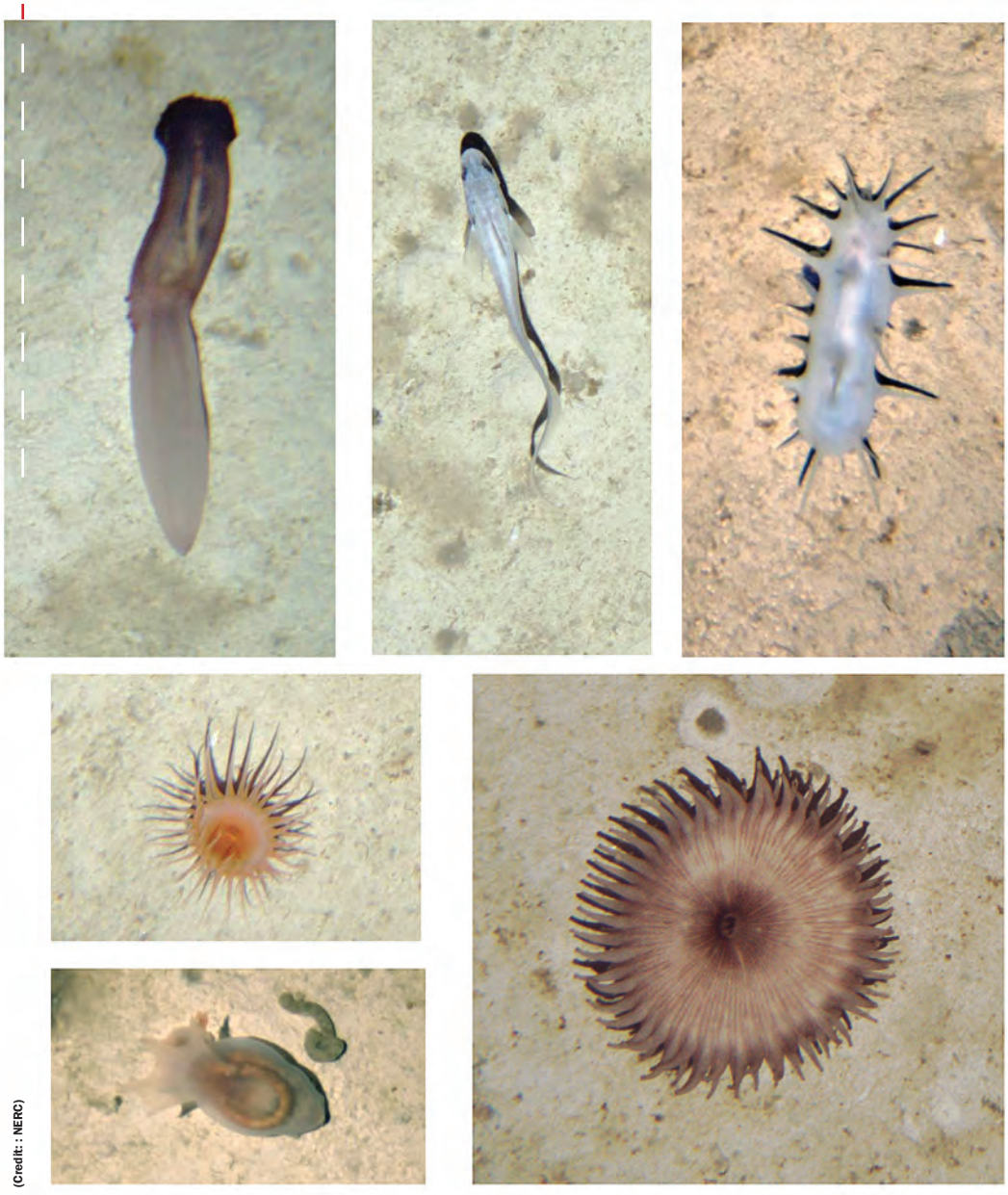
"I am currently working on a system to automatically detect and measure phytodetritus (organic particulate matter resulting from phytoplankton and other organic material in surface waters falling to the seabed) aggregation on the seabed using these images," said Dr. Morris, "This will allow us to discern any link between the distribution of these aggregates with the topography of the seafloor and the animals that are in that area."

The distribution, abundance and biodiversity of communities within any habitat is particularly important when establishing marine conservation areas. The method developed by NOC is currently being used to assess changes within community structure over a three year period within a marine conservation zone, Haig-Fras, in the Celtic sea.

A project called Shelfseas Biogeochemistry (SSB), will also utilize this technique to map out four different transect areas with various seafloor substrate (mud versus sand), assessing species composition in each area and if this changes following the plankton bloom in the spring.

In the future, advancements in automated technology and image processing will allow larger areas of the deep-sea to be mapped, increasing our understanding of the distribution of species, their abundance and biodiversity. This will allow researchers to better predict the impacts of climate change and ocean acidification and the consequent implications this would have for carbon sequestration, impacting the ocean ecosystem as a whole. Accurate environmental assessments of the impacts of human activities, such as deep-sea mining and oil exploration, will also become increasingly vital over the coming years. Not only can this technology accurately assess impacts in the direct vicinity of the activity, it will also be able to assess impacts over areas far larger, which is not economically viable with conventional deep-sea survey methods.

All animals observed throughout the AESA project. Top left: is a sea cucumber Psychropotes longicauda. Top middle: Macrouridae sp. Top right: sea cucumber Oneirophanta sp. Middle left: sea anemone Actinauge sp. Bottom left: sea cucumber Amperima sp this is one of the most abundant animals observed in t this study. Bottom right: sea anemone Sicyonis sp.



(Credit: : NERC)

Last month Marine Technology Reporter had the opportunity to meet with Dr. Holly A. Bamford, acting Assistant Secretary for Conservation and Management for the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), in her office to discuss a wide range of topics covering all that is subsea, with a focus on government and industry working in stride to mutual benefit.

By Greg Trauthwein, Editor

Insights from NOAA's Acting Assistant Secretary for Conservation and Management

Dr. Holly A. Bamford

To start, can you share with the readers of MTR how you became involved in your chosen field?

It's funny because I come from a small town in Pennsylvania and as a kid we'd go to the shore. Growing up, my father had a family business, so when I went off to college I went into business. But when you get to college, you are exposed to a lot of things, and I came to find the oceans, estuaries, and streams really fascinating. It's a very dynamic environment. I still got my business degree and then I went off and got a PhD in environmental chemistry. My background is unique because most people came up either through the sciences or policy. I find that the business has been tremendously helpful. If you can't communicate your science, manage a budget, or lead people, it's a really difficult way to go about doing any type of research. And I found that I didn't have to divorce the two because I think the ocean is a business. It's our business as a community. And it's the blue technology. So I really find that those two combined – Oceans is *my* business.

So you have a degree in business, a PhD in environmental chemistry, and now you're in government.

(laughs) And now I'm in the government.

What drew you to government, or more specifically, NOAA?

After coming out of academia, you are really groomed to stay in the academic institutions. I'm published, I was a basic researcher, and I wanted to go into the federal sector – particularly NOAA – to really learn about the mission-driven science, and how to make my science applicable to operations. And my goal was to stay for two years and then go back to academia; but I never left. I felt there was a need in the federal sector to have PhD scientists who understood and communicated the business aspect of science.

From the job that you do here, how is it the same and how is it different from when you started?

When I first got here, it was a hard transition from academia because the way the government talked about science was different than the way I was trained.. But once I figured that out, I really like it because the thing about NOAA science is that it is mission-driven. You get satisfaction in seeing the work we do helping people. So in academia, it was great because it's exploratory, but I didn't always see the end link to how it was being used by communities. Here we do every day; that's the best part of the job.

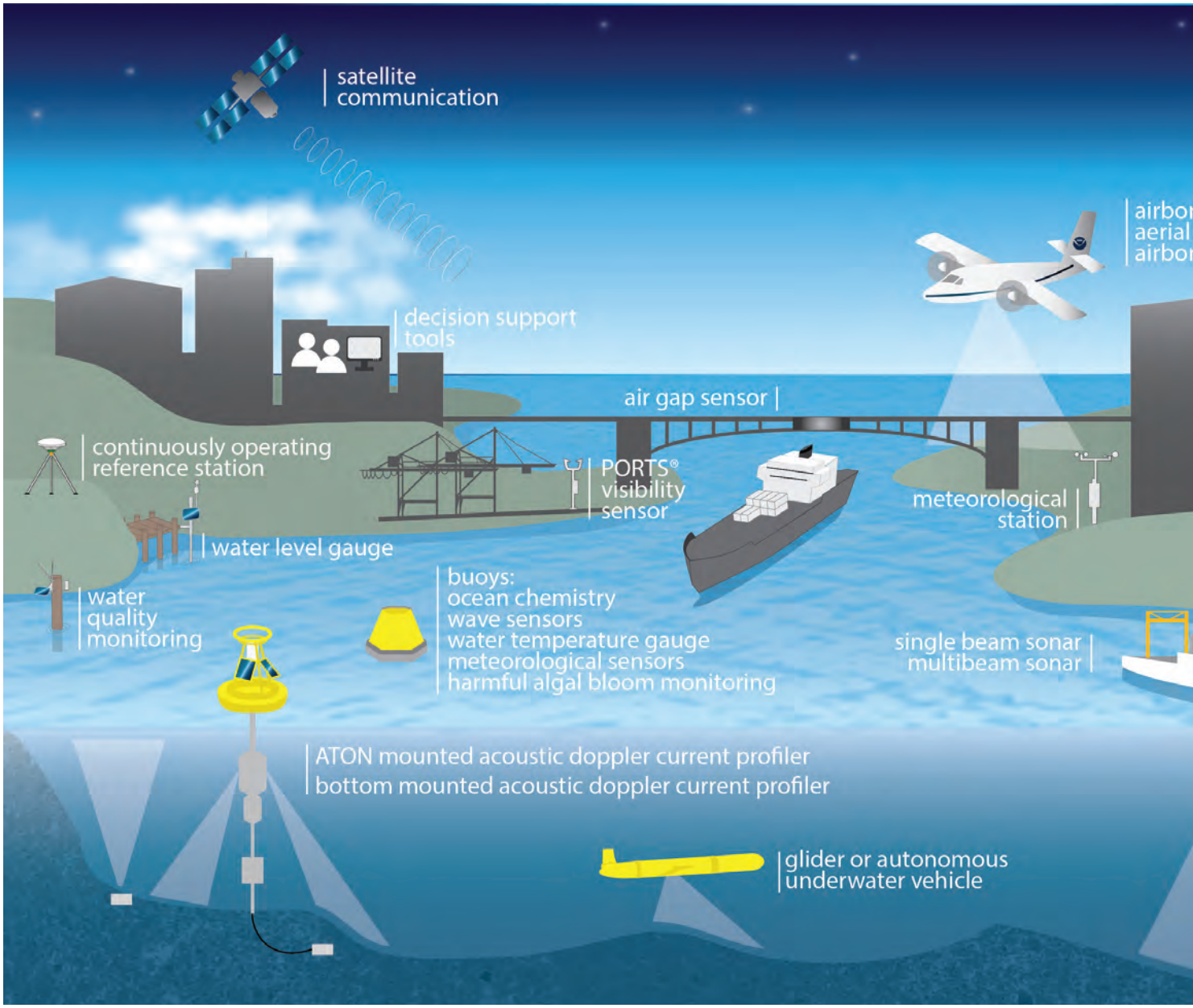
From the time you've been at NOAA, of which accomplishment are you most proud and why?

