MARINE TECHNOLOGY REPORTER

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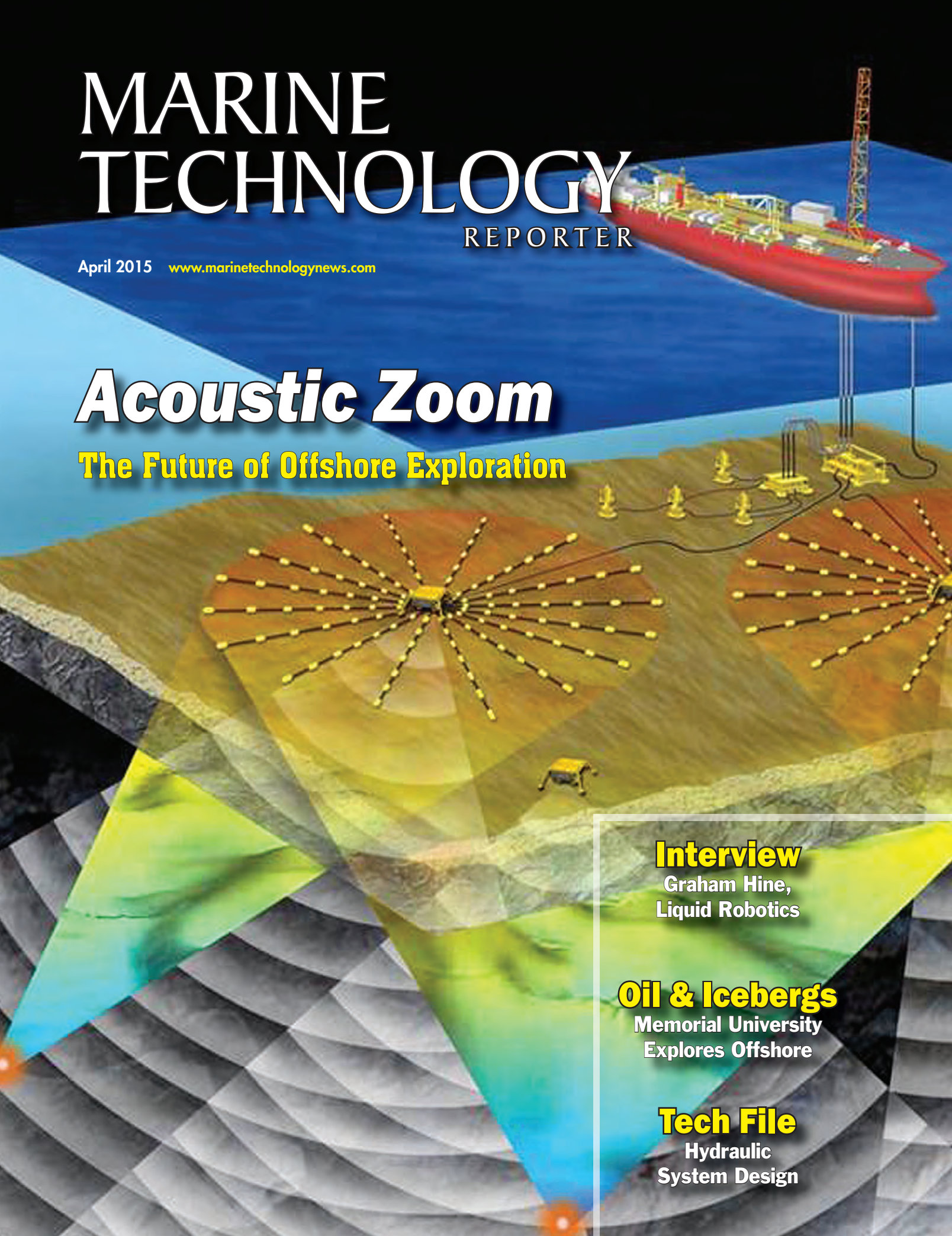

Acoustic Zoom

The Future of Offshore Exploration

Interview
Graham Hine, Liquid Robotics

Oil & Icebergs
Memorial University Explores Offshore

Tech File
Hydraulic System Design

VideoRay

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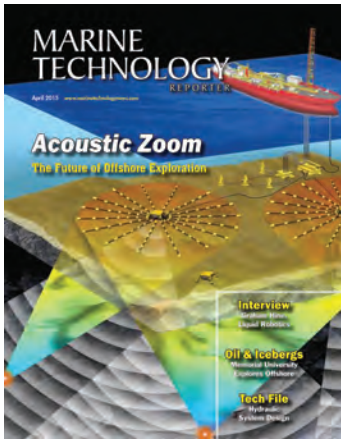

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Liquid Robotics

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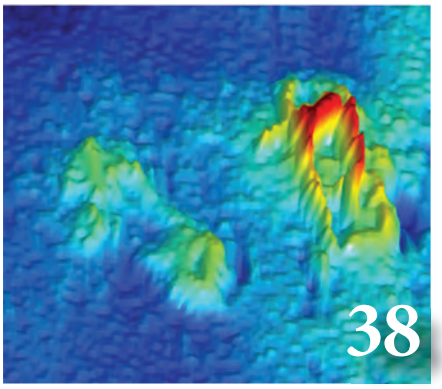

The Authors

Tom Peters

Tom Peters is a freelance writer living in Lower Sackville, Nova Scotia. He is retired from the newspaper business after 41 years with The Halifax Chronicle-Herald. *p. 42*

Kira Coley

Kira Coley graduated with a BSc. (Hons) Marine Biology degree from University of Portsmouth and has extensive experience as a Field Scientist in various locations. *p. 32*

Karl Kenny

Karl Kenny, President and CEO of Kraken Sonar Inc., grew up in a small fishing village in Newfoundland where his family has historical connections to the sea. *p. 38*

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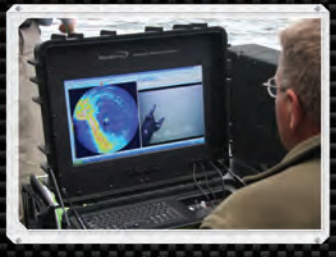

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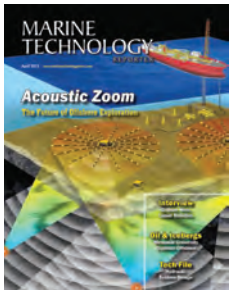

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NEW YORK
118 E. 25th St., New York, NY 10010
Tel: (212) 477-6700; Fax: (212) 254-6271

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

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

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

Web Editor
Eric Haun
haun@marinelink.com

Contributing Editors
Capt. Edward Lundquist, USN (Ret.)
Claudio Paschoa
William Stoichevski

Production Manager
Irina Tabakina
tabakina@marinelink.com

Production & Graphic Design
Nicole Ventimiglia
nicole@marinelink.com

Sales & Event Coordinator
Michelle Howard
mhoward@marinelink.com

Manager, Public Relations
Mark O'Malley
momalley@marinelink.com

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

CIRCULATION
Kathleen Hickey
mtrcirc@marinelink.com

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

Advertising Sales Manager
Lucia M. Annunziata
annunziata@marinelink.com
Tel: (212) 477-6700 • Fax: (212) 254-6271

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

Japan
Katsuhiro Ishii • *amskatsu@ dream.com*
Tel: +81 3 5691 3335 • Fax: + 81 3 5691 3336

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

As the reality of depressed oil pricing starts to settle in, it is literally anyone's guess as to the breadth, depth and length of this latest energy trough. I am regularly in touch with some of the brightest minds in global energy circles and to date I have found that if you ask 10 people, you receive 10 different answers. The fundamentals of this swoon are wholly different from the drawdown of 2008, which was driven by macro economic factors. While the simple premise of supply and demand are surely at work in 2015 – the glut of energy and relative paucity in demand is surely not a figment of the imagination – there are some external political forces seemingly at play.

In the running of your day-to-day business theoretical doesn't have much use. Oil is stuck in the $50 per barrel range, projects are drying up or being pushed back, and the need for your products and services to the offshore oil and gas market are waning … or are they?

The beauty of the subsea sector is that it is a consistent 'hamster wheel' of innovation, constantly churning out new products and services; new means and methods to operate under the water more safely, efficiently and cost-effectively. Challenging times are opportunities for innovative companies, opportunities to present new ways to think, act and operate when the cash from $115 per barrel is not flowing freely.

Our cover story dubbed "*Acoustic Zoom: The Future of Offshore Exploration*," is a perfect example of this. **Kira Coley** reports, starting on page 32, of new approach for seismic surveying developed by researchers at the University of Bath, offering a resolution and efficiency beyond the reach of existing seismic methods, reducing the need of unnecessary drilling.

This is one among a sea of technologies being developed globally, and if you have one that you feel worthy of profile in our pages print and electronic, I welcome your call or email.

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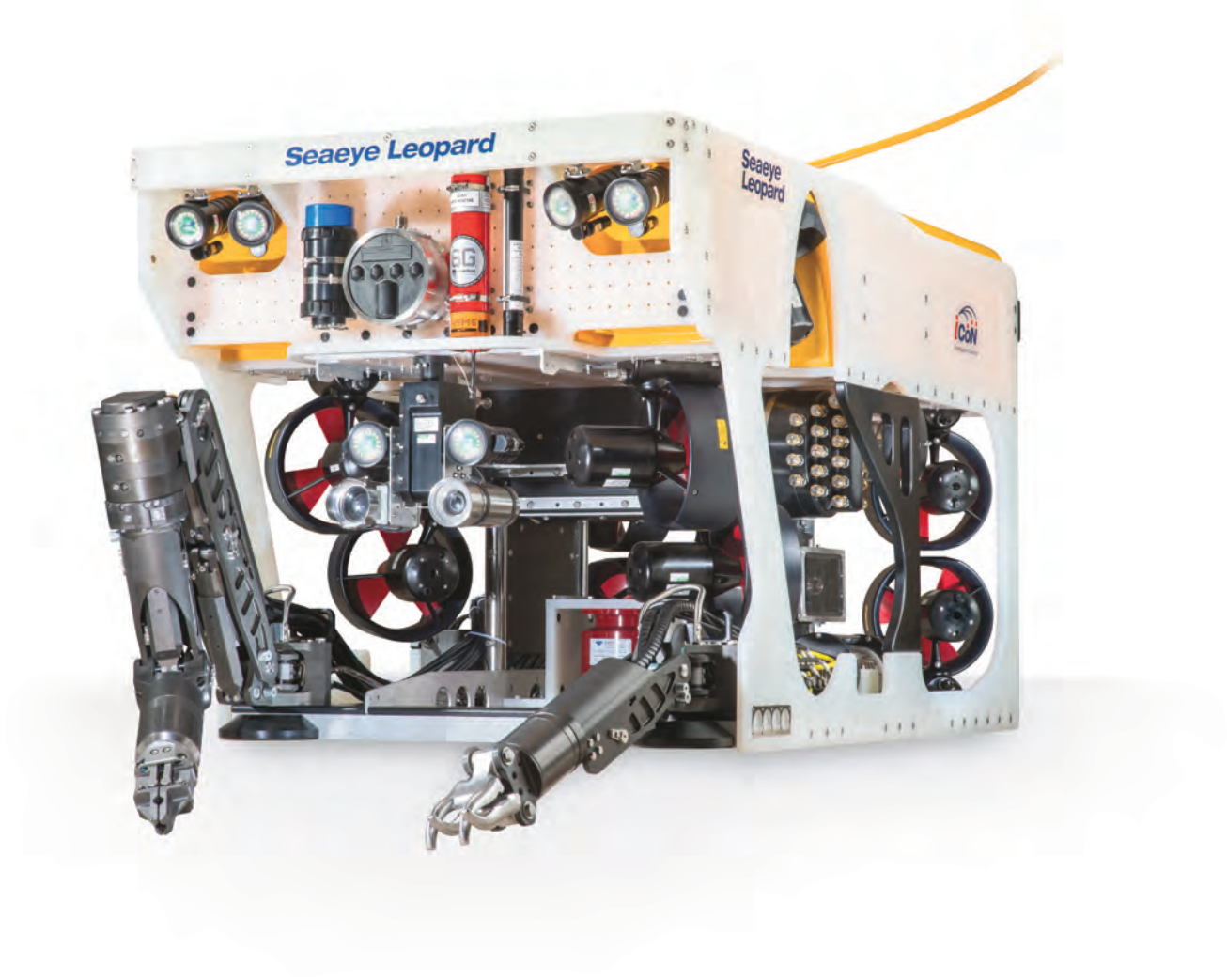