There are two things. One is our response to (hurricane) Sandy. NOAA is very well-known for our weather forecasts, and supporting communities in preparation for an extreme event. I felt that through the work we did preparing before the storm, we were well positioned, ready to respond and then support recovery. So, I think orchestrating that – getting airplanes in the air, boats in the water – to do the hydrographic surveys, helping the Coast Guard to determine the re-opening up the port of New York/New Jersey. We surveyed 80% of the Port of New York/New Jersey as we positioned our vessels behind the storm, trailering them up from Florida, so they were 'good to go' when the skies cleared. We were well-prepared and positioned to support the coastal communities on the recovery.

Very good. So that was number one. What was the second accomplishment?

The second was prioritizing and coordinating the ocean and coastal portfolio of NOAA; most of that's within the NOAA National Ocean Service. We had a diverse set of programs each with their own elevator speech, and when I came in as the head of that organization, I tried to bring them all to-

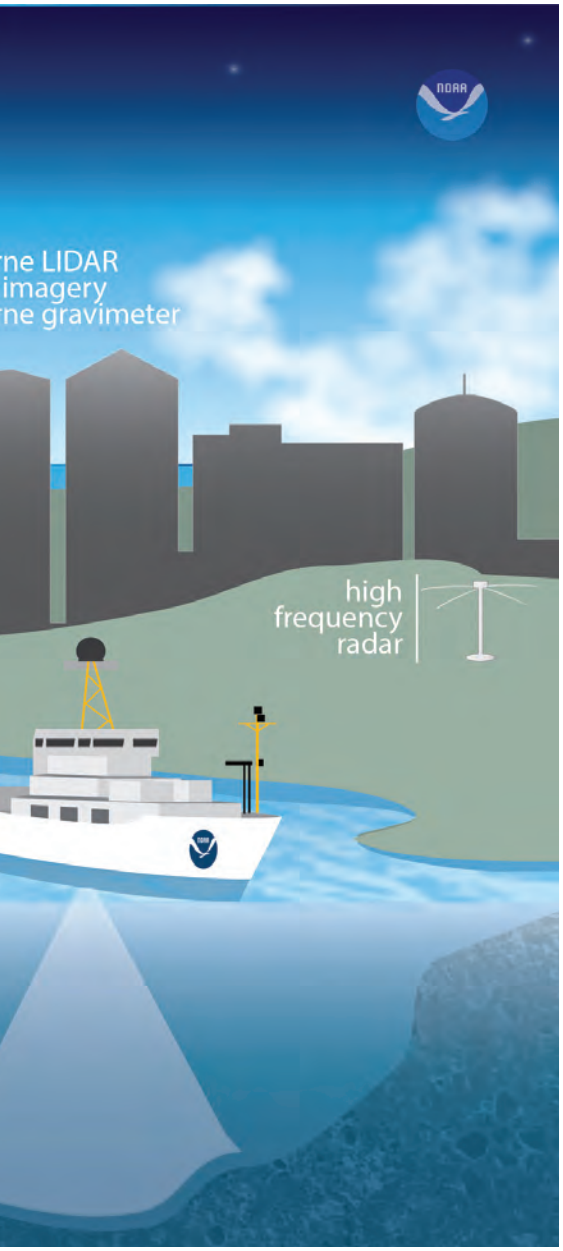
Coastal Intelligence is a multi-faceted, multi-tech endeavor



gether around some centralized themes. Coming out of that we as a team developed integrated priorities that truly enhanced our coastal and ocean services. We merged budget lines and shared resources which fostered coordination and partnerships across the organization. We also created one of the biggest coastal programs in the agency by merging programs together and getting people to work together. And what this does is it helps people on the ground; there's less confusion. Now you're dealing with a more integrated, holistic approach to coastal services, from observations and data to products and information central to coastal community decision-making. So I am very proud of helping to make us more streamlined in how we provide services on the ground, from an oceans and coastal perspective.

Can you discuss the top three or four NOAA initiatives today, and the actions are being taken to implement these initiatives.

NOAA has four priorities. The first is helping communities be more



Science lets us know more about the oceans. In the past I think we looked at this as an infinite resource, but science has told us it is not. The oceans are finite. A year after the Japanese tsunami we were seeing marine debris wash up on U.S. and Canadian shorelines; it's not that big of a world.

Dr. Holly Bamford

resilient. As you saw with (hurricanes) Katrina and Sandy, as well as the historic snowstorms, the recent droughts, mudslides and flooding, communities are becoming subject to more of these extreme events, but also chronic issues like sea-level rise. We are focusing our efforts to support communities with information, as my boss, Dr. Kathryn Sullivan, likes to call "environmental intelligence." And that's basically gathering the most accurate, best available information, and putting it in the hands of decision-makers so they can make informed decisions.

What is a physical manifestation of "more information" in action?

Let me give you an example. Ships come in and out of the Port of New York/New Jersey; thousands of them on an annual basis carrying tens of million metric tons of cargo. Businesses need to get their product from point A to point B, safely and on time. A product which is going to come off the boat, onto a rail, onto a truck, into WalMart in Iowa. All of this is very dependent on the intermodal transportation. There's decisions being made every day on how to get a ship into port, safely and at the right time, taking into consideration wind, wave, water level and currents conditions. NOAA has a system that provides – every six minutes – real time oceanographic and atmospheric information to a pilot navigating into port. We are providing critical, accurate information so they can make decisions on how to safely navigate into port.

So we have resilient communities.

Next is evolving the weather service. People want information 'now,' and we are in a technology-driven world. It is amazing how far we have come; but we still have far to go. Over the next several years, NOAA National Weather Service will evolve its operations to build a nation where communities and our economy become ready, responsive and resilient to the increasing vulnerability to extreme weather, water, and climate events. We are still working to provide the best information, so evolving the weather service includes staying up with best technology, best models, best information, data and forecasts, and then giving that to the public.

So when you look at technologies driving the ability to deliver that, what do you count as the key technologies?

It is critical that the data and observations that we collect, and the models that we develop, are state-of-the-art. But also the way in which it is disseminated is critical. We work very closely with the newscasters and forecasters to ensure that that information is getting out in the appropriate way. The way scientists speak is not the way the public speaks, so we need to make sure it's being translated in a way that people understand to take the appropriate actions.

So now we have resilient communities, evolving the weather service, and …

The next one is improving our observations, which is more than just satellites. We talk about modernizing all of our operations. This includes partnerships and collaborations with other agencies, with other industries, with other academic and research institutions. So we want to increase our observational capacity – it includes satellites, it includes ships, it includes buoys, gliders, land and ocean observation systems. That's a big part of how we derive our models and our data that we provide the public, so that's a very important foundation for us. The fourth priority is organizational excellence. All this depends on our people and people are the most important asset that we have at NOAA.

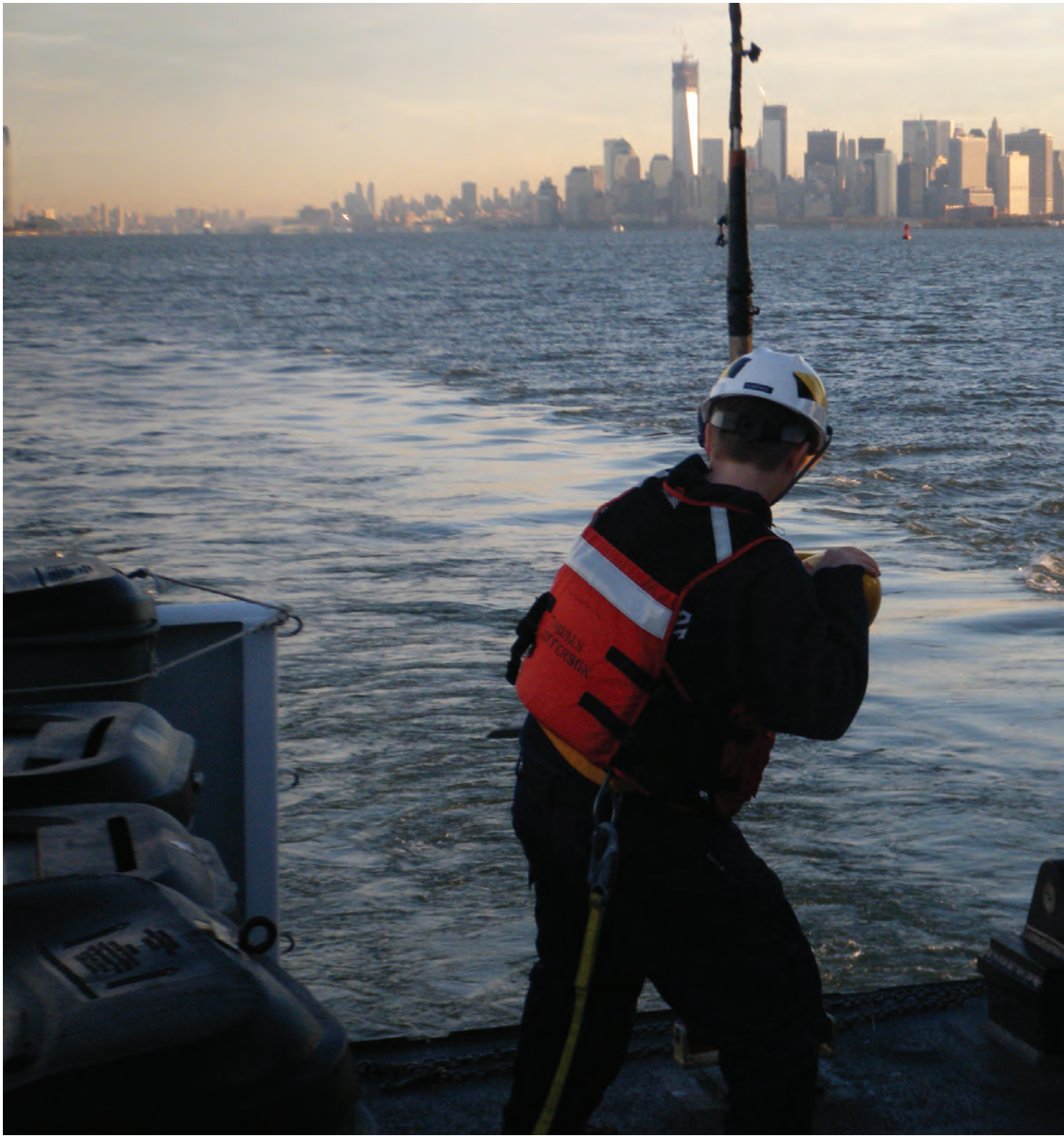
Let's talk about your observation capabilities and ships, ships which are big, expensive, and expensive to deploy. How do you see your observational techniques evolving in the coming 10 to 20 years?

In the past, when science wasn't as integrated as it is today, we had specific ships for specific activities. Now we're moving to a multi-use platform that can integrate tasks; at the same time you're gathering fish data, you're using side scan sonar to gather bathemetry and hydrographic data. So integration of data collection is going to be key to maximize the resources we do have. I think you're going to see more technology in gliders, unmanned aerial systems, unmanned underwater systems. We're going to see crowd-sourcing. We're going to see ships of opportunity, ships where we can place instruments for data collection. While the importance of unmanned systems will increase, ultimately I still think it's critical to have people at sea; we can't just go to satellites, we can't just go to unmanned observations.

So it sounds like NOAA is actively engaged in building partnerships among industry and academia. How do you see this relationship evolving for the greater good of all?

So let's look at our weather enterprise. The weather enterprise itself encompasses private sector research institutions, academic institutions, government, NGO, so you have a breadth of participation. And within that billion dollar enterprise, you have the providers who provide the infrastructure – sensors, observations, data collection. And then you have the intermediaries who take that information and produce products. If you look at the weather enterprise, early on the providers were busy, because everybody was trying to develop the right sensors and the right technology and the appropriate resolution. Over time, the intermediaries responded to the drive by communities to know more about the weather so that they could make decisions, business decisions, opening and closing schools, and emergency responders. You've got the Weather Channel, you've got the news, the weather is part of

NOAA was instrumental in preparing for and helping after Superstorm Sandy in 2012



our daily lives. If you are in an elevator, you may turn to someone and ask "how's the weather?" My dream is that you're in the elevator you turn to somebody and you say, "How about those oceans!"

And so the study – The Ocean Enterprise: A study of US business activity in ocean measurement, observation and forecasting – is trying to quantify the ocean enterprise; we are working with companies to ask, "You are a part of the ocean enterprise … where are you on this spectrum?" We are trying to figure out where those companies fall, as a provider or an intermediary, and to understand the scale and scope of business activity in ocean measurement, observation and forecasting. We are in the early phases right now, and we are actively getting companies to sign on.

How is the study going?

We have over 600 private sector firms already signed on, 83% self-identified as "providers." I was just with the energy sector two days ago, and they want to know where to place their assets, they want to know about the security of their grids, and they want to know about the intermodal transportation moving energy from offshore to onshore and to market. The information that they want is not from the primary providers, but from the developers of information, the intermediaries that deliver a usable product.

You're getting all these companies together, everybody's putting in information and input, and a study is going to come out. So what is the overarching value of that study?

In some sense it is very basic to understand and quantify the ocean enterprise. What companies are actually playing in this arena? Who is focused on ocean activities from sensor development to application development? It is about bringing awareness, it is about understanding the value of the oceans overall.

In one neat sentence, how would you summarize NOAA's stance regarding engaging business, the private commercial community, in activities to mutual benefit?

I would say "decision support."

A good example would be ecological forecasting. We are gathering a lot of information on ecological forecasting and disseminating that to the broadest set of users. We're not developing applications, but we are going to be gathering the relevant, timely and reliable information and putting it out there. Right now, we give it to emergency responders, we give it to decision makers, and coastal communities. If you were going to Miami this weekend, for example, wouldn't you want to know if there was a harmful algae bloom?

We are continuing to advance our observations and modeling capacity to get the best understanding of specific events. And it is even better having the private sector come in, grab that open access data and disseminate it. It would be great if you were going to Miami to not only check the weather but the water quality conditions and if any beaches were closed due to harmful algal blooms.

The state of the industry: in overview, when you look out, what do you see?

Science lets us know more about the oceans. In the past I think we looked at this as an infinite resource, but science has told us it is not. The oceans are finite. A year after the Japanese tsunami we were seeing marine debris wash up on U.S. and Canadian shorelines; it's not that big of a world. When you look at the transportation industry, the ships are humongous. Look at the size of the Maersk Triple E class (containerships that measure four football fields long). The larger ships are coming to our shores, and I think as an industry we have to look at our physical and informational infrastructure and ask 'are we ready?' Do we have the physical infrastructure to handle larger vessels and do we have the ocean and coastal technology and observations to support coastal communities.

How would you assess our current knowledge of the oceans, and what are the means to exponentially increase that knowledge?

Yes, we know more than we did 10 or 15 years ago, but there's still a lot more we need to know. I think the key thing to remember is that the oceans are a very dynamic environment, constantly changing and evolving. You don't go out and measure the pH in a spot and then say 'ah! We're done! We know it!' We work in a dynamic environment that's changing all the time, so we need to adapt our observations and technology to the environment. We study a lot on the surface of the water, but I think there's a big gap sub-surface. We saw that gap when we were looking at Deepwater Horizon (accident) and watching the way oil responds at all depths. Look also at the intensity of hurricanes. We're putting out gliders in sub- to mid- water levels to see how that actually impacts trajectory and intensity of storms. Ocean acidification is another perfect example. We are working with the shellfish industry and hatcheries, and they want early warning systems to know when the pH can change dramatically, because then they need to buffer their waters or else their business is going to be in danger.

So let's turn our attention to your budget. I'm assuming that they're not running to you with barrels of cash every year. What is the key to making progress in a tough budgetary environment?

The budget varies. We have a large mission and a lot of requirements. And when bad things happen, like (hurricanes) Sandy and Katrina, the supplemental budgets help out to improve future forecasting. But I think the hardest part is always involving the science piece. When you're fighting for your budgets, it's easy to fight for the very linear; if you look at defense, I need X number of warships to protect X-area of coastline, for example; it's understandable. When we look at ocean science … and we are tracking ocean acidification, or

we're tracking water quality, or we're tracking sea level rise and inundation; and you're not sure what the end result is going to be but you know it's going to be significant in terms of protecting communities and making better decisions … it's hard to sell that and to get the resources to do it. We are always tightening our belts, and we're always trying to continue to evolve, and the resources. With that said, in my world, in the ocean service, we've seen, if you look at our budget's tracking, we were down more than a hundred million dollars between 2008 and 2013. So I'm used to tightening my belt. How have we managed? We changed our philosophy, and we need to work together, we need to be integrated. And that is not just within ourselves, but it's with the private sector, the public sector, the NGOs.

Technology. Which ones do you personally find to be the most exciting, with the most potential to make your job and the job of your colleagues better.

One of the things I think we're going to see in new technology in the ocean industry is lower cost and higher efficiency. To give you an example, we've been measuring water levels for years using sensors in the water, measuring pressure change and looking at the changes of water level. Now we are going to microwave, moving towards an instrument that's cheaper, that's out of the water so it doesn't require divers or the removal of bio-fouling. We also need systems and platforms that have capacity for multi-use. It can be the way we develop our buoy structure, to handle more instrumentations. We talked about diverse platforms. I think, in the future, it can't just be all ships. It can't just be all buoys. It can't just be all automation or people; it has to be an integrated approach. And then, I think, we talked about crowd sourcing. For years we've been gathering data from the public and shippers on various items, from whale observations, to water temperature, to dangers and obstructions in the channel.

And then in terms of information, I think improving our data access is critical from a federal perspective. We need to have open access-open data that allows industry to grab it, so it could be easily accessible and in a format that is downloadable for a multitude of uses.

Every business, every position, has its challenges. What do you consider to be your greatest challenge?

I think it is focusing. There are so many great things happening and we have a fantastic mission – we explore from the bottom of the ocean to the surface of the sun. Sometimes the challenge is simply picking the ones to spend our time on. And my drive today is resilient communities. Look at what the future holds – intense storms, sea level rise, increased populations coming to the coasts, a great ocean economy that has not even been fully tapped, great potential. My challenge every day is answering the question: 'How do we make communities more resilient and adaptable to the coming changing conditions?'

Bio: Dr. Holly A. Bamford

Dr. Holly A. Bamford is the acting Assistant Secretary for Conservation and Management for the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). Dr. Bamford works closely with Congress, agency leaders, partner organizations, and local communities to develop policies and take conservation and community resiliency actions to ensure coastal and ocean stewardship and services.

Previously, as Assistant Administrator for NOAA's National Ocean Service (NOS), Dr. Bamford directed the federal agency that provides coastal and ocean science-based solutions to address evolving economic, environmental, and social pressures on our oceans and coasts. Prior to this appointment, she served as Deputy Assistant Administrator for NOS, where she managed the financial and business operations while strategically improving the agency's performance to meet its vast ocean science and service missions. After Hurricane Sandy, Dr. Bamford was named the Incident Commander for NOAA responsible for all post response actions such as overseeing the agencies response to oil spill, chemical spills, marine debris impacts, hydrographic surveys to open critical navigation ways and ports, and high-resolution aerial imagery to map shoreline changes. Dr. Bamford earned a Ph.D. in the field of organic environmental chemistry, quantifying the physical and chemical processes that control the transport and fate of organic contaminants. She also spent a year as a guest researcher at the National Institute of Standards and Technology developing analytical methods to detect trace organic contaminants in water and air particles. Dr. Bamford over 20 publications that have been widely referenced in the field of environmental chemistry and water quality, including papers in Environmental Science & Technology, Atmospheric Environment, Marine Pollution Bulletin, and Environmental Toxicology & Chemistry.

Dr. Bamford presented at a number of national and international meetings, academic institutions, as well as addressed the public through national media outlets including NBCNews with Lester Holt, CNN, ABC, NewsHour with Jim Lehrer, Good Morning America, Rolling Stone, People, and the Wall Street Journal.

Louis Whitcomb makes it possible for remote controlled underwater robotic vehicles to explore the most extreme environments on earth—including the icy depths of the arctic. "of all the environments on earth," he says, "this comes closest to science fiction."

By Andrew Myers

Out in the middle of of the Arctic Ocean, a German icebreaker, Polarstern, punches its way slowly through arctic sea ice to a spot just a few hundred miles shy of the North Pole.

Polarstern is no mere icebreaker, however: It is a floating scientific laboratory. Aboard was a team of international scientists and engineers intent on exploring one of the last remaining scientific frontiers on Earth, the world beneath moving arctic ice.

"The phytoplankton communities that thrive under arctic ice during the arctic summer are the primary means of biological production," says Louis Whitcomb, chair of Mechanical Engineering at the Whiting School, and among the lucky few on the Polarstern. "Biological oceanographers are beginning to understand and unravel the mysteries of these communities and the food chain that depends on them."

While it was this scientific vacuum that brought Whitcomb to the top of the world, he was not on Polarstern as a microbiologist or geologist but as an engineer. Whitcomb is one of the world's leading experts in remotely controlled underwater robotic vehicles.

The Hardest Lesson

Before she went down, Nereus logged some 76 missions over seven years, providing an unprecedented trove of scientific data from the deep.

A 20-Year Quest

Whitcomb went to the Arctic last summer as the co-principal investigator, together with collaborators at the Woods Hole Oceanographic Institution, in the development of an entirely new underwater vehicle, called Nereid Under Ice.