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SAAB TECHNOLOGIES

SAAB

Lytle

Northrop Grumman

Grange

Photo: Teledyne

ROVOP's Wagner, Vorenkamp & Eychner

Photo: ROVOP

Northrop Grumman Names Lytle VP, Undersea Systems

Northrop Grumman Corporation named Alan Lytle vice president, Undersea Systems business unit, for the company's Electronic Systems sector. In his new position, Lytle will have executive responsibility for all Undersea Systems programs and products involving the design, development and production of advanced undersea capabilities including submarine sensors, unmanned maritime systems, minehunting systems and torpedoes. He will be based at the company's facility in Annapolis. Lytle joined the company in 2010 as director, Undersea Systems special defense programs. In 2013, he assumed the role of director, business development and strategy, focusing on emerging and growth markets in the undersea domain. Prior to joining Northrop Grumman, Lytle was a principal investigator and program manager at the National Institute of Standards and Technology. His primary research areas were field robotics and 3D imaging systems. Lytle is also a U.S. Navy submarine officer and served on fast attack submarines before transitioning to the Navy Reserve. He currently holds the rank of captain.

Teledyne TSS, Teledyne CDL Combine Sales Teams

The Teledyne TSS and Teledyne CDL sales teams have been working progressively closer together to present a complementary range of products to an overlapping customer base. According to the companies, they are now at a point where it has become sensible for both sales teams to unite.

According to the companies, this will provide customers with a more focused and efficient service. TSS and CDL will remain separate trading entities, offering their own products and are simply offering their products through a single sales organization.

New areas and regions of responsibilities have been determined and a customer communication strategy created. The new organization will now be progressively unveiled to the companies' combined customer base.

The new organization went 'live' at Ocean Business following a reception for customers and the press.

Martyn Grange has been appointed to oversee the transition and will lead the newly combined team. All TSS and CDL sales managers therefore now report to Martyn with immediate effect.

ROVOP: New Houston HQ

Remotely Operated Vehicle (ROV) services provider, ROVOP, has established a Western Hemisphere headquarters and support base in Houston as well as appointed three ROV industry professionals to lead the business. Scott Wagner, Brett "Gonzo" Eychner and Wayne Betts bring a combined total of more than 100 years' global experience in the ROV services sector to ROVOP.

They join an established management team and staff of 130 based in Aberdeen, Scotland, who have developed ROVOP into a leading player in the ROV field.

"ROVOP is changing the market for ROV services," said Mark Vorenkamp, chairman of ROVOP. "Over the last two decades, ROV technology, capability and service has fallen behind the pace of change seen in other industries. ROVOP's approach is to employ the most advanced, capable, reliable and maintainable ROV technology, world-class business systems and the best offshore personnel trained in our own ROV Academy.

ROVOP's facility is located in North West Houston on a 1.5 acre site which includes a 4,500 sq. ft. office and 17,300 sq. ft. workshop where the company will manage its fleet of FMC Schilling Robotics and SAAB Seaeye ROVs.

"The recent mobilization of two Schilling Ultra-Heavy Duty (UHD) Generation III ROVs, capable of closing a blow out preventer (BOP) within 45 seconds to meet American Petroleum Institute (API) requirements, illustrates ROVOP's commitment to supporting clients with industry leading technology in the Gulf of Mexico," said Wagner, ROVOP Houston MD. "Myself and the rest of the team are excited to extend this offering in the U.S. and wider Americas market."

Pradith Joins HYPACK Support Team

HYPACK, Inc. announced that Vitad Pradith has joined the HYPACK support team.In his new role, Pradith will work alongside HYPACk's support team, providing customers with customer support, onsite trainings and system integration. Pradith previously worked as a Physical

Pradith

Photo: Hypack

Kerr

Cullen

Scientist at NOAA Office of Coast Survey for the past 11.5 years. His primary role provided the technical direction and support to the Coast Survey Navigation Response Teams (NRT) who are agile teams of hydrographers performing nautical chart updates and function as emergency responders during national incidents in the maritime domain. Pradith was also involved with several maritime archaeology cruises as the chief mapping scientist, transitioned research and development projects into proof of concept and field operations, and advised contracting officers on technical procurements. He has led sensor and technology evaluations related to hydrography and emergency response applications, as well as hydrographic data processing improvements using high performance computing systems.


Photo: Teledyne Marine

Teledyne Tech Workshop

October 4-7, San Diego, Calif.

Teledyne Marine announced its newly expanded users' workshop in which speakers, influencers and attendees from around the globe will converge to explore, learn and share their experiences on a broad range of technologies.

Building upon Teledyne RDI's long-standing ADCPs in Action and Teledyne Marine Acoustic Imaging's Underwater Technology Workshops (UTS), this newly combined and expanded event will allow attendees to enjoy the one-on-one focus and industry camaraderie they've come to expect, with a new breadth of products, applications and technologies to further enhance their user experience.

This three-day workshop will include customer presentations, product/software training, field service meetings, networking opportunities and on-water demonstrations provided by 13 of Teledyne's top-tier oceanographic manufacturers. Products will range from: ADCPs, CTDs, DVLs, Imaging and Mapping Sonars, Motion Sensors, Navigation Systems, AUVs, ROVs, Modems, Gliders, Surface Platform and Interconnect Solutions.

Speakers Sought for Teledyne Joint Technology Workshop

A component of the users' conference will be presentations given by customers sharing their field and laboratory experience utilizing Teledyne products. The three-day workshop will include four concurrent morning tracks dedicated to the following broad topic areas: Offshore Energy; Oceanographic Research/Hydrography; Defense/Security; and Civil Engineering/River Monitoring.

Teledyne customers are encouraged to submit an abstract sharing their experience using Teledyne products for any of these applications. Abstracts can be submitted for speaking slots or poster paper presentations. All accepted speakers will receive free admission to the event; poster paper presenters will receive a $100 discount off their registration fee. Abstract due date is April 30, 2015.

Full details and an online abstract submission form can be found at:

http://tm-techworkshop.com/call-for-speakers/

North Sea Oil: Harkand wins Maersk Oil North Sea Deal

Harkand won a multi-million contract with Maersk Oil North Sea Ltd., for the provision of DSV services in the North Sea region. The 12-month contract will be serviced by Harkand's two DSVs, the Harkand Da Vinci and Harkand Atlantis, supported by project management and engineering from Harkand's Aberdeen office. The contract covers well tie-ins, structure installation, piling, flexible flowline lay, flexible riser installation, pre-commissioning, riser recovery, decommissioning and general inspection, repair and maintenance (IRM) work. The Harkand DaVinci and Harkand Atlantis are both equipped with state-of-the-art saturation diving systems, 140t active heave compensated cranes and Super Mohawk ROV spreads.

Cullen New ROV Ops Manager at The Underwater Center

The Underwater Center has appointed Steve Cullen to the newly created role of ROV operations manager, where he will lead the development of the center's ROV training and trials activities. He joins from Ashtead Technology and Subsea 7 where he took up similar training roles, with responsibility for ROV personnel's technical and engineering training. Cullen will this week help to judge the MATE (Marine Advanced Technology Education) ROV Scotland competition, taking place at RGU. The competition is designed to challenge students to apply the STEM skills they are learning in the classroom to solving problems from the marine workplace. The Underwater Center is a purpose built training and trials facility which incorporates an extensive pier complex including four dive stations, classrooms, workshops and decompression chambers.

New Lineup for NOAA Hydrographic Services Panel

NOAA administrator Kathryn Sullivan, Ph.D., has appointed six members to the Hydrographic Services Review Panel, a federal advisory committee that gives NOAA independent advice for improving a range of services and products that support navigation and coastal resilience.

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(Credit: NOAA)

The Hydrographic Services Review Panel advises NOAA on improving services for navigation and coastal resilience.

New members of the panel are:

- **Larry Atkinson,** Ph.D., Slover professor of oceanography, Climate Change and Sea Level Rise Initiative, Old Dominion University, Norfolk, Virginia
- **David Maune**, senior project manager, Dewberry Company, Fairfax, Virginia
- **Capt. Salvatore Rassello**, director of nautical operations, Carnival Cruise Lines, Miami, Florida

The reappointed members of the panel are:

- **Carol Lockhart**, Geomatics Data Solutions LLC, San Diego, California
- **Joyce Miller**, director of seafloor data services, Hawaii Mapping Research Group, University of Hawaii School of Ocean and Earth Science and Technology, Honolulu
- **Susan Shingledecker**, vice president and director of environmental programs, BoatUS Foundation, Alexandria, Virginia

"Providing coastal communities, boaters, and the commercial maritime industry with timely, reliable, accurate and authoritative information is essential as we strive to keep commerce flowing through our nation's ports," Sullivan said. "The Hydrographic Services Review Panel provides NOAA with essential expertise on commercial maritime needs and hydrographic data that is tremendously valuable to us as we work to build resilient communities and businesses along our nation's coasts."

The new and reappointed members join current members:

- **Rear Admiral Ken Barbor** (ret.), U.S. Navy, Stennis Space Center, Miss.
- **Lawson W. Brigham**, Ph.D., University of Alaska at Fairbanks
- **Capt. Deborah Dempsey**, Columbia River Bar Pilots, Bellingham, Washington
- **Rear Admiral Evelyn Fields** (ret.), NOAA Corps, Germantown, Maryland
- **William Hanson**, Great Lakes Dredge & Dock Co., Oak Brook, Ill.
- **Gary A. Jeffress**, Ph.D., Texas A&M University, Corpus Christi, Texas
- **Edward Kelly**, Maritime Association of the Port of NY/NJ, New York, New York
- **Frank Kudrna**, Kudrna & Associates Ltd., Westmont, Illinois
- **Scott R. Perkins**, Surveying and Mapping LLC, Overland, Kansas

The new members joindc the panel at the next public meeting from April 8-10 in Long Beach, Calif.

Scottish MATE ROV Challenge

More aspiring young engineers will get the chance to participate in an international competition to design underwater machinery and robotics thanks to leadership and support from Subsea UK. The body, which represents the U.K.'s $13 billion subsea industry, has entered into a long-term partnership with RGU to sustain and extend the highly successful Scottish MATE ROV Challenge.

The STEM initiative aims to inspire future engineers through hands-on experience of designing remotely operated vehicles (ROVs) used underwater in the oil and gas, defense, oceanology and marine renewables industries.

The annual event, which is coordinated by the Marine Advanced Technology Education (MATE) Center in California in partnership with Aberdeen's Robert Gordon University (RGU), involves teams made up of pupils from schools across Scotland. To date, MATE ROV has worked with 460 pupils from 29 schools with an annual commitment from BP and ad-hoc support from other oil and gas companies.