Nereid will allow researchers to observe the little understood and important ecosystems below the moving polar sea ice, under massive glacial ice

LEFT
NUI being launched from the F/V Polarstern on NUI Dive #1 on July 21 – the first engineering dive in which the vehicle's navigation, telemetry, and control systems were tested.

RIGHT
View from the forward camera of a small "rescue robot" as the NUI team practiced emergency vehicle recovery procedures on July 11, 2014. Happily, no such emergencies occurred.

shelves such as the Ross Ice Shelf in the Antarctic and, at greater depths, in the immediate vicinity of the mid-ocean ridges such as the Gakkel Ridge of the arctic seafloor—where the Earth's fiery interior meets near-freezing seawater.

Whitcomb has invested more than 20 years of his life imagining and guiding the development of technologies necessary to operate in some of the most extreme environments on Earth. He made a name for himself as co-principal investigator on the development of several novel underwater vehicles such as Nereus, the remotely controlled underwater vehicle that, in 2009, went to the bottom of the Challenger Deep in the Mariana Trench, the deepest point on Earth.

The month-long expedition aboard Polarstern targeted an altogether different, but no less forbidding, environment in the upper water column under multiyear moving arctic sea ice.

This is a magical and unfamiliar world. Each summer, bolstered by round-the-clock daylight, the waters below the Arctic's azure floes grow cloudy with blooms of phytoplankton that soak up the sunlight that penetrates the ice. These uncountable single-cell plants are the base of a food web in the Arctic Ocean that weaves itself outward and upward from microscopic animals to the fish and the birds, through the pinnipeds and polar bears, all the way to whales that are among the biggest creatures ever to traverse the planet.

"The underside of the ice was dotted with dark algal blooms and the sea becomes thick with life. The water is almost gelatinous, there is so much life," says Topher McFarland, a postdoc in Whitcomb's lab and a specialist in underwater navigation systems who also traveled aboard Polarstern.

"Combined with the surreal blueness of the light filtering through the ice and snow, it creates this sense of unreality. It's like being on a different planet."

As fascinating and fundamental as this photosynthetic ecosystem is, however, it may ultimately pale in comparison with what transpires at the sea bottom on a jagged scar known as the Gakkel Ridge. Undersea volcanically active mountain ranges like this are where new seafloor is minted by the minute as the Earth's molten interior surges upward, creating new ocean floor at the ever-so-leisurely pace of a few centimeters per year.

The heat from inside the Earth creates thermal vents where warm, chemical-rich water and gases spew out. This environment is perhaps more forbidding even than the icy waters above. Seawater at the vents can reach a searing 662 degrees Fahrenheit, even in the Arctic, and it is packed with sulfides, methane, and other inner Earth chemicals.

"Of all the environments on Earth,

Whitcomb and his post-doctoral student Christopher McFarland's technical efforts on this expedition focused on the development of NUI's novel navigation, control, and acoustic telemetry systems, which were first prototyped on the Homewood Campus with Whitcomb's underwater testbed vehicle, the JHU ROV, in his Hydrodynamics Laboratory in Krieger Hall.

this comes closest to science fiction," says Whitcomb. The world first became privy to this region in 2003, when geologist Henrietta Edmonds and collaborators published a foundational paper describing the evidence for the existence of hydrothermal vents spanning the entire Arctic Ocean along the length of the Gakkel Ridge. More than a decade later, the Gakkel Ridge has been visited by only a few expeditions and remains an elusive target to study. Nereid holds the promise of enabling scientists to have a closer look.

While Whitcomb and the Nereid team were aboard Polarstern mostly to test their brand-new vehicle, someday Nereid will virtually transport scientists to other places below the ice—beneath the glacial ice shelves and under ice tongues of Greenland, Antarctica, Alaska, and elsewhere. These expansive features, which occur when glaciers meet seawater, are at the front line of climate change. Rapidly melting glaciers, it is believed, are contributing to sea level rise.

An ice-shelf is formed where a glacier slides into the sea and melts from the sea bottom upward, causing a narrow wedge of water to form between seafloor and ice that can stretch hundreds of kilometers. Until now, the under-ice vehicles that could venture into these areas have been limited in mobility and functionality, Whitcomb says. Their capabilities are excellent for hydrographic mapping and water-column surveys, but they are unable to perform near-ice and near-seafloor optical imaging and intervention. Nereid, with its remarkable suite of scientific capabilities, will eventually change all that.

"You can't safely put a human-occupied submarine under an ice shelf. It's too dangerous. There's no escape route. But it's perfect for underwater robot vehicles. Nereid can go there,

complement existing technologies, and extend the scientific possibilities," Whitcomb says.

Engineering Marvel

Years of research and engineering—and more than $4 million—have gone into creating Nereid. It is one of the most sophisticated under-ice vehicles developed to date.

The month-long expedition aboard Polarstern was Nereid's maiden voyage and so its research objectives, on this trip at least, were limited. Nereid's first two dives under the ice (about five hours each) were principally engineering trials, where the team operated the vehicle for the first time under moving sea ice. Nereid's third and fourth dives were devoted to scientific surveys in which Nereid conducted optical surveys to study sea ice physics, and conducted plankton surveys for biological oceanography.

Nereid is known as a "hybrid," meaning that it is fully capable of operating on its own—autonomously—or it can be operated remotely from the surface via a thin, lightweight fiber-optic cable.

Nereid will be able to venture to depths of 2,000 meters. "More importantly, it will be able to roam up to 20 kilometers from the mother ship," Whitcomb says.

He not only oversaw the development of Nereid as a whole, but he also was personally invested in engineering systems that control the vehicle, its navigation, and the microfiber tether design, among others. Developed and built in collaboration with the Woods Hole Oceanographic Institution in Massachusetts and the University of New Hampshire, Nereid has been funded by the National Science Foundation, the James Family Foundation, and the George Frederick Jewett Foundation East. The team's participation in the 2014 Polarstern expedition was made possible by the support of the National Oceanic and Atmospheric Administration, chief scientist Antje Boetius, and the captain and crew of Polarstern PS86.

Among the many current or planned capabilities for Nereid will be high-

definition cameras and powerful lighting to illuminate the ice surface where the all-important algae cling. These are the very base of the food web. Nereid will eventually boast a robotic

arm capable of plucking samples directly from the sea bottom, or taking samples from the ice. It will even be able to chemically test those samples while at depth using instruments mounted aboard the vehicle.

Nereid also has many instruments designed to measure the environment around the vehicle, including Doppler-based sensors that are able to evaluate currents in the water. Other sensors will monitor temperatures, as well as oxygen and chlorophyll levels in the water column. Likewise, there are instruments able to measure the amount of light that makes it through the ice fueling the hungry blooms of algae with energy.

Of all the cutting-edge engineering that went into Nereid, however, perhaps the most notable is the tethering system that uses a fiber optic cable just a few times thicker than a human hair.

The tether carries high-definition video and navigational data back and forth to the mother ship at the speed of light. This cable provides a gigabit Ethernet data stream to the surface, as well as a high-definition video feed that will allow scientists to observe the under-ice world as never before and as close to firsthand as is presently possible.

Nereid's lightweight expendable tether enables it to have horizontal and vertical mobility that is not possible with conventional steel armored tethers, mostly used until now. These far heavier steel cables severely limit horizontal mobility and restrict a vehicle's depth range to about 7,000 meters. Beyond that length, McFarland says, the steel breaks under its own weight.

"The fiber optic system is based on the one we developed for Nereus, but the world below the ice presents some very different and difficult challenges. The ice is often jagged, pitted, and deeply contoured—all of which present the possibility of snagging," Whitcomb says.

Nereid's tether is expendable. It is so thin and lightweight that 12 miles of it can be wound into a single canister the size of a lunchbox, greatly improving both Nereid's economics and its range. The fiber costs about a dollar per meter, McFarland says. While such a figure is not exactly inconsequential—a single spool holds about 60,000 feet of fiber—neither is it prohibitive, should Nereid need to cut and run.

"We published five or six papers on the spooling system alone. The tether pays out from the spool, like a ball of twine," Whitcomb says. "It's a subtle design. The biggest challenge is to not double back on yourself, which is pretty easy to avoid."

The fiber itself is neutrally buoyant and simply hangs in the water, free to move wherever Nereid, or the water currents, takes it. The system employs two canisters, one suspended from the base ship above; the second trails behind Nereid connected by a hose—an umbilical, as the engineers call it.

Each canister acts like a fishing reel with fish on the line: Nereid moves, the tension increases and cable spools out. The spool is so sensitive that surface tension between the water and the cable is enough to tug the fiber out of its cocoon. Unlike fishing reels, however, once the fiber is spooled out, it cannot be reeled back in. The cable pays out over a wheel that keeps track of the distance meted out.

"It's pretty exciting from an engineering standpoint. You end up with a vehicle that is free to move great distances both vertically and horizontally," Whitcomb says.

This is important because the dangers are many under the ice. Jagged floes are always nearby and at the bottom rock outcroppings could present snagging hazards. Whitcomb notes, as well, that he cannot rule out the threat of "biological aggression"—an animal masticating on or running into this lightweight tether. In the face of these many risks, Nereid is elaborately programmed with fail-safe mechanisms.

"If the tether gets severed during a dive, Nereid will automatically descend to a pre-programmed depth below the ice and use acoustic communications to signal its position. Then the team sends acoustic commands to guide it back to its mother ship for recovery," he says.

Dead Reckoning

In an era of ubiquitous GPS positioning, it is hard to imagine that navigation is an issue for Nereid, but the thick shroud of ice and water render GPS signals useless below the surface. Nereid, therefore, must go old school and rely upon dead reckoning combined with other methods to fix its position. Of course, it does so with some sophisticated technology. Nereid is equipped with a north-seeking gyrocompass that helps track its heading. It also features upward- and downward-facing acoustic sensors that gauge speed. Whitcomb has been a key leader in creating the navigation systems for Nereid and, before that, Nereus. The acoustic sensors bounce sound waves off nearby surfaces (such as the sea floor or the underside of sea ice) and use the Doppler shift to calculate speed by listening closely to the returning signal. The returning sound waves get altered—higher in frequency—

as the vehicle approaches an object, and then farther apart—lower in frequency—as the vehicle moves away.

"It's like when an ambulance passes and your perception of the pitch of the siren changes as it goes by. This is the Doppler shift in action. If you know the frequency of the outgoing signal, you can use this shift in frequency of the returning signal to calculate the vehicle's speed," McFarland says.

If Nereid is within 200 meters of the seafloor, it is able to get an acoustic fix. Or, it can use the ice above as a guide, though the ice is less accurate because it is in constant in motion. In a

pinch, Nereid can even get an acoustic fix on particulate matter in the water itself.

"Once you know Nereid's heading, speed, and how long it's been traveling, you can estimate a pretty accurate position," McFarland says.

While the summer trip aboard Polarstern was more test run than full-scale scientific endeavor, Nereid came through with flying colors. "Nereid did very, very well," says Whitcomb.

"I've been working in this area a long time and I'm still thrilled when we launch a new vehicle," says the veteran engineer. "Remotely controlled robotic vehicles have proven tremendously successful in enabling scientific study in extreme environments on other planets, on Mars and the moon. Now we are using them to explore areas on Earth that were once out of reach scientifically. It's exciting to be a part of it."

Louis Whitcomb brings to Nereid hard-won experience with the highs and lows of creating groundbreaking underwater robotic vehicles. He played a similar lead engineering role in the decade-long development of Nereus (rhymes with "serious")—a research vehicle that, in 2009, reached the Challenger Deep, seven miles below the surface, the deepest point in all the oceans.

Sadly, Nereus was lost in May 2014 on a dive to the Kermadec Trench near New Zealand at approximately 6.5 miles depth.

Though no one knows for certain what happened, Nereus is believed to have imploded in the crushing deep-sea pressure that can reach an astounding 1,100 times that of the surface. Before she went down, however, Nereus logged some 76 missions over seven years, providing an unprecedented trove of scientific data from the deep.

"We knew when we designed Nereus that there were some risks. Nereus had to be lightweight and small enough to be launched from a conventional U.S. oceanographic research ship," Whitcomb recalls. "Within those parameters it's hard to design an invulnerable system."

While Nereid was begun long before Nereus went down, the loss still stings and the lessons are sure to influence engineering choices as Nereid evolves.

Nereid was not designed to dive beyond 2,000 meters, far shallower than Nereus, but, by the same token, Nereus did not have to contend with a thick icecap between it and the surface.

"Nereus was a great proof of concept, and Nereid bears the unmistakable imprint of the lesson learned," Whitcomb says.

"We hope to build another improved Nereus in the future."

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The World's Cold Ocean Lab

(Photos by Dave Howells for RDC)

"Our collective expertise and infrastructure related to harsh environments and the Arctic sets us apart as the premier location and jurisdiction for carrying out R&D that will define how to safely and efficiently develop Arctic opportunities."

Those were the words of Newfoundland and Labrador Premier, Hon. Paul Davis, at a recent address announcing a $4.9 million investment by Fugro GeoSurveys – a leading geoscience company with a corporate history of more than 50 years – in collaboration with the Research & Development Corporation of Newfoundland and Labrador (RDC) to operate a new Arctic-class vessel, with research and development capabilities, in the province's waters in 2017.

"Our investment in this initiative, and the resulting access to an ice-class vessel, with R&D capabilities, will further strengthen our position in this area," said Davis. "This is an investment in a key asset that will solidify our position as a real-time Arctic laboratory."

Newfoundland and Labrador is Canada's easternmost province, strategically positioned in the North Atlanic, at the edge of the Arctic. It sits along Iceberg Alley, along multiple key international shipping lanes, and its waters are the Northern hemispheres coldest south of the Arctic Circle. It is this unique mix of proximity and Arctic-like conditions that make the province a natural cold ocean laboratory. Centuries of answering the challenges of Arctic-type conditions have given rise to a powerful culture of innovation.

Home to growing sectors such as oil and gas, shipping, education and training, and research and development, as well as traditional sectors such as mining and commercial fisheries, a bevy of experts go to work every day in the province, seeking to increase their ever-growing aptitude for operating in harsh conditions. This includes remote sensing, ice management, ocean observation, simulation, telecommunications, and navigational systems, and the best minds in academia,

private enterprise, and industry operate in a highly collaborative fashion.

The evolution of Newfoundland and Labrador's vibrant ocean technology cluster has been long and distinguished. Historically, the province has been a launching point for Arctic exploration and today it is a hotbed for cold ocean expertise.

The maritime entry point to St. John's is the iconic Narrows, flanked by the historic Cape Spear – the most easterly point in North America – and Signal Hill, where Marconi famously received the first trans-Atlantic radio transmission at the turn of the twentieth century. While its unassuming, tourist-luring, brightly colored houses and downtown packed with heritage buildings only hints at its global standing in ocean technology via the vessels moored at its docks, what lies beyond is a network of cutting-edge infrastructure, facilities and expertise.

Playing an important role in the province's ocean technology cluster is Memorial University (MUN), home to the Fish-

Deepwater Floater – Spar

eries and Marine Institute (Marine Institute or MI for short), which has students from every province in Canada and is the number one producer of seafarers in the country. MI's Center for Marine Simulation (CMS) boasts the largest suite of marine simulation technology in North America. The university is a production line for wave after wave of graduates with cold ocean expertise, including ship operations, vessel design, ocean instrumentation and equipment, marine information and communication technologies, ocean mapping, and underwater technology.

MUN is also home to the Genesis Center, a small business incubator that helps to grow business startups – including ocean technology companies – and advance technology developed at an academic level into commercialization.

Virtual Marine Technology (VMT) exemplifies the power of this process. Incorporated in 2004, VMT specializes in small vessel simulation, meeting a need in the global market. While simulation of large vessels was already very advanced a decade ago, there was a dearth internationally of simulation technology for small craft, and search and rescue (SAR) craft in particular. VMT is an example of a Newfoundland capacity in ocean technology that became a global economic opportunity.

This capacity runs not only along the corridors of academia, but through high-tech labs filled with 3D printers, prototyping workbenches, and banks of glowing monitors. Members of the ocean technology cluster take their creations out into the field, the field itself intricately replicated in simulators and test centres.

The Full Mission Ship's Bridge Simulator at CMS is a 30-ton ship structure mounted on a hydraulic base in a surround theatre that can accurately simulate any ship and sea state, anywhere in the world. It is one of sixteen (soon to be seventeen) high-end marine simulators at the Center.

Also home to St. John's is the impressive ocean technology and engineering facilities of the National Research Council, Canada's premiere Research and Technology Organization. With expertise in ocean, coastal and river engineering, arctic conditions are replicated in their ice tank – the longest in the world – conducting physical testing to demonstrate the effects of freezing and thawing on scale model vessels and structures.

NRC also provides numerical modeling to provide a comprehensive test bed for the world's harshest environments.

Beyond their testing facilities, NRC's experts conduct full-scale testing in the field to compare and validate the data generated in their world-class laboratories. NRC works to solve research and technical challenges to transition projects into commercial opportunities on a daily basis. Investiture in scaled testing and trials help industry de-risk and mitigate the costs of full-scale implementation.

C-CORE can also be counted among the storied institutions central to the cluster, housing two centers of excellence, known for its knowledge of sea ice and icebergs, and for developing techniques to mitigate risk through ice management and remote sensing.

While these institutions demonstrate the depth of ocean technology expertise in the province, the cluster's breadth grows day-by-day. Mature companies continue to push the boundaries of innovation, while specialized startups – led by entrepreneurs and backed by the Province's commitment to support them – tread new paths of excogitation and execution.

Broad Range of Expertise

C-CORE, for example, was established in 1975 as the Center for Cold Ocean Resources Engineering. Today, through its Remote Sensing group (the largest concentration of such expertise in Canada) and LOOKNorth Center of Excellence, it utilizes satellite technology that can produce imaging of a very large area, down to centimeter-level detail, providing critical ice surveillance to feed mitigation strategies.

On the other end of the spectrum, EMSAT is a late-stage startup specializing in the design of real-time monitoring solutions that has been around for about four and a half years. Having benefitted from the Genesis Center and leveraged funding opportunities in the province, EMSAT is a team of seven with its own office space, developing and producing powerful data monitoring and reporting software that is now being utilized as far afield as Brazil to connect with MetOcean buoy system.

Seaformatics Group is in the process of commercializing its crowning creation, the Seaformatics 'Pod', a 20 ft. tall, 1400 lb. unit with a 6 ft., floating horizontal-axis turbine tethered to a weighted base by a flexible member, enabling it to harvest power from water currents in basically any direction.

Whitecap Scientific Corporation is also housed at the Genesis Center and has engineered a system that allows two standard cameras to be mounted side by side to create three-dimensional models of underwater sites that can then be analyzed and manipulated in the lab, allowing users to pin notifications to the model itself and to layer older models over newer ones to track the evolution or degradation of a structure.

Newfoundland and Labrador's ocean technology cluster extends outside of St. John's city limits, too. MI's Holyrood Marine Base provides a venue for studies in areas such as marine environmental studies; marine biology, marine ecotourism, diving, and oil spill response.

In Conception Bay South, Kraken Sonar Systems Inc. has developed the a Synthetic Aperture Sonar; a technology it was recently invited by Parks Canada to bring to the Arctic in a successful search for the lost vessels of the Franklin expedition. In the Town of Clarenville, SubC Imaging is quickly becoming known for its subsea camera technology, its soon-to-market 4k camera the first of its kind.

These companies are all examples of startups within the past five years that are already having a significant impact on their respective markets, but estab-

Display of client facility page for port monitoring.

lished companies also have a considerable presence in Newfoundland and Labrador. Oil producers such as ExxonMobil, Chevron, Husky Energy, Statoil, and Suncor have been active in the province's abundant oil fields for decades.

As announced recently, Provincial Aerospace (PAL) is partnering with Airbus to bid on Canada's upcoming Fixed-Wing Search and Rescue contract.

Major names like Fugro are adding further strength to the mix. Technip Group is another world player that is seeing increasing activity in the province, where it has held an office – the center of its Canadian operations – since 1997. It has been involved in every major offshore development project in Atlantic Canada to date, including Terra Nova, White Rose, and Hibernia. An important contributor to the region's success, more than one billion barrels of oil has flowed through Technip pipe in Eastern Canada to date, and it is heavily involved in a number of Arctic and sub-Arctic initiatives, some of which are at an advanced stage of development.

"Positioning ourselves in Newfoundland is really ideal because we have that government support, we have the facilities, and there are world-class researchers here at the university that we collaborate with," said David Shea, Engineering Manager at Kraken Sonar Systems Inc.

The government support Shea speaks of is another important element in ensuring the continuing growth of the cluster. Through programs and initiatives such as its Arctic Opportunities Initiative, the Province is working to provide support, build capacity, create international awareness, and facilitate relationships and partnerships.

"We have a very healthy, collaborative environment," said Whitecap Scientific's Sam Bromley. "You have a lot of complimentary companies in the region. There's an attitude that, 'we're here to build something that's greater than any one company'. There's a lot of support from government agencies to foster innovation. Overall, it's just a perfect place to develop ocean tech."

Long-running industry associations such as Noia (Newfoundland and Labrador Oil and Gas Industries Association) and ADIANL (Aerospace and Defence Industry of Newfoundland and Labrador), and cluster organization, OceansAdvance (the voice of the province's ocean technology cluster), further bolster the efforts of the Province to promote Newfoundland and Labrador's awesome ocean technology capacity around the world.

"We have not only the heritage and a part in developing some unique technologies; we've got the core knowledge, we've got continuous research, and we've demonstrated we have the entrepreneurs that are needed to take an idea…to commercialization," says Noia President & CEO, Bob Cadigan.

Sensing Success

Newfoundland and Labrador companies push forward on remote sensing tech

Newfoundland and Labrador (NL) is home to a number of companies at the cutting edge of remote sensing technology. From mature, established organizations to specialty start-ups, the province is increasingly excelling in this high technology category.