"MATE ROV has captured the imagination of school pupils and subsea business alike since it was first run in Scotland in 2008," said Subsea UK chief executive, Neil Gordon. "Representing the entire subsea supply chain, Subsea UK is ideally placed to communicate and promote the initiative to industry, ensuring more meaningful engagement. This in turn will provide the best experience for the pupils who may become tomorrow's subsea industry leaders. By bringing the industry closer to the program and securing longer-term commitments in terms of cash, expertise and equipment, we hope to extend its reach to more pupils across Scotland and eventually to other regions in the U.K."

Subsea company ROVOP has also stepped in to support the initiative, which along with the financial contribution of Subsea UK and another new sponsor, brings a much-needed $24,000 to the program.

www.marinetech.org

Valeport Launches Customer Photo Contest

U.K.-based Valeport designs and manufactures instrumentation for the oceanographic, hydrographic and hydrometric communities is asking its customers worldwide to send in videos or photos of Valeport products in action for the chance to win an iPad Air 2 for the best video footage and an iPad Mini 3 for the best photo. Kevin Edwards, Valeport sales and marketing manager commented, "We're always really interested to hear about the interesting projects and applications our products are deployed in and this competition is about identifying more of those stories. Our products are used in many sectors including; environmental, defense, oil and gas, renewable energy, construction, dredging and civil engineering and we're looking forward to finding out more about the often quite unique projects Valeport products are supporting.

The competition closes May 22. Submissions can be entered at:

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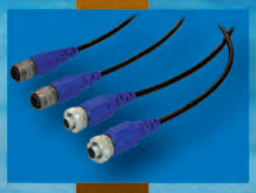

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Surveyor Interceptor ROV

First Commercial Work for Gassco AS

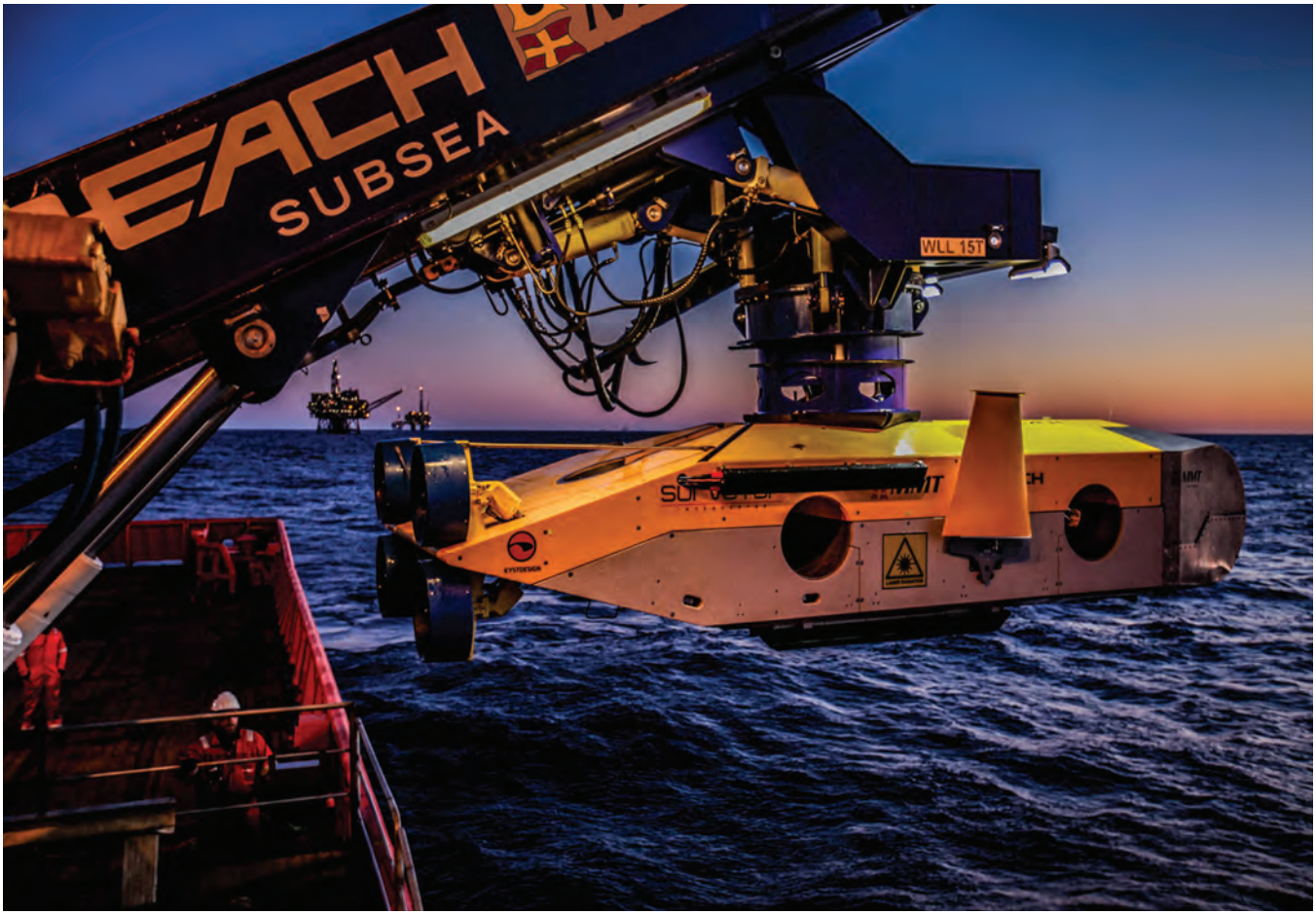
MMT and Reach Subsea complete its first commercial project with Surveyor Interceptor ROV for at Knarr Gas pipeline in the North Sea.

The pipeline inspection was conducted from the vessel Edda Fonn. This work was to verify that the rock berm on the pipeline was still intact prior to puttin a commissioning pig train and gas in the pipeline in near future.

"After the successful offshore tests on Europipe 2 last year we did some fine tuning on cameras and when we finally went to work," said Ola Oskarsson, MMT´s founder and project manager for SROV. "The new Launch and Recovery System which was reconstructed after measurements during the sea trials performed well in sea state up to 3.8 HS. The Knarr gas pipeline, which runs from 400m water depth up to 140m over a stretch of 106 km, was surveyed in one effort at speeds of up to 4.5 knots. The Interceptor SROV swam four to five meters above the pipe and a multibeam with 0.1 m gridsize and full 3D photomosaic was collected. The velocity and quality of data was outstanding and the system proved itself. The field report was delivered 18 hours after the 17 hour survey.

The final draft report was delivered eight days after leaving the vessel. "The weather had been dreadful during February and we needed to work fast in the given weather window since the pipe was ready to put in use."

On the March 1, 2015, Gassco became the operator for the Knarr Gas pipeline. While this first survey with the SROV reached a speed of 4.5 knots, according to MMT the SROV has potential to survey at a speed of up to 6 knots.



New Market Intel for UK Subsea

Subsea UK launched SubseaIntel, a new market intelligence service to help subsea companies exploit global opportunities. Subsea UK represents the UK's $13B subsea sector, and the new on-line database is designed to provide regularly updated details on almost 1,200 subsea projects worldwide.

Data can be customized to review and compare the current status of subsea projects and developments as well as uncover the market-leading countries and industry trends. Information is categorized by a number of key factors including: region, operating or contracting company and water depth.

"Members will be able to pinpoint the most relevant regions, projects and contracts for them with all the project characteristics and analysis they need to make informed decisions.

SubseaIntel is now live and is exclusive to members of Subsea U.K.

> "For the first time, valuable intelligence on the global market will be readily available to help them with planning, forecasting and business development."
>
> Neil Gordon, Subsea UK

E-marine Fleet Expansion

E-marine, a provider of submarine cable installation and repair solutions in the Middle East and Sub-Continent region, unveiled plans to expand its fleet of cable ships in 2015, with the first ship, the CS Maram, beginning dock trials ahead of its maiden voyage this year.

CS Maram, which was built in Abu Dhabi, UAE has been designed to manage the installation and maintenance of all types of submarine cables, including fiber optic telecommunications cables and energy cables. The ship is expected to successfully complete dock trials and be ready for launch within the coming months.

E-marine's planned fleet expansion will see the addition of further multi-purpose vessels in the coming years, boosting its coverage across the region, with a particular focus on East Africa and the wider region. The expansion will help strengthen the firm's presence in the high-growth subsea cable market and undertake activities to stem demand from telecoms and energy sectors.

The fully loaded maintenance and installation vessel will incorporate a submarine robot or ROV (Remotely Operated Vehicle) that will enable the vessel to undertake pre-inspections and surveys of the seabed and cut trenches to bury the cable.

CS Maram

(Photo: E-marine)

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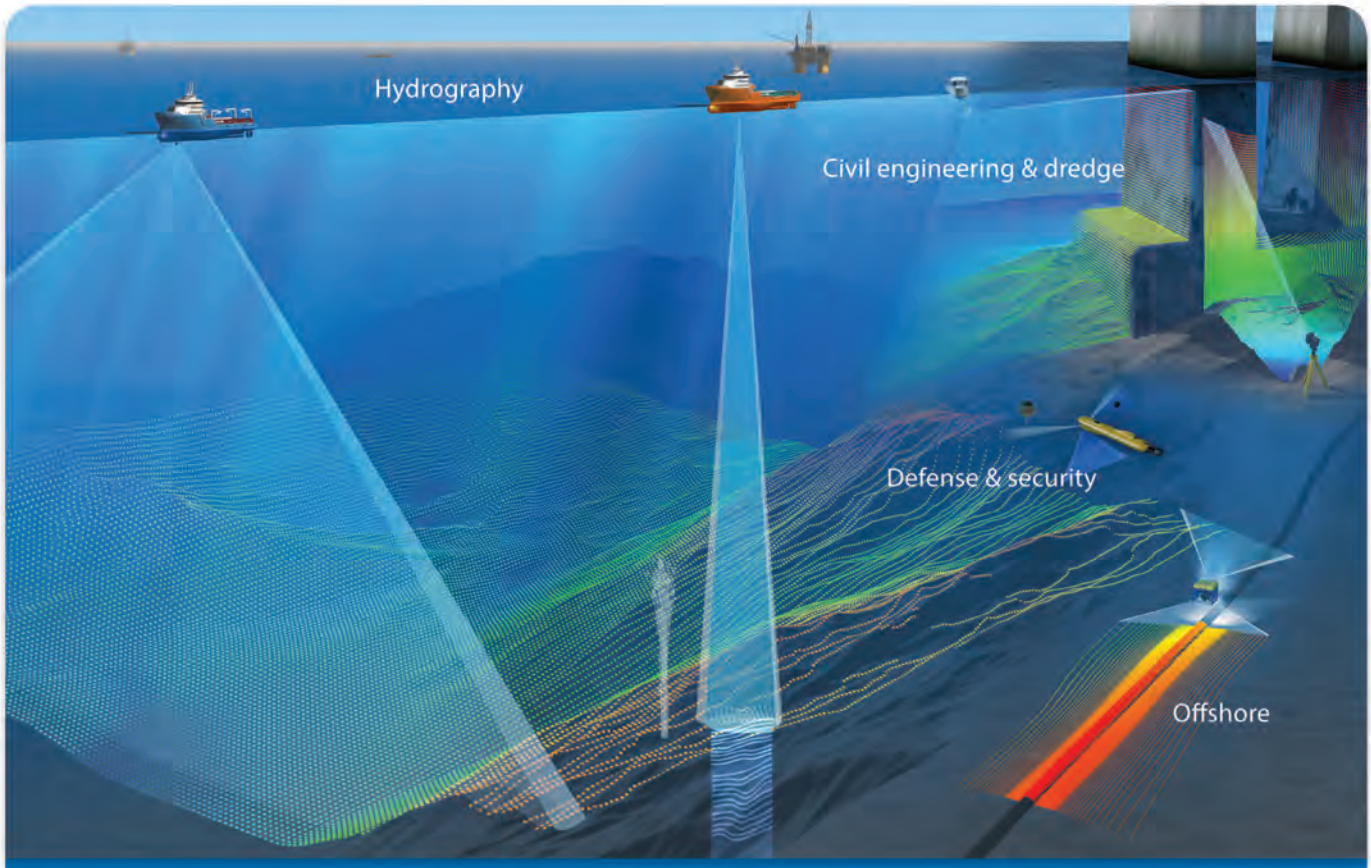

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Design of Hydraulic Systems for Subsea Applications

By Royce Gerngross, Engineer Marine and Offshore &
Dr. Alexandre Orthm, Project Risk Manager

Global Growth Drives Subsea Expansion

More than two-thirds of the earth's surface is covered by water, and there are many potential resources there that await exploration and development. Industries involved in this new frontier include mining, oil and gas, infrastructure, energy generation and natural science.