Rutter Inc. has spent more than 20 years developing a proprietary suite of radar technologies including its Sigma S6 system, which has helped it lay claim as the largest supplier of ice radar systems in the world. Its technology is largely used in the global oil and gas industry, with oil spill, and wave and ocean current monitoring added to its proprietary suite, along with small target monitoring utilized in other sectors such as homeland security.

"Generally, a very harsh environment, for example off the east coast of Newfoundland, or as you move towards the Arctic, those harsh environments come with a lot of risk, so anything that helps to manage that environment, to monitor it, helps to mitigate and manage those risks," said Brian Johnston, Strategic Business Development Manager.

Rutter employs around 50 people, most stationed in its St. John's, NL office, with a small group based in Germany. It is a specialty radar systems developer creating software that can be used in conjunction with any manufacture of radar out in the field.

Recent innovations include the Sigma S6 Sea Fusion system, which allows operators of oil and gas platforms to take data from multiple radars positioned around the structure and fuse them together to provide one coherent view. The system simplifies operation of the radar and analysis of the data and improves the safety and security of the platform.

Also in the category of mature companies is NOTUS Electronics Ltd. Founded in 1992 by Bradley Henderson, Managing Director, NOTUS is a developer and manufacturer of hydro acoustic sensors used in commercial fisheries. Its three main products, the Trawlmaster, Seinemaster, and Gearfinder 700, all use transponder-based acoustics to relay vital geometry and other ocean related data over ocean ranges up to 3000m.

The NOTUS Trawlmaster technology relays information on the vessel's trawl back to the captain, detailing factors such as door spread (the distance between the trawl doors), door angle (heel and pitch), catch (indicating when the cod-end is full), and bottom contact (indicating if the trawl is in contact with the seabed). This is critical information for maximizing the efficacy of the operation, optimizing fuel efficiency, and tracking the area that has been swept.

NOTUS has brought a number of sophisticated wireless monitoring systems to the market, with a product line that re-

Pictured Above: **EMSAT is developing technology to remotely ensure structural health of critical assets (pipelines, bridges, etc.)**

NOTUS Electronics Ltd.

mains affordable for all size and type of vessel.

On the other end of the spectrum are some very new remote sensing technology companies. EMSAT, with a team composed of electrical and software engineers and environmental scientists, has developed real-time data monitoring software that is now being used as far afield as Brazil. Its technology advances enhance existing sensor technology used in offshore oil and gas and other ocean-related industries, helping decision-makers to derive data insight and provide information on critical parameters, introducing a large degree of automation (alerts and data reports) and intuitive back-end interfaces (data visualization and tailored dashboard).

The dataset is diverse. EMSAT's technology aids in the real time data processing of phenomena such as wave height, wave direction, ocean currents, and meteorological information such as wind speed, wind direction, and temperatures. Beyond environmental measurements, there is also a need for real-time data monitoring relating to integrity of a structure, vessel or piece of equipment.

For example, EMSAT is partnering with Seaformatics that has produced a unique ocean sensor platform 'pod' that sits on the seabed and harvests power from ocean currents using a large turbine to provide long-term, real-time, wide-area monitoring. EMSAT's software solution can relay information from the environmental parameters being monitored to the pod's internal temperatures and the speed the turbine is spinning. Strategic partnerships with sensor providers and industry partners allow EMSAT to provide innovative end-to-end monitoring solutions.

The 'SAT' in 'EMSAT' stands for 'satellite', and its inclusion in the company name was no chance occurrence. Satellites are necessary when operating in remote ocean environments, a key area of focus for EMSAT.

The company is already engaged in a number of projects related to Arctic monitoring.

Agile Sensor Technologies is also a new company and one of many examples of university-led R&D making its way out of the halls of academia and into commercialization.

Agile was established in late 2014 to commercialize technologies developed during a Memorial University (MUN) project that was originally focused on the so-called "sense and avoid" problem for unmanned aerial vehicles – it evolved to include technologies for ocean application as well.

"The MUN team's approach to sense and avoid was to put intelligent sensors on the vehicle," said Brian Terry, Agile President and CEO, adding that additional technologies were developed to improve the capabilities of the motion platforms that aimed the sensors.

Led by MUN Faculty member Nicholas Krouglicof, now Agile's VP of R&D, the research team set up a Mechatronics Development and Prototyping Facility on the MUN campus, capable of creating functioning mechatronic (mechanical and electronic) machines.

The key technologies that have arisen from the MUN research and licensed to Agile are an intelligent camera with an embedded application that can be used for docking of au-

tonomous underwater vehicles, a high-speed, high-accuracy pointing device and an aerial vehicle for inspection and other applications. The camera application has the potential to be a game-changer in cold, harsh and ice-prone environments like the Arctic, allowing Autonomous Underwater Vehicle (AUV) to remain underneath ice, docking on the seafloor to recharge, greatly extending their operational range. Developed originally for use with the intelligent camera, the pointing device is patentable subject matter in its own right, with many more potential applications, such as underwater laser scanning. Applications of the aerial vehicle include use in iceberg tracking and offshore platform facility inspection.

GRi Simulation: ISE Explorer AUV being recovered with a Hawboldt LARS.

Virtual Worlds

Newfoundland and Labrador is simulation central

Through its history, Newfoundland and Labrador has produced generations of seafarers and ocean innovators. Surrounded by the cold, harsh, ice-prone waters of the North Atlantic, at the edge of the Arctic, the people of Canada's most easterly province have had to embrace the sea and answer its challenges to thrive and make livings.

Today, technology ensures that training seafarers and prototyping new technologies does not have to mean risking life and limb, or unnecessary expense. Newfoundland and Labrador houses some of the most advanced simulators in North America.

Central to this is the Center for Marine Simulation (CMS) housed at Memorial University's (MUN's) Fisheries and Marine Institute (MI). The CMS is home to a suite of 16 marine simulators, with a 17th soon to be added in the form of an Offshore Anchor Handler Simulator.

MI's best-known simulator is the Full Mission Ship's Bridge Simulator. Mounted on a hydraulic base in a surround theatre, it is one of only two full-motion ship's bridge simulators in the world, capable of accurately simulating any ship and sea state.

CMS is also home to a Ballast Control and Cargo Handling Simulator; three Dynamic Positioning Simulators; a Navigation and Blind Pilotage Simulator; aPropulsion Simulator; and aTug Simulator. MI is using its simulation capacity to nurture the next wave of ocean experts through its School of Maritime Studies and its School of Ocean Technology.

Further to the in-house capabilities of CMS are private companies specializing in the fields of lifeboat and ROV (Remote Operated Vehicle) simulation.

Virtual Marine Technology (VMT), incorporated in 2004, has created simulation systems which allow lifeboat operators to practice lifeboat launch, operation and recovery drills using equipment specific to the type of lifeboat on board their platform, drilling rig or vessel.

The cabin-based systems, not unlike flight simulators, allows lifeboat coxswains to train effectively in real emergency situations and with major hazards such as fire and explosions, in a safe, virtual environment.

"There are many different lifeboat manufacturing companies in the world currently who offer different lifeboat designs, hooks and lifeboat controls" says VMT's VP, Sales and Marketing, Alfred Whiffen. "We create training systems which emulate the specific type of lifeboat used and incorporate the emergency response plans of the operator we are working with."

So realistic are the simulators that it is not uncommon for operators to become seasick, or to work up a sweat during the simulation exercises. All the better, say VMT's technicians, for ensuring that lifeboat coxswains will be adequately prepared for a real-life emergency.

"It's really about competency development," says Whiffen.

"Enhancing the competency of the guys that operate these boats." Boats that, unlike the larger craft simulated at CMS, which will ideally see real-world operation in an emergency situation.

VMT maintains a close affiliation with Memorial University, its simulators being used in the Marine Institute's training

Company Profiles

of select Newfoundland and Labrador companies

GRI Simulations Inc. (GRI)

GRI Simulations Inc. (GRI) is a software development company focused on real-time simulation, modeling, and visualization for critical marine activities. GRI's first product was the Virtual Remotely Operated Vehicle (VROV) Simulator System that was designed as an instructional tool to be incorporated into existing ROV Pilot training programs. It applies the technologies of Virtual Reality and dynamic physical modeling to generate realistic, scenario-based ROV simulations.

Steve Dodd
Tel: 709-747-5599
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www.grisim.com

SubC Imaging

SubC Imaging is a worldwide market leader in providing state of the art underwater vision systems for deployment in harsh environments. Designed for use with ROVs, AUVs, Ocean Observatories, stationary platforms or by divers, SubC currently has a wide range of products from cameras, lighting, batteries, lasers and multiplexers to topside video management systems for recording, overlaying and streaming. Custom solutions for client specific applications including integration of third part components are also available.

Ron Collier
Tel: 709-702-0395
rtc@subcimaging.com
www.subcimaging.com

SeaformaticsGroup

The Seaformatics Pod addresses the challenge of cost effective supply of sustainable power to data collecting sensors in the ocean. The Seaformatics Pod, a platform technology developed at Memorial University, uses a patented underwater turbine that harvests power from low speed ocean currents to recharge its battery pack. The Pod allows for longer deployments, without the challenge of frequent battery changes. The Pod's design enables long-term, real-time and wide-area monitoring of ocean parameters from a variety of sensors.

Andrew Cook
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cook@seaformatics.ca
www.seaformatics.ca

Agile Sensor Technologies Inc.

Agile Sensor Technologies Inc. offers sensors and sensor platforms that meet the size, weight and power (SWaP) requirements for deployment on unmanned underwater and surface vehicles. Using proprietary linear motor technology and reconfigurable hardware, Agile offers a fast, accurate, and reliable pointing device (gimbal replacement) for directing cameras, lasers and other sensors towards a region of interest. It also produces a small form factor intelligent camera that can perform onboard image processing functions in real-time.

Brian Terry
Tel: 709-864-3110
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www.agilesensors.com

Kraken Sonar Systems Inc.

Kraken Sonar Systems Inc. is a marine technology company engaged in the design and development of high performance sonars and acoustic sensors for military and commercial applications. Kraken is the leading developers of Synthetic Aperture Sonar (SAS), an advanced sonar technology used for ultra-high resolution seabed imaging.

Glenda Leyte
Tel: 709 757-5757
gleyte@krakensonar.com
www.krakensonar.com

Whitecap Scientific Corporation

Whitecap Scientific Corporation delivers ROV3D-Surveyor, the World's first Live 3D Eventing System for underwater video inspection. Capture the full 3D shape of your inspection targets as naturally as traditional video inspection, using your existing underwater cameras. Live coverage indicators ensure you never miss a thing. Hang notes and documents right on the 3D model. Measure – Assess – Plan. ROV3D.-Surveyor clears the path for new levels of understanding, risk assessment, data management, reporting, and decision making.

Sam Bromley
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sam@rov3d.com
www.rov3d.com

programs, and to perform human factor studies that guide the continued development of the simulators. VMT has also established solid working relationships with the biggest lifeboat manufacturers in the world.

Another simulation capacity is that of subsea ROV (Remote Operated Vehicle) and AUV (Autonomous Underwater Vehicle) simulation, thanks to GRi Simulations Inc.