These activities all involve complex and highly technical systems. Many of them, particularly those performed beneath the sea's surface, utilize a broad array of electro-hydraulic systems to carry out their work—lower and lift equipment to the seabed, remote operation of subsea systems, and permanent monitoring of emplaced systems such as petroleum wellheads or communications cabling.

It is frequently assumed that such hydraulic equipment needs to be specifically designed and engineered using special materials to enable operation under the pressures and corrosive conditions of different sea depths. However, many standard hydraulic systems engineered for surface use can be, with sufficient customization, utilized effectively in this demanding environment.

Ultimately, the operation of hydraulic systems—whether on land at sea level atmospheres, or deep under the sea—requires isolating the hydraulic circuit from external environments and controlling the fluid to actuate work; the principles are the same, and thus the design principles for subsea simply call for considering additional conditions.

Comparison of Subsea Requirements

In order to select the best solution for a given application, it is necessary to understand how the different subsea water depths impact the hydraulic system. The analysis used in oil and gas exploration supply an effective set of guidelines.

■ Shallow water: Up to 1,000 ft (305 meter)

At this depth, components must operate in saltwater, but not in significantly high water pressures. At this depth, (which includes the technical safe limit for divers not pressure suits, at 100 meters), the equipment is relatively easy to operate, put in place and retrieve. However, the surface light may penetrate up to 200 meters, thus promoting the growth of sea life over the equipment surface; this must be factored into designs of equipment such as hydraulic cylinder rods.

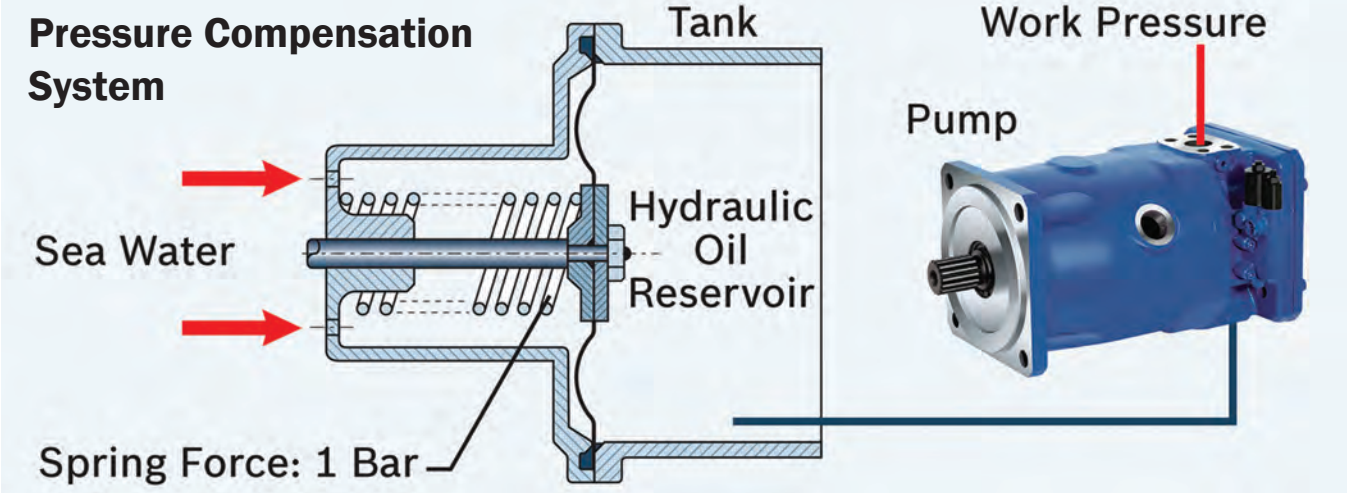
Table 1

Summary of the Main Subsea Requirements per type of Application

Req.	Applications	Ocean Energy	Oil & Gas	Mining	ROVs/ AUVs	Infra-structure	Natural Science
Water Depth	**Shallow Water:** <= 1,000 ft. (corrosion, sea life)	X	X	X	X	X	X
	Deep Water: >1,000 ft. (water pressure, distance to shore, full remote operation, sea currents)		X	X	X	X	X
	Ultra-Deep Water: > 6,000 ft (very high water pressure, extreme sea conditions, distances, large equipment)		X	X	X	X	X
Safety	Significant risk of injury to people or environment	Low	Very high	High	Low	High	Low
Reliability/ Availability	Cost of downtime due to unexpected field failures	High	Very high	High	Medium	High	Low
Maintainability	Ability to repair system on location or on sea surface (scheduled downtime)	Varying production	Continuous production	Varying production	Intermittent production	Continuous usage	Intermittent usage

Figure 2:

Pressure Compensation System



■ **Deep water: from 1,000 ft. (305 m.) to 6,000 ft (to 1,830 m.)**

Every 10 meters, the water column increases the environmental pressure by 1 bar; thus, at a depth of 5,000 meters the ambient pressure is 500 bar. At these depths, all work is done with remote control systems and subsea robots such as ROVs (Remote Operated Vehicles) or AUVs (Autonomous Underwater Vehicles). Here, components become exposed to high external water pressures, which may require special design features like pressure compensation or structural modifications to accommodate the increased pressures.

These depths are typically found significantly far from shore, requiring floating operational facilities such as ships and platforms, creating further challenges.

■ **Ultra -deep water: From 6,000 ft (1,830 m) to 35,800 ft (10,911m)**

Beyond 6,000 ft, there is much less experience of subsea equipment (outside of military applications and research vessels). As depths increase, even the engineering of hoisting and tether equipment construction must change, to accommodate the dimensions and weight of the systems as they increase with the water depth. Furthermore, the ocean conditions become harsher, such as the size of waves or the forces caused by maritime currents.

The Subsea Enabler: Robotics

Since divers can't operate below 100 meters, the bulk of subsea activities must be performed by ROVs and AUVs, complex systems which utilize extensive electromechanical and electrohydraulic subsystems to accomplish tasks. Their operational depths can be in any range. Typically, robots are not submerged for long periods of time. However, it is critical they are ready when needed, and if they malfunction the downtime must be kept to a minimum.

Hydraulic drives can prove their full strength in these machines: they are powerful, compact, precise, intelligent and rugged, providing excellent power density and adroit flexibility for a wide range of tasks. ROV/AUV developers continue to seek more sophisticated performance and reliability from the electrohydraulics systems integrated into their machines.

Subsea Design Requirements

Successful growth of many subsea applications depends upon equipment that can be reliably and safely deployed and operated over extensive periods of time, without requiring overly-expensive en-

Subsea Industry Challenges

Several key industries already undertake significant subsea activities—here are some hydraulics-related challenges they face:

Oil and gas production

- The move to deep and ultra-deep water drilling is forcing more process equipment from surface to subsea
- Key requirements are ultra-high reliability, ability to install and maintain utilizing ROVs/AUVs technology
- Expected operating lifetimes are for the life of the field, typically covering 25 to 30 years
- New techniques to accurately simulate the performance of a hydraulic system across this timeframe becomes a key success factor

Subsea mining

- Most mining occurs in shallow water using current dredging technology
- As mining moves to deep and ultra-deep water in near future, ruggedness and long term durability will be crucial
- Several companies currently developing large remotely operated mining vehicles.
- Transport of bulk materials over long distances while overcoming additional water weight is key challenge

Communication & Power Transmission

- Infrastructure facilities, such as communication cable crossing the Atlantic Ocean, are subject to different underwater geography conditions, including different water depths and complex deep ocean currents
- Regular inspection and repair of power and communications cables in deep sea regions most significant
- Heavy dependence on ROV's or AUV's using hydraulics

Natural science

- Special observations ROV's and AUV's are under development
- Key capabilities include reliable operation of both moveable observation equipment—cameras and other sensors—and mobile sample-gathering tools
- Research locations are widely varied in terms of depths, salinity, currents and other conditions
- Reliability is ultra-crucial: failure of a ROV for even a day can drastically impact researchers with limited time and funding to complete projects

gineering, operating and repair costs. There are built-in costs for subsea work that are unavoidable: operating equipment at a distance with remote devices, and dealing with external water pressure and corrosion conditions. Careful planning and a willingness to integrate smart design principles into subsea hydraulic systems make it possible to accomplish these goals cost-effectively.

Pressure Compensation

Pressure compensation is useful in any system which operates below water. It is used to keep the pressure between external environment (seawater) and reservoir constant, as seals are typically designed for the pressure drop in one particular direction and limited to a specified amount.

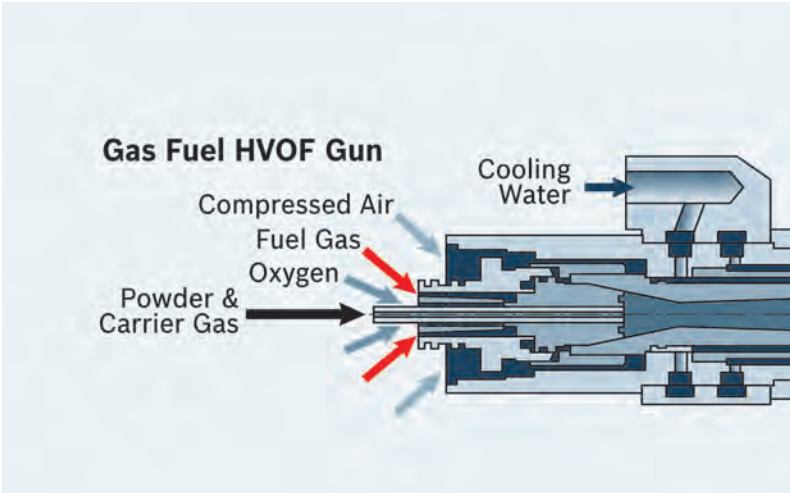
Most components readily available on the market were designed for operation in normal surface environments. Almost all machines have sealing surfaces or parts which cannot withstand high subsea external pressures or high pressure drops. One option—more difficult and expensive—is to seal pressure-sensitive components inside a protective chamber. This is usually a container with rigid construction and heavy duty seals to withstand the high external pressures.

A more effective solution is called pressure compensation. Using this system a pressure is applied inside the component equal and opposite to the ambient pressure outside. In a typical hydraulic system, the standard reservoir is replaced with a sealed reservoir containing a flexible medium separator.