GRi began to focus on simulation technologies in 1999. Answering a training requirement for ROV operators, the company took a new approach of utilizing networked PCs rather than the approach of large workstations that had been the previous focus of industry.

From there, the innovations continued, GRi creating a level of detail in its simulations that eclipsed the competition. For instance, GRi found a way to accurately simulate the tethers that connect ROVs to surface ships, preventing what Stephen Dodd, VP Operations, describes as potential "negative learning", whereby ROV pilots trained using inferior simulators might run into potentially very costly difficulties should the tether becomes caught or tangled.

It is a level of detail that has become the hallmark of GRi's simulation technology, which can accurately replicate large subsea structures, complex mechanical systems and harsh environments in high detail. The cameras and sonars used aboard the ROVs that become the pilots' eyes to the underwater world are themselves precisely simulated, while trainee pilots can also be exposed to extreme sea conditions, without any risk to the expensive real-world equipment.

In addition to training, GRi's technology is used for product prototyping that can save AUV/ROV technology manufacturers substantial time and money. So accurate is GRi's virtual ocean environment and dynamic performance that new technology designs can be tested at variable depths, current conditions, extreme conditions, and carrying out a range of activities, without the need to put an underwater vehicle overboard or even build it in the first place.

"So instead of having to run a three-year offshore wet-testing program with multiple equipment fabrications; it won't eliminate it completely, but you'll quite possibly be able to cut your project time and costs in half," says Dodd. "It cuts out a lot of early prototyping. You can test the fully-finished system while it's still on the drawing board."

GRi also maintains a close cooperative relationship with the Marine Institute; its simulators being used as part of MI's pilot training programs. This is a critical component in training pilots who need to have a firm grasp of the intricate controls and a 'feel' for operating a robot under water.

GRi simulators are also utilized in the training operations of a number of private companies and public institutions, including for example Alpena Community College in Michigan and the Underwater Training in Brazil.

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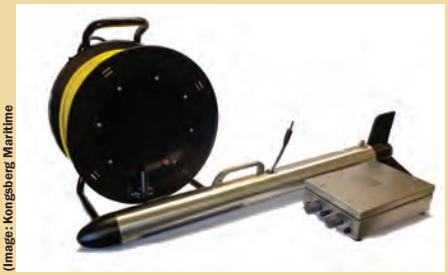
PulSAR: *New SSS for SAR Operations*



(Image: Kongsberg Maritime

A new tow fish side scan sonar has been introduced by Kongsberg Maritime for use in search and recovery (SAR) missions as well as underwater inspection, engineering and scientific surveys. Developed by Kongsberg Geoacoustics, PulSAR is designed for intuitive operation and easy deployment by nonspecialized personnel, enabling effective short-notice surveys using vessels of opportunity, the developer said.

The PulSAR system is designed to acquire high resolution acoustic images of the seabed using a compact, rugged stainless steel tow fish that is operated with a water protected (IP66) deck unit and small cable hand reel. The system can be deployed on small vessels such as open RIBs. Large areas can be surveyed efficiently revealing small objects and structures in great detail. PulSAR operates in a frequency range of 600 kHz to 1 MHz and both FM and CW source signals can be selected in order to optimize the range and resolution for the given survey task. PulSAR is battery or mains powered, using 24 VDC or 110/230 VAC. It has an integrated GPS system that provides positioning information with SBAS differential corrections and an external positioning system can be connected via a serial port.

The system is delivered with a dedicated software package to be run on a laptop computer connected via Ethernet to the deck unit. It allows the user to plan and conduct the survey and acquire sonar data with embedded positioning information.

www.km.kongsberg.com

PREVCO Subsea: New 15,000 PSI Chamber

(Image: Prevco

PREVCO Subsea, LLC is a subsea engineering consultancy, specializing in submersible pressure vessels, instrumentation housings, junction boxes, pressure relief valves and other subsea enclosures and accessories, is increasing their Pressure testing capabilities. Following a successful move in April 2014 into a 30,000 sq. ft. facility, the Prevco team are already expanding the new building to add a new 15,000 psi hydrostatic chamber which had to be

lifted in through the roof. The installation took place last December and involved the heavy vessel being lifted by two cranes one, a 97-ton crane and a second, 297-ton crane, one of the largest cranes available in the area, maneuvered the vessel into a vertical position for lifting. The vessel was raised above the building and lowered through a hole in the roof, finally coming to rest on a specially designed mounting stand.

The new vessel joins two other test tanks and increases the in-house pressure testing capability and services offered to outside companies needing pressure testing.

SeeByte Software for L-3 Klein Sonar

(Image: SeeByte

SeeByte demonstrated its Automatic Target Recognition (ATR) software using a L-3 Klein Associates sonar payload (L-3 Klein UUV 3500, dual frequency 455/900 kHz) on an Iver-3 vehicle. This process involved the ATR software being tuned to the Klein sonar in order for the software to be able to identify contacts of interest in the sonar data. The tuning of the sonar was done using settings commonly applied in mine countermeasures (MCM) missions. Once the mission was completed the data was imported into SeeTrack Military where the Mission Review Tool was used to mark and measure contacts. The geo-referencing engine was used to visualize all relevant data from that same location.

www.l-3klein.com

SeaBotix LBV Performs for Lake Erie Diving

(Image: SeaBotix

SeaBotix' client, Pat Murphy, President of Lake Erie Diving, reported a new personal distance record for internal pipe inspection with his SeaBotix LBV300XL. "It was an internal inspection of a 48-in. (122 cm) intake pipe in Lake Michigan," Murphy said. "The pipe was 6,140 ft. (1,872 m) in length and I did it in one run from shore in just under two hours. I did not go above Gain 5 [half of full power]. I look forward to going the maximum umbilical length I have of 6,760 ft. (2,061 m) someday, now that I know the vehicle will pull it."

www.seabotix.com

WiFi & GPS to X-Series Profilers

Streamline SVP data collection with AML's WiFi device, Data Xchange. Following Beta trials, Data Xchange is set for a March 2015 release. Bringing the benefits of long-range WiFi to X-Series profilers, the device enables wireless data transfer and integrated GPS positioning. Upon surfacing, Data Xchange transfers collected data through an automated WiFi link between profiler and computer at a rate 40 times faster than via cable. "When designing this product, we made backwards compatibility an absolute must. It was important to us to make sure existing customers could experience the benefits of Data Xchange without having to purchase a brand new instrument," said AML's President, Robert Haydock. Also important was staying true to the modularity of X-Series and Xchange products: Data Xchange can easily be moved amongst all X-Series profilers. With new SeaCast 4 software, automatic, simultaneous exports to multiple formats further simplifies the process of data collection.

(Image: AML

Data Xchange can be seen at Ocean Business (booth K8)

STR SeaSpyder

Great Yarmouth based marine technology experts Subsea Technology and Rentals (STR) announced the supply of two SeaSpyder underwater camera systems to the Association of Inshore Fisheries and Conservation Authorities (AIFCA), for use by its 10 individual statutory organizations. The delivery of SeaSpyder underwater camera systems and deployment solution to the IFCAs is to improve their ability to gather information on seabed habitats and species across England's inshore waters. This work is to support Defra's ambitious target of achieving a well-managed network of marine protected sites by 2016. The SeaSpyder underwater drop camera system is part of a family of field proven underwater camera systems manufactured by STR for the marine survey and environmental communities. The SeaSpyder is designed for operation in shallow-medium water depths with the standard system having a working depth range of 500m. For applications demanding a deeper rating, a "telemetry" model is offered which operates over longer cable lengths for operation down to 1000m. Both models are fitted with a next generation digital SLR camera offering high resolution digital stills and HD video for the highest imagery detail.

www.str-subsea.com

(Image: STR

Software Aids Subsea Power Cable Installation


(Image: Makai Ocean Engineering

Makai Ocean Engineering, Inc. recently modified the popular telecom cable lay software, MakaiLay, to address specific issues experienced by the subsea power cable industry. The result of this effort was MakaiLay Power, a real-time software tool for controlling power cable deployment at-sea. This software was recently purchased and used by the OUOCI Consortium to install a subsea power cable in Venezuela for the Chacopata-Margarita Submarine Cable Interconnection Project. The OUOCI Consortium, which stands for Oceanus Co., Ltd. (OU) and Ocean C&I (OCI), used the cable ship CS Creator (IMO No.9630846) for the lay. The cable installation involved two separate 230kV XLPE (polyethylene-insulated) power cable lines from and was completed by OUOCI Consortium successfully in November 2014.

www.makai.com

Sonardyne Ranger 2 for Pieter Schelte

Sonardyne's Ranger 2 Ultra-Short Baseline (USBL) acoustic positioning system was selected by Allseas Group for the world's largest pipelay and platform installation/decommissioning vessel, Pieter Schelte, which was built by Daewoo Heavy Industries and measures 382 x 124m. Pieter Schelte was named a **"Great Ship of 2014"** by *Maritime Reporter & Engineering News*, sister publication to MTR. The vessel is designed to be able to lift loads of 48,000 metric tons and has sufficient deck space to deliver or remove a complete topside module and jacket in one trip. The Ranger 2 USBL system will be used as a high precision independent acoustic reference for the vessel's Kongsberg dynamic positioning (DP) system during structure installation or pipelay operations when maintaining a steady position is a critical requirement.

www.sonardyne.com

OSIL & ASV: Mooring-free Buoy Launched


(Image: OSIL

Ocean Scientific International Ltd. (OSIL) teamed with ASV Ltd. to offer a low-cost, mobile alternative to a permanent moored buoy system for monitoring. The system uses one of the ASV C-Stat station keeping buoys which can be deployed for up to four days at a time, running either on hybrid diesel, or full electric power, and can be programmed to remain in position with a set watch circle, shadow a vessel, or follow a set patrol route, allowing data to be gathered over a much wider area than could normally be achieved with a fixed point buoy. OSIL's knowledge of instrumented and telemetered data buoy systems allows the buoy to be equipped with different instrument options, which include a turbidity probe, an ADCP, or a multiparameter sonde, which could be configured for various sensors, including hydrocarbons, DO, pH and turbidity.

www.osil.co.uk

SWE's New Portable Power System

(Image: SWE

Southwest Electronic Energy (SWE) launched POW-R Tote, designed to be a rugged, lightweight, 12V/117Ah portable power system which provides compact-convenient energy for wherever standard power sources are unavailable. About the size of a lunchbox, and weighing 23 pounds, POW-R Tote uses Lithium-Ion battery technology to deliver two times longer run time and two times more power at half the weight when compared to a typical 12V lead acid battery commonly used in similar applications. POW-R Tote is housed in a heavy-duty, watertight storm case to handle harsh environments. Two power connectors come standard: An automobile 12v auxiliary outlet which powers and recharges low power devices and an Anderson SB50 Powerclaw connector for higher powered gear.

www.swe.com

Waveblade Tested at The Underwater Center

A new technology for the oil and gas industry has undergone a commercial trial at the subsea training and trials facility, The Underwater Center. Commercial divers and ROV pilot technicians recently trialed the Waveblade while


(Image: The Underwater Center

working in Loch Linnhe, simulating a realistic operational environment.