In this way the external environment pressure is transferred to the reservoir, just as a normal surface system has the external air pressure on top of the oil in the reservoir. The difference is the seawater is prevented from mixing with the oil. Through this clever system any component used on the surface can be used subsea as long as all volumes that normally contain air

Figure 3:

HVOF Coating Technology for Large Hydraulic Cylinders



can be vacated of air filled with fluid and connected to the reservoir to maintain the pressure balance.

Corrosion Protection and Sealing

On offshore machines, it is common to have a seal, sealing surface, seawater, and some other medium in contact and interacting with each other. On large hydraulic cylinders, for example, maintaining the integrity of the cylinder rod, which is routinely exposed to environmental conditions in operation, is essential for maintaining the long-term operating life of the system.

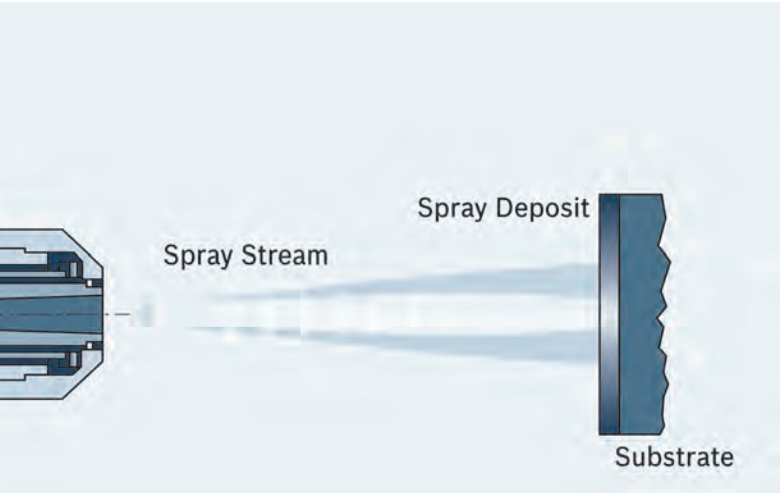
The rod surface needs an appropriate coating to provide a good and durable base for the cylinder's tribological system between the cylinder head and the piston rod. There have been major advances in cylinder coating technologies, including metallic/metal mix systems applied with high velocity oxygen flame (HVOF) or cobalt alloy coatings applied via plasma arc welding.

In hydraulic actuator design there is always an interaction between seals, fluid, and material surface. The study of these three items is known as tribology. Knowledge of this is critical for system designers, to both keep seawater out of a system and keep the hydraulic fluid in.

Human Safety and Environmental Protection

Equipment engineered for subsea applications must protect both people and the ocean environment from any damage. For deep water and ultra-deep water operations, surface operators need protection from equipment failures during the whole life cycle of the subsea system.

Subsea operations are carried out in environmentally sensitive areas. Hydraulic systems that follow safety principles, such as fail-safe systems that use a de-energization principle,



where the system automatically moves to a safe position if the power supply is cut off, are examples of systems with safety engineered-in.

These principles of risk assessment and functional safety have been established through international standards such as ISO 12100, ISO 13849 and ISO 4413.

Reliability and Availability

The reliability of subsea equipment with a projected long lifetime of 30 years in such a harsh environment is one of the largest challenges for the industry today. Reliable hydraulic system design for subsea application can apply different approaches at the same time:

- *Usage of components with a high degree of reliability: if available, a reliability indicator shall be used for comparison such as MTTF, B10 or Weibull distributions.*
- *Redundancy — when possible and more cost-effective redundant architecture can be installed for higher system reliability: in some case, more than two components may be needed to support each other.*
- *Integration of failure diagnostic features, such as suitable sensors as well as the correct algorithm for processing the information to detect a failure and decide the correct reaction.*

In oil and gas applications, field operators expect to use subsea equipment during a well location's entire service life (30 years or more) with minimal maintenance. Suitable sensors have to be designed, integrated and pressure-proven to detect failures and, if possible, anticipate future failures by including condition monitoring functions.

Designing for Safe and Reliable Subsea Ops

At multiple frontiers and across multiple industries, subsea applications continue to grow. The safe, reliable and effective development of such opportunities has already been proven. However, as industries move deeper under the ocean, certain fundamental technical challenges increase, particularly for hydraulically-driven systems.

These challenges can be met through a combination of standard, "off-the-shelf" systems proven to operate in rugged conditions on the land, with suitable adaptations (such as pressure compensation) and smart, cost-effective application of more advanced materials where needed. This approach can ultimately enable a more cost-effective approach to subsea development and wider access to the potential resources this emerging "frontier" offers.

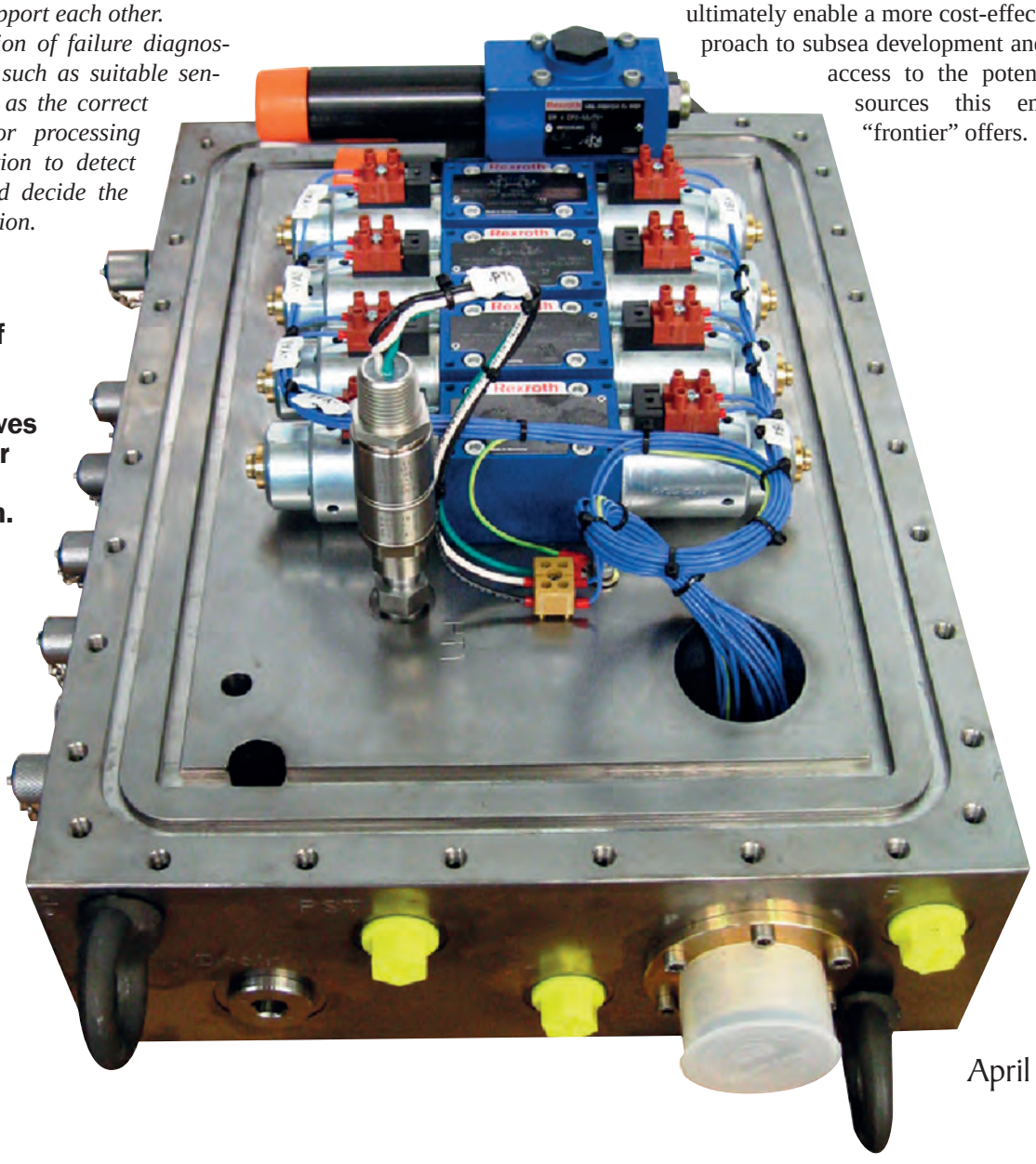


Figure 4: **Example of industrial electrohydraulic valves adapted for subsea application.**

Interview with Graham Hine

Launched to listen to the songs of humpback whales, Liquid Robotics has evolved into a harvester of data from the sea. Graham Hine of Liquid Robotics shares with MTR his insights on the future direction of unmanned underwater systems, and more specifically, his company's role.

By Greg Trauthwein, Editor

Mr. Hine, please tell us a bit about yourself.

I am Graham Hine, Senior Vice President of Product Management and one of the founders of Liquid Robotics. By training I'm a software engineer and started my career at Centigram developing embedded systems. Entrepreneurial ventures hold a special place in my heart and I've had the good fortune to participate in them throughout my career, participating at every level and starting two of my own. As a kid, I was accused of being a fish in the ocean, always the last out of the water at the beach. At Liquid Robotics, I've been able to marry these two joys of mine, building a company from the ground up that's helping the world better understand our oceans.

For the benefit of our readers, briefly describe your company and your specific offering to the AUV market.

Our genesis began on the Big Island of Hawai'i where the Wave Glider was born. Joe Rizzi, the chairman of the Jupiter Research Foundation, had a love for the song of the Humpback Whales as they wintered in Hawai'i. He set off to design a way to capture their singing and pipe it to shore. After a few years of experimentation, he enlisted my Dad and brother, Derek and Roger Hine, to come up with a design. A mechanical engineer, Roger figured out a way to convert the up and down motion of ocean waves into forward thrust. By harvesting the energy of the ocean waves you don't need fuel. You don't produce emissions and you can stay out for long periods of time.

In 2005, we began extensive prototyping and testing. We started with a model of a Wave Glider in a fish aquarium and then advanced to my pool and then to sea. We quickly realized we had a product that had broad commercial application and one that could help better measure and understand our oceans.

In January of 2007, Liquid Robotics was incorporated. Since this time, we've built and deployed over 300 Wave Gliders, amassed over 425,000 nautical miles at sea, navigated and communicated through 16 hurricane-class storms and conducted 100s of customer missions globally in some of the harshest ocean conditions in the world – from the Arctic and Antarctica.

So summarize the company's offering today.

We produce and sell the Wave Glider. It's the world's first wave and solar propelled, Unmanned Surface Vehicle (USV). What is important is we're at the surface of the ocean. We are able to persistently collect and communicate data at the boundary between the sea and air. Think of us as the communications hub connecting the undersea world of acoustics to the world of air and radio. This is vitally important since, until now, there has not been a cost effective, long endurance, unmanned platform that can bridge undersea sensors or vessels to aerial, shore, or space systems. We describe this capability as seafloor-to-space communications.

The Wave Glider is equipped with sophisticated sensors, computing, communications and navigation systems and

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can be sent off across an ocean or to a specific location to observe and monitor for months or up to a year at a time. We are able to accomplish this without using fuel, without manpower, and without harming the environment. A few examples of how we help commercial and government customers are:

- *Scientists can get real time information from seafloor tsunami sensors to warn coastal communities if they are threatened.*
- *Governments can detect illegal offshore activities such as smuggling, unlicensed fishing, and environmental damage.*
- *Oil & Gas companies can better monitor their subsea infrastructure.*
- *Commercial sites can communicate with their AUVs and submarines instead of waiting for them to surface to find how their jobs are going.*

Describe the trajectory of AUV use over the past five years.