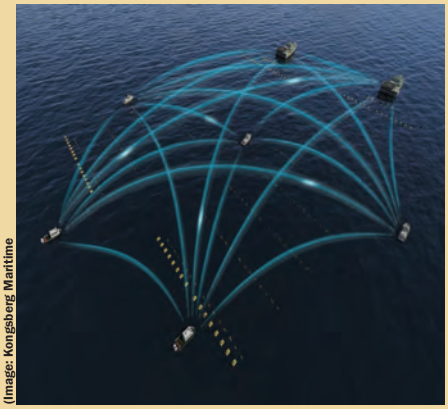
Waveblade is a lightweight, handheld submersible power tool designed to remove marine growth through vibration without harming underlying surface. The tool has been developed to be used as a hand tool for divers and also as a separate tool to be fitted to the arm of an ROV.

Waveblade's patented technology delivers high frequency resonance through its oscillating head, sending multidirectional vibration through the blade into the unwanted marine growth. The wave power has been shown to remove organic growth more thoroughly in a fraction of the time without damaging surfaces compared to current methods such as scrapers and high pressure water jetting.

www.theunderwatercentre.com

Kongsberg Connects Seismic Vessels

A communication solution developed by Kongsberg Seatex for the marine seismic sector was introduced. According to the developer, the Kongsberg MBR system enables high speed, high capacity and extremely robust data, voice and video transfer between multiple vessels and other assets. The Kongsberg MBR is geared toward inter-vessel communication in the seismic industry, where the capability to quickly and reliably transfer data is a significant operational advantage.



(Image: Kongsberg Maritime

The MBR system is a maritime radio network distribution system operating in the 5GHz band and has demonstrated stable, high capacity communication in a maritime environment, handling close by vessel operations, platform obstructions and distances in excess of 50km. Operating as a maritime 'Information Highway', MBR connects crews and vessels with a high-speed and high capacity digital communication channel with 'Fast Track' priority options.

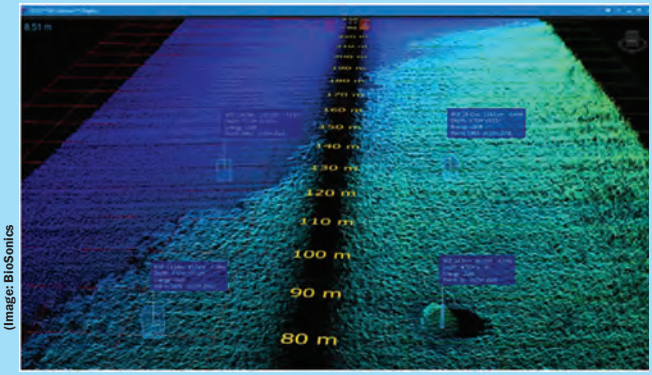
www.km.kongsberg.com

Sonar Makers Partner for Seagrass Surveys

Two sonar manufacturers from the Pacific Northwest have joined forces in a cooperative effort aimed at improving efficiencies in aquatic habitat mapping. Seattle-based BioSonics Inc., and Ping DSP, with headquarters located in Victoria, BC, recently conducted trials to evaluate the effectiveness of a Ping DSP 3D Sidescan sonar combined with a BioSonics MX single beam echosounder as a means for locating and quantifying seagrass beds.

The Ping DSP 3DSS-DX-450 provides wide-swath bathymetry data with full-water-column three-dimensional backscatter imagery, while the BioSonics MX echosounder uses a focused, relatively narrow beam (90) capable of penetrating the vegetation canopy and accurately locating the bottom beneath the plants. When deployed simultaneously, the hybrid 3D sidescan/single beam system offers a unique combination of capabilities ideal for mapping and quantifying submerged aquatic vegetation. The Ping 3DSS provides qualitative information across large areas whereas the BioSonics single beam sonar provides quantitative subsampling across areas where plants are known to exist.

Paul Kreutner, owner of Ping DSP summarized, "With the Ping 3DSS, we could clearly visualize seagrass beds at distances over 50 meters on either side of the survey vessel. This allowed us to quickly locate the edges of the grass patches and navigate directly through the plant beds where the MX system was used to collect accurate height and density measurements of the vegetation."



(Image: BioSonics

Ping DSP 3D Sidescan Data File Showing Seagrass Bed.

The MX echosounder is a purpose-built aquatic habitat assessment system developed by BioSonics in 2012. BioSonics echosounder data is processed with specialized software called Visual Habitat to obtain plant height and density measurements as well as substrate classification. BioSonics developers are now looking at potential ways to adapt Visual Habitat software for Ping DSP sidescan data.

Tim Acker, BioSonics owner and president, aid, "We see tremendous synergies between the two technologies and across our businesses. It's great having a trusted, local partner for collaborations like Ping DSP."

TE Connectivity INSTALITE Boots

TE Connectivity (TE) announced its new INSTALITE Molded Boots that are up to 30 percent lighter than TE standard -25 boots. These high-performance heat-shrink boots have been designed for applications in military ground systems, aerospace and marine. Their optimized interior geometry reduces installation time as well as provides a faster recovery, the manufacturer said.

www.te.com

Outland Technology LED Laser Light

Outland Technology introduced a new underwater LED laser, model UWL-810. With uses ranging from ROVs, dive cameras, to fixed installations, the UWL-810 gives the operator the opportunity to scale its subject on a 2D screen using underwater videoThe UWL-810 runs on any power source from 5-30 Volts, AC or DC. It features a 50,000 hour life and an LED spread of 100MM. Just 1" Dia. x 6.8" L, this unit has a depth rating of 800 meters with an optional 2000 meters available. Materials include anodized aluminum and acrylic.

www.outlandtech.com

Teledyne TSS's Saturn AHRS and INS

Teledyne TSS's Saturn AHRS and INS (Attitude and Heading Reference System and Inertial Navigation System) is now market ready. The Saturn product family is based upon fiber-optic technology developed and manufactured by Teledyne TSS. The family also incorporates advanced digital signal processing and algorithm design to deliver a highly accurate and reliable product to meet the demanding needs of the marine market.

www.teledyne-tss.co.uk

(Image: Teledyne TSS

Tritech Sonars for Swedish Navy ROVs

(Image: Saab Seaeye

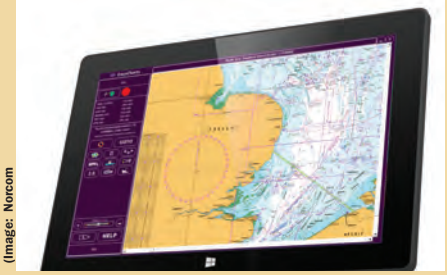
The Swedish Defense Materiel Administration, Försvarets Materielverk (FMV), has selected Tritech as the preferred supplier for sonar and acoustic positioning onboard SAAB Seaeye Falcon Remotely Operated Vehicles (ROVs). The 10 ROV systems will be deployed for seabed surveys, inspections, light underwater work and recovery of objects and encompass a full suite of Tritech sonars including Gemini multibeam imager, Micron mechanical scanning sonar, PA500 altimeter and MicronNav USBL.

www. tritech.co.uk

Nav Charts App

Norcom Technology Limited will launch a web and PC based navigational charting app at Ocean Business 2015. eChart software combines up to date information from different sources including wreck, cable, tide and geographical data for navigational charts, making it suited for use by companies carrying out desktop studies prior to installation of offshore structures, cables, pipelines and vessel monitoring. Chart data is supplied in chart packs, which can be downloaded from www.norcom-technology.co.uk or the data can be supplied on CD or USB memory stick.

www. norcom-technology.co.uk



(Image: Norcom

New Subsea Modular Spreader Beams

Modulift has revealed its newest product range, Subsea Modular Spreader Beams, designed to safely hold weights up 500 metric tons.

The subsea modular beams have an open section design suitable for water submersion by eliminating the risks of any cavity or pressure issues and are finished with a three-coat paint system based on a two-pack epoxy paint combination. Modular elements produce a new collection for deep water lifting.

modulift.com

Valeport Software

(Image: Valeport

Valeport's newly released operating software Datalog X2 with an embedded Terminal X2 program is now available for free download via the company's website. The new version is designed to interface, configure and download data from both legacy and new products and also includes bonus Seawater Calculation utilities. It will be issued with new products from February 2015 and is largely used in conjunction with Valeport's Tide Gauge, Sound Velocity Profiler, CTD and Current Meter product ranges.

www. valeport.co.uk

Moskito

New Tool to Recover Oil from Sunken Wrecks

A tool for removing oil trapped in submerged vessels was developed in Norway by Miko Marine.

Moskito is designed to address the pollution threat that exists with the large numbers of sunken ships around the world that still contain significant quantities of oil in their tanks as cargo or bunker fuel. Many of the thousands of ships sunk during WWII now have seventy years of corrosion eating at their plates and the days are drawing closer when the pollutants could escape.

Options include sealing the wreck or recovering the pollutant in a controlled manner, which Moskito seeks to do.

How it Works

Moskito is able to be deployed by divers or by an ROV to any ocean depth. Once in position outside the tank the Moskito's three magnetic feet are planted against the steel hull and a technician on the surface activates a 75 mm (3-inch) diameter electrically powered tank cutter drill. With its operation controlled through a dual video link, the Moskito's drill pierces the steel tank walls which may be up to 40 mm (1.5-inches) thick. The cut disc then falls away inside and is immediately followed into the tank by a patented spring latch coupling that automatically connects and locks a hose to the tank without allowing any of its contents to escape. With the hose securely in position a subsea pump can be activated to extract the oil at the rate of up to 12 cu. m. per hour and send it to the surface for safe and non-polluting recovery. If it becomes necessary to relocate the Moskito it can be easily repositioned without being returned to the surface. Being such a compact device it is also easy to use multiple units close together if a higher rate of extraction is required.

Emerging from R&D

Moskito arose from a research and development project launched by Miko Marine in 2012. It attracted the interest of the Norwegian Coastal Administration (NCA) which had been grappling with the same pollution problem being caused by spontaneous leaks from sunken wrecks around Norway's coastline. NCA decided to support Miko Marine's quest to find a solution and the two organizations joined forces with the backing of Innovation Norway, a government-sponsored research and development organization.

The name of the tool was the inevitable consequence of its working similarity to the unpopular insect. Just like the insect it has to be light, versatile and adaptable because when a ship settles on the seabed there is no knowing how its tanks will come to rest. However, with a visual inspection and by studying the plans of the vessel a means of attack can be found. The Moskito is then delivered to the outside of the tank where it penetrates its skin and inserts its proboscis so that the liquid inside can sucked out. The insect allusion falls short of the engineering reality but the principle is the same and measuring just 65 cm (25-inches) by 45 cm (17-inches) and weighing only 80 kg, by subsea engineering standards the tool has an insect's light touch.

"This was not an easy product to develop as it required us to call upon our highest standards of engineering and design," said Nicolai Michelsen, GM, Miko Marine.

www.miko.com

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