Looking back five years in the AUV market, I think about where Liquid Robotics was in 2010. At that time, we had been conducting extensive, long duration mission testing of the Wave Glider and had just begun selling commercially to the Navy and Oil & Gas companies. We learned a great deal with systems at sea for months and actually our longest has been 2. 5 years. There were challenges – bio-fouling, shark bites and more. But the platform had proven itself to us, and we knew we could prove this technology to the world and that there was a market.

Over the next five years, we focused on safety, durability, software and sensor integration and worked with partners to create affordable solutions. Other AUVs/ASVs manufacturers have also focused on improving performance, duration at sea, and remote capabilities. The AUV/ASV industry has come a long way in the past five years, proving the effectiveness of the technologies and ability of these systems to conduct missions not feasible by manned systems.

How would you describe the maturity of the market today?

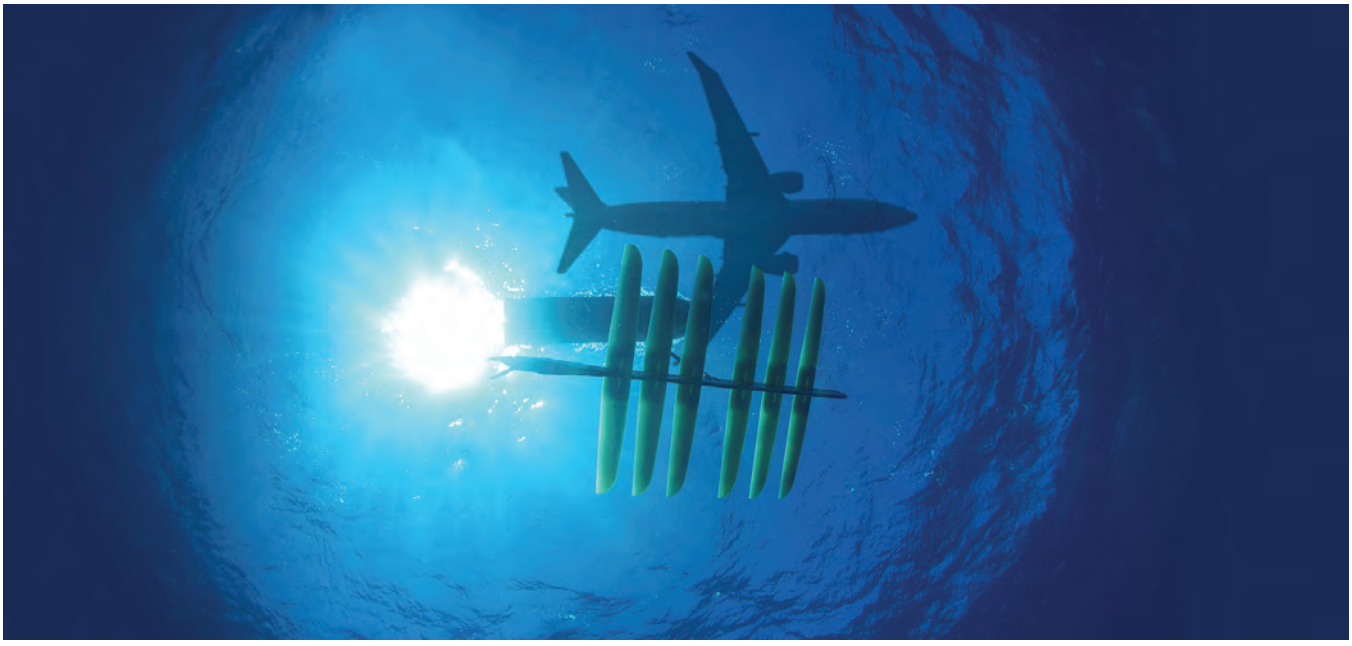
We're at an exciting time in the unmanned systems market and at the beginning or initial stages of commercial acceptance of the AUV technology. In my view, the market is still in the early stages of adoption and customers are just beginning to understand how transformative AUV and ASV technology will be.

However, the ASV/AUV path was paved by our unmanned aerial companies who, decades ago, were where the AUV maritime world is today and are now experiencing a rapid and sustained market growth. Customers today understand the cost and risk mitigation benefits of unmanned systems. However, the primary markets have a historically slow adoption rate. Specifically, I'm referencing the Oil & Gas and Government markets. These markets are showing encouraging signs as they are now incorporating unmanned vehicles in their long range strategic planning and budgets.

In your opinion what are the top technologies that are driving the AUV market further, faster, today?

In my view it is straightforward. The first is the advancement in commercial computing and communications.

Dr. James Gosling, the creator of JAVA, is our Chief Software Architect and has guided the team that designed Regulus, the Wave Glider operating environment based on Linux and of course, JAVA. In my opinion, software innovation and application development for unmanned systems is the most exciting field and will have the biggest impact on business growth and scientific discovery.



The technologies are increasing in performance while decreasing in power consumption and price. This enables companies like us to design more compute and communication capabilities into the platform making it possible to compute and process data at sea versus waiting to do so on shore. The more processing and application intelligence we can move to the ocean the greater our abilities to understand the dynamics at the surface and subsurface.Second are software technologies with an emphasis on autonomy. The intelligence of the USV comes from the operating environment. Deploying 100s to 1000s of USVs, ROVs, AUVs and other unmanned systems requires sophisticated, open standards based software to enable interoperability, communications and safety at sea. At Liquid Robotics, we've invested greatly in this area and have one of the world's best software engineers leading our architecture. Dr. James Gosling, the creator of JAVA, is our Chief Software Architect and has guided the team that designed Regulus, the Wave Glider operating environment based on Linux and of course, JAVA. In my opinion, software innovation and application development for unmanned systems is the most exciting field and will have the biggest impact on business growth and scientific discovery.

When we discuss unmanned systems, particularly ROVs, we often discuss "getting the diver out of the water." From where you sit, what are the main market uses today and how (or is) that changing.

It's become almost cliché to say that robotics are best applied to dull, dirty, and dangerous tasks. ROVs have, in many of the most dangerous cases, taken the "diver out of the water." Persistent (long duration) USV's like Wave Glider are helping to keep the "sailor out of the storm." This allows offshore energy companies to explore when they could not otherwise economically do so. It allows regulators to insist on monitoring they could not otherwise contemplate. And it enables mankind to be a better custodian of our marine resources. These market uses: exploration and survey, environmental and meteorological assessment, and surveillance and assessment will see unmanned surface vehicles in uses around the globe.

How is your company investing?

Liquid Robotics is investing heavily in engineering in the areas of safety, power systems/management, platform reli-

ability, software (both core systems and data delivery) and integration tools. Our strategy is to develop the world's best, unmanned surface vehicle and work with partners to innovate and integrate sensors, payloads and develop applications. It's important to build out software and hardware integrator's toolkits for easy integration and support with training and go-to-market programs.

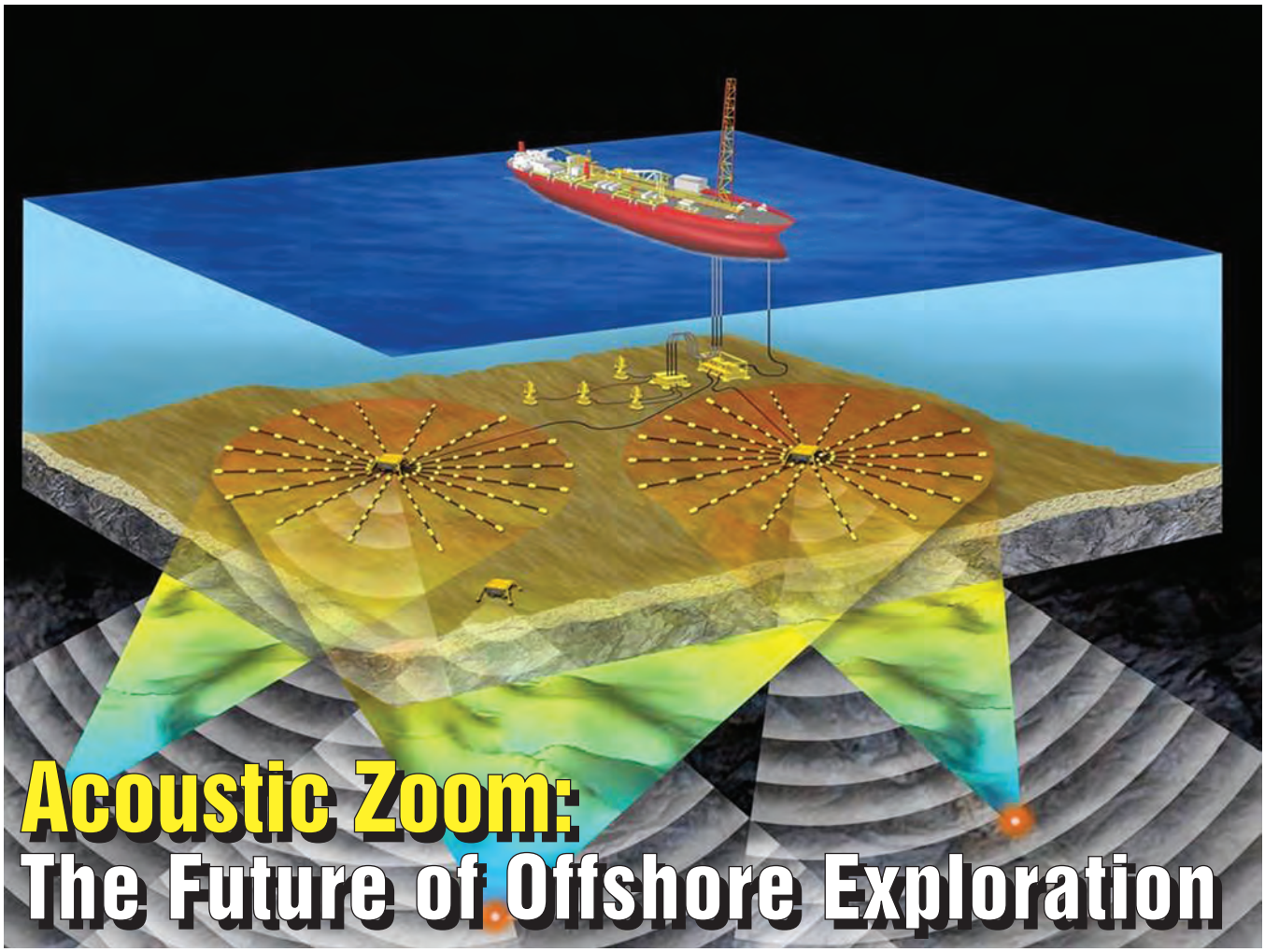
Big picture, what signs or indicators do you monitor to gauge the future direction of the market? What are those signs/indicators telling you now?

As we discussed, we see many positive indicators regarding the health of the AUV market. Historically slow unmanned systems adopters such as the Oil & Gas customers are now increasing their use of AUVs, ROVs, and ASVs for environmental monitoring, meteorology/oceanography, and security. Their pilots and proof of concepts using ASVs in some of the harshest environments such as the Arctic have shown great success. In the Navy the Chief of Naval Operations is mandating the use of unmanned systems to augment naval assets for enhanced and cost effective surveillance for underwater warfare. These are very encouraging signs for the health of the AUV/ASV market.

Please provide one case study where your system was deployed to complete an operation more safely and/or efficiently.

Many missions come to mind, yet I'll share the NOAA Pacific Marine Environmental Laboratory (PMEL) mission in the Arctic. As part of a multidisplenary mission, two Wave Gliders were deployed in the Beaufort Sea for two months. Their task was to measure the water temperatures at the sea-air interface to determine how the melting galciers were affecting the oceans' temperatures. After collecting 900,000 measurements, while being calibrated against U.S. satellites and NOAA buoys, the Wave Gliders were able to collect data in greater densities and in greater resolution than ever before. The in-situ findings determined the water temperatures were higher than previously meausured. The NOAA PMEIL case study, named "Is there a ''new normal'' climate in the Beaufort Sea?" can be found at the url:

www.polarresearch.net/index.php/polar/article/view/19552



Acoustic Zoom: The Future of Offshore Exploration

Since industrial oil extraction began in the mid-19th century, civilization has gradually turned to new offshore resources to meet global energy demands. As the industry ventures further into polar and deep-water regions, the complexity of today's exploration projects continues to rise. Given the falling oil prices and rising production costs, current market dynamics will become a catalyst for changes in conventional explorative and extraction practices. A new approach for seismic surveying developed by researchers at the University of Bath, offers a resolution and efficiency beyond the reach of existing seismic methods, reducing the need of unnecessary drilling and the associated impact to the marine environment.

Image above: Diagram of the Acoustic Zoom method being used on the seabed.

The UKs industry body, Oil & Gas UK, recently reported the worst annual performance for four decades. In 2014, the UK oil and gas sector invested $7.8 billion more than the total annual earnings. Due to surging costs, exploration in the offshore fields is also on a continuing downward trend.

According to the World Ocean Review, the total global energy consumption has risen by about 70% over the past three decades. In addition, the International Energy Agency (IEA) in Paris estimates that consumption will grow by a further 50% by 2030. While worldwide energy consumption appears to be on the rise, insipid economic growth combined with increased production activities in various countries has led to a drop in oil prices from $110 to less than $50 a barrel.

The UKs industry body, Oil & Gas UK, recently reported the worst annual performance for four decades. In 2014, the UK oil and gas sector invested $7.8 billion more than the total annual earnings. Due to surging costs, exploration in the offshore fields is also on a continuing downward trend.

Improvements in both cost and efficiency up to 40% per barrel

may be required for the UK to maintain a sustainable future in the oil and gas sector. In an industry traditionally resistant to change, new approaches will need to be established in order to affordably meet the rising demands of the global energy market.

"The key is to be smart. We need to gather a more comprehensive, detailed knowledge of the environment and the geology before attempting to drill," said Prof. Jacques Yves Guigné, inventor and developer of Acoustic Zoom. "For instance, brute strength drilling and hope for the best is not an option anymore. Higher definition and more reliable imaging is needed to delineate in advance and effectively assess potential in a deep water or polar site, especially in complex conditions."

Given today's prices and concerns for the environment, balancing industry overheads and marine impacts are paramount to both success and profitability. The changing market is set to drive the need for advanced remote sensing solutions which not only offer higher resolution and improved performance, but reduce the cost to both the industry and the ocean.

Oil and Gas Exploration

Seismic survey techniques are used to produce an image of the rock formations beneath the seabed and identify potential oil and gas deposits in sedimentary basins. Exploration and appraisal drilling can then determine the type and volume of any accumulations present.

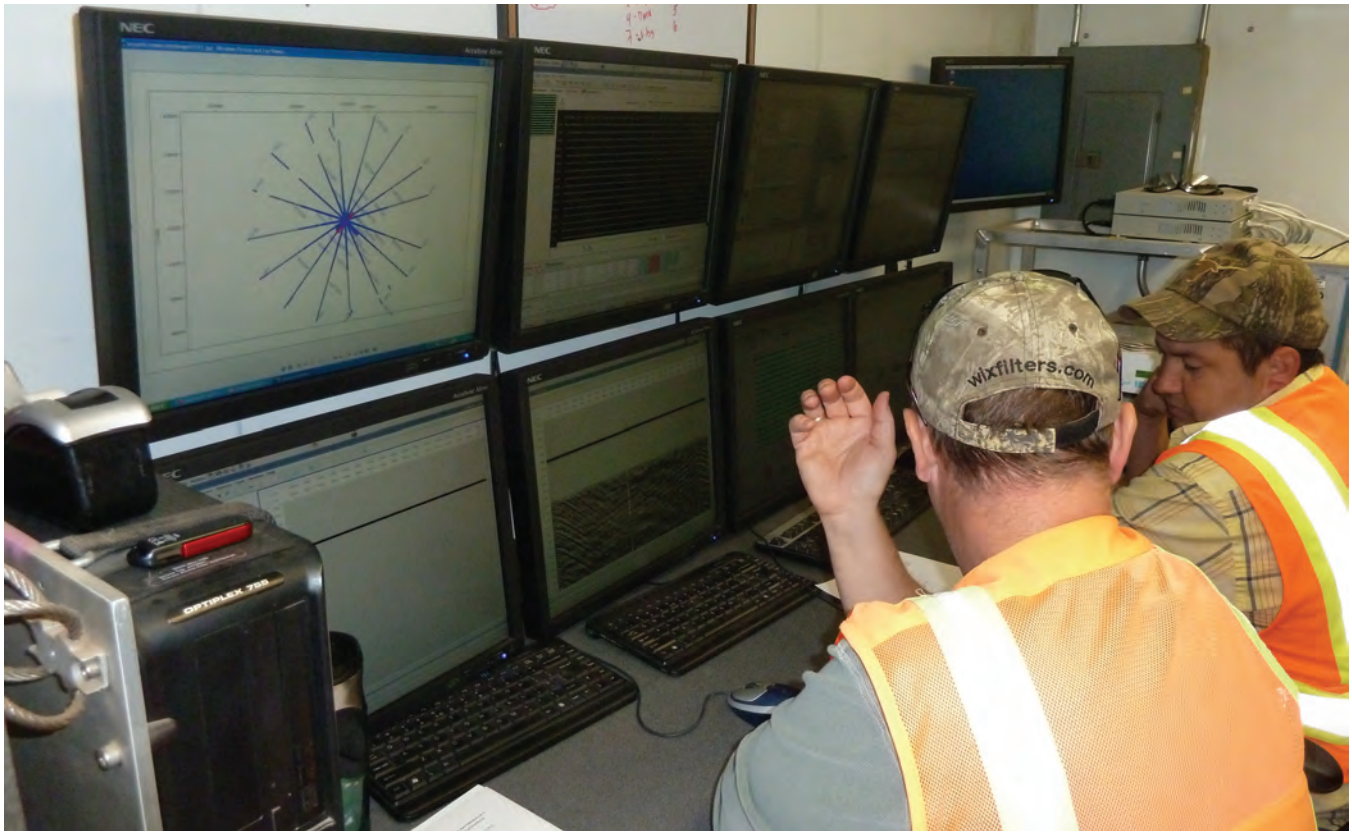
Seismic surveys follow a similar general principle of echolocation or sonar. A ship-towed array of multiple airguns sends pulses of sound by a rapid release of compressed air through the water column, towards the seafloor. The sound waves will either refract (bend) or reflect off the seabed and the returning sound is detected by a receiver. The presence of possible deposits in rock formations can be revealed by analyzing the time the waves take to return. Properties of the substrate can be estimated by observing patterns in the returned sound. The problem is that the resolution of such imaging is poor and the sound used to create it can be disruptive to the marine community.

"The issue is that the industry as a whole is very conservative

Acoustic Zoom marine source being taken out to sea.

Developed by Prof. Jacques Guigné and Prof. Nicolas Pace at the University of Bath, Acoustic Zoom is a novel seismic exploration technique adapted from sonar applications …

Acoustic Zoom uses a 16-spoke array set on the ocean floor to measure how the energy is scattered.



The layout of the receivers can be viewed on the data screens.

in adopting innovations until such new approaches have had a long history of proven use. This means changes to current geophysical practices have evolved slowly, often missing out on what could be a more effective seismic survey, better data and enhanced processing of features from such data," said Guigné.

This conservative approach is now being challenged as the industry considers venturing into new targeted offshore fields previously thought too expensive and difficult to exploit. This includes areas such as the Arctic, where exciting geological formations are more subtle and complex, but hold great potential for revealing deposits.

These deposits can be missed or masked by the diffractive nature of the formations that surrounds the potentially rich fields. The necessity to capitalize on these untapped regions encourages acknowledgement that more rapid adoption of innovative imaging methods is necessary.

Acoustic Zoom

Developed by Prof. Jacques Guigné and Prof. Nicolas Pace at the University of Bath, Acoustic Zoom is a novel seismic exploration technique adapted from sonar applications. The principle differs from that of conventional seismic survey which analyzes the reflecting sound energy returned from the seafloor. Instead, Acoustic Zoom uses a 16-spoke array set on the ocean floor to measure how the energy is scattered.

The array transmissions transfer energy as small calculated bursts released slowly over time. As the system is stationary, energy is directed in a localized manner at the seabed and

not the water column, therefore marine mammals and their habitats are typically not disturbed.

The introduction of Acoustic Zoom addresses the need for producing high resolution images of the geology by fully exploiting the use of acoustics in a manner similar to a radio telescope. A principle first used to search galaxies in the mid 1950's and still used today.

"Acoustic Zoom is an 'earth telescope,' a stationary lens from which propagating sounds can be manipulated and made to be directed to "zoom" into a field with unprecedented imaging qualities, capturing the way the sound energy gets redistributed - attenuated, reflected and scattered - all three forming the final but detailed image of the geology," said Guigné. "It also allows a controlled low dose acoustic footprint, gentler on the surrounding environment, limiting the disturbances to fragile marine life. If anything, sea life of all forms has been seen to swim around the system out of curiosity, not out of alarm."

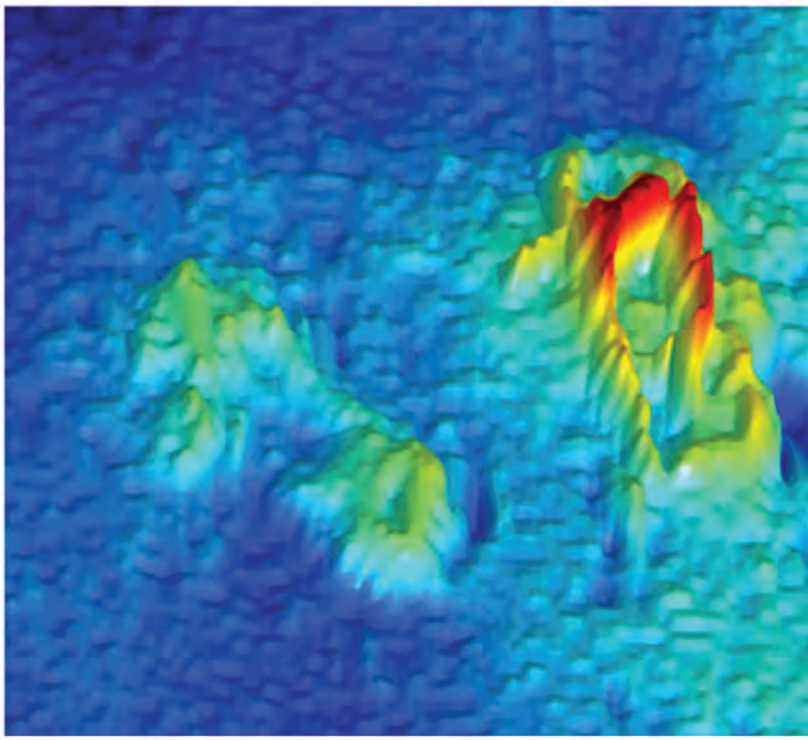
The higher resolution found using this method offers the industry a way of reducing the need for unnecessary drilling in the future. Acoustic Zoom hails the beginning for innovative technologies in this industry, reducing both the associated operational costs as well as the environmental impacts of explorative activities.

Future of Offshore Exploration

Today's regard for safety of personnel and environmental awareness is the central focus of industries' designs. As organizations are reshaped in relation to the drop in oil prices, large ambitious offshore developments have had to be temporarily halted or reappraised. This has led to critical reviews on practices and expenditures.

The complexity of today's exploration projects continues to rise, and the need for aggressive innovation in the seabed seismic segment has never been higher. Technologies which are both safe to operate and cost-effective, will become part of the resurgence in activities.

"There is no question that the oil and gas industry will persist, grow and remain very profitable. It is an industry that when pushed to the edge, responds through better cost effective management practices and adoption of more advanced technologies. Acoustic Zoom is part of this changing tableau and will over time be a recognized evolutionary force for changes to the way we execute exploratory surveying." Guigné.



3D Image Fusion

for Ultra High Resolution Seabed Surveys

By Karl Kenny, President and CEO, Kraken Sonar Inc.

Seafloor mapping is one of the oldest professions known to humankind. Mariners have been measuring the depths under their vessels for thousands of years. The science of measuring and charting the depths to determine the topography of the seafloor is known as bathymetry. Bathymetry is gathered from a variety of sources, including satellites, aircraft, surface ships, submersibles and underwater platforms. Bathymetric data are used to generate navigational charts, 3D models, seafloor profiles and other fusion images. Today, governments, navies, telecom companies, offshore energy corporations and scientific institutions map the seafloor for many applications. Knowledge about the seafloor is imperative to better understand our oceans.

Our perception of the ocean floor has expanded through the use of 3D geospatial applications. However, most 3D bathymetry maps that historically represent continuous global seafloor coverage are artist renditions. It wasn't until recently that concerted efforts have been made to compile sonar bathymetric data in the public and classified domains to produce higher-resolution 3D digital terrain models of the seafloor Given that seabed surveys are often conducted in areas for which little *a-priori* information is available, the real-time generation of 3D seabed maps will significantly improve our ability to explore and understand the seafloor environment.

While conventional sonars are commonly used for seafloor imaging and bathymetry, they suffer from some basic limitations. Firstly, the imaging resolution, or the system's ability to distinguish closely spaced objects, is not constant but degrades with range. In Synthetic Aperture Sonar (SAS), these limitations are overcome by using the sonar platform's trajectory. The forward motion of the sonar is used to synthesise an array that is much longer than its physical length by combining multiple pings in software rather than adding more hardware as a way to gain higher resolutions.

Figure 1 (above): Synthetic Aperture Image and co-registered bathymetry of automobiles on sea floor. Note the correlation between imagery and bathymetry features, such as the open doors, and collapsed roof.

SAS uses sophisticated signal processing techniques to compare the multiple observations of the same area of seafloor to calculate its depth. The image resolution of the seabed is significantly increased – often by an order of magnitude - compared to conventional sidescan sonar. In essence, the resolution becomes independent of range and of frequency. SAS systems can achieve an image and bathymetry resolution of a few centimeters even in very deep waters.

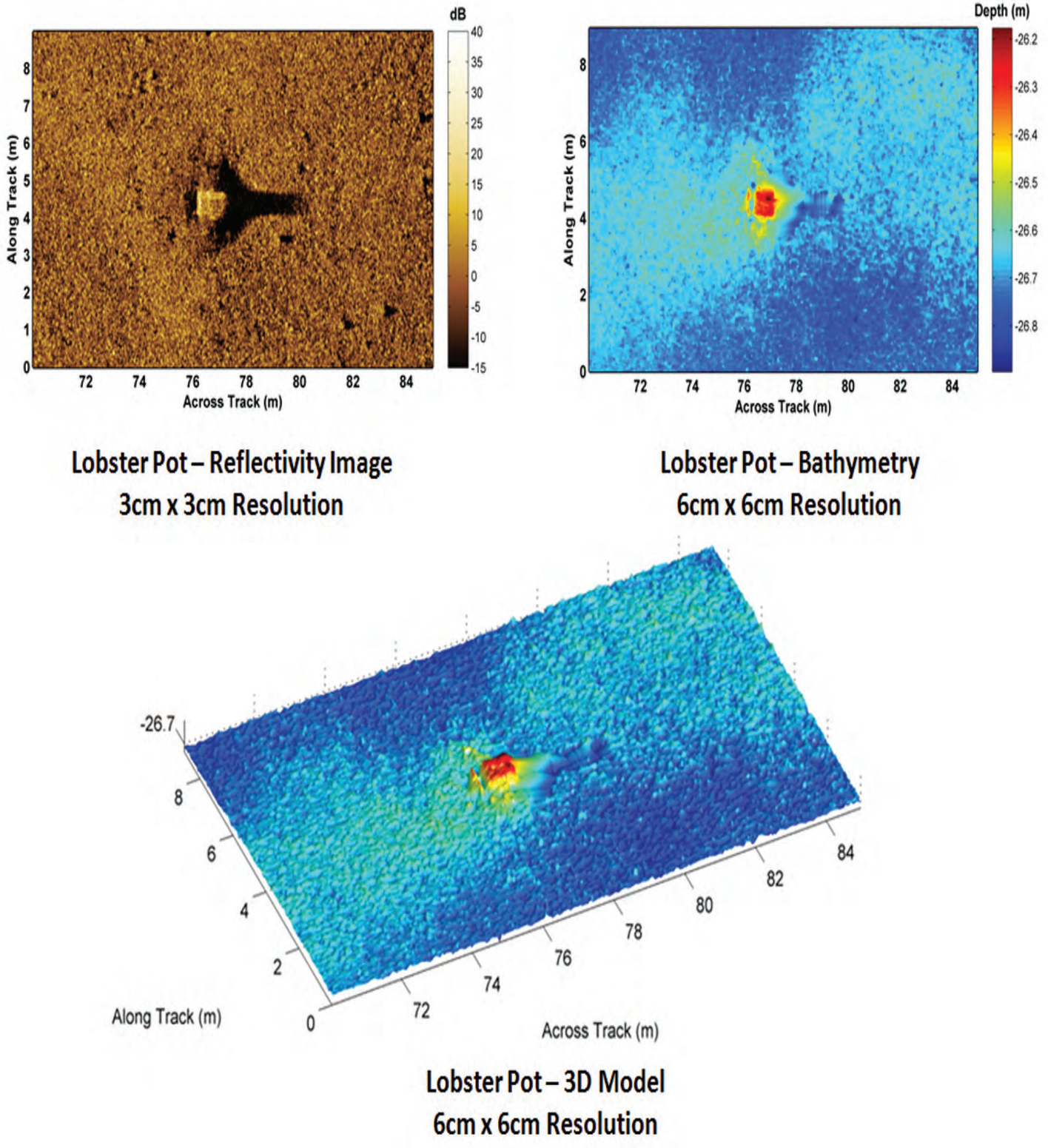
Figure 1 shows a simultaneously co-registered INSAS reflectivity image and 3D bathymetry of discarded automobiles in Halifax, Nova Scotia collected during sea trials with the Defence Research Development Canada.

While SAS has been around for over a decade, military applications such as naval mine countermeasures have been its major development driver. However, SAS is a multi-use technology with great potential for offshore oil and gas surveying, hydrographic surveys, underwater archaeology, benthic habitat mapping and deep sea mining. The viability of SAS as a high resolution survey sensor seems a logical progression for the industry with the additional benefits of increased data quality, better resolution and a pathway to a deliverable of more integrated data fusion surveys.

In addition to reflectivity images, SAS can produce highly detailed topographic maps of the seafloor by detecting the angle of arrival of seabed echoes coming from a given range bin. In a configuration known as Interferometric SAS (INSAS), two vertically separated arrays produce bathymetric maps that are exactly co-registered with the corresponding SAS images. This combination of synthetic aperture processing and interferometry solves the problems of limited resolution and coverage rates encountered with conventional swath bathymetric sonars and multibeam echo sounders. When the InSAS bathymetric resolution approaches that of the corresponding SAS image, it becomes possible to overlay the reflectivity and topography to create a true 3D picture of objects on the seabed.

The use of INSAS systems – such as the AquaPix system produced by Kraken Sonar Inc. - is a promising tool for achieving these objectives in both very shallow water and deep water environments. AquaPix® produces real-time, high resolution, three dimensional (3D) digital terrain models of

Figure 2: Note the correlation between the image and bathymetric features.
The blurring behind the target is a by-product of the lack of acoustic data in the shadow region.



the seafloor with bathymetric resolution as low as 5cm x 5cm and simultaneous co-registered imagery resolution as low as 3cm x 3cm.

With high resolution INSAS it is possible to use image fusion techniques to combine the bathymetric data with the reflectivity data to create a true 3D representation of objects on the seabed. The ability to generate centimetre-scale resolution in all three dimensions has the potential to provide significant improvements in the detection, classification and identification of small seabed objects.

Figure 2 shows an example of a co-registered INSAS reflectivity imagery and corresponding bathymetry image from a sea trial conducted with the US Naval Undersea Warfare Center, Rhode Island.

The image clearly shows a target of interest at 76 m range across track. When merged with the 3D bathymetry, the dimensions of this target are quickly determined, enabling single-pass detection, classification and identification of the target of interest; it is an abandoned lobster pot.

Image Fusion is a process of combining the relevant information from a set of images of the same scene, into a single image, wherein the resultant fused image will be more informative and complete than any of the input images. One of the goals of image fusion is to create a single enhanced image more suitable for the purpose of human visual perception, object detection and target recognition.

The reliability and overall detail of the image is increased, because of the additional information. Image fusion has become a common term used within medical diagnostics and treatment. The term is used when multiple images of a patient are registered and overlaid or merged to provide additional information. The utilization of Interferometric Synthetic Aperture Sonar to generate high resolution 3D digital terrain models and maps of the seabed is an ideal application of pixel level image fusion.

Seabed survey workloads can significantly increase with the number of images that need simultaneous monitoring. A human observer cannot reliably combine visual information by viewing multiple images separately. Further, the integration of information across multiple human observers is often unreliable. Thus, a seabed survey system that can provide a series of single fused images with more accurate and reliable information than any source image is of great practical value.

The potential advantages of image fusion using Interferometric Synthetic Aperture Sonar are that information can be obtained more accurately, as well as in less time and at a lower cost. These advantages correspond to the pursuit of *complementary, more timely and less costly* information.

Complementary information from co-registered, high resolution imagery and bathymetry data enables potential new features in the underwater environment to be perceived that perhaps are impossible to perceive using just an individual data source. Multiple sensors providing redundant information can also serve to increase reliability in the case of sensor error or failure.

Timely information results when an INSAS system is employed, since the overall system may enable a human operator to reach a conclusion about some property of the environment more rapidly than making decisions based upon data from individual sensors operating at different resolutions and acoustic frequencies.

Less costly information may be obtained from a system using multi-image fusion. For example, a single sensor can be used to obtain performance that could only otherwise be achieved using a combination of expensive multiple sensors.

Multi-sensor image fusion seeks to combine information from different images to obtain more inferences than can be derived from a single image. It is widely recognized as a very efficient tool for improving overall performance in image based applications. When used with Interferometric Synthetic Aperture Sonar it enables ultra high resolution seabed mapping operations to be carried out in a more timely and cost-effective manner.

Memorial University & Understanding Icebergs

By Tom Peters

They can come in all shapes and sizes, silently shuttled along by the currents. The larger versions are white, glistening and beautiful and a potential disaster waiting to happen.

Icebergs off the coast of Newfoundland and Labrador are one of the many products of a harsh North Atlantic environment and a hazard to offshore exploration rigs, drill ships, and platforms. In any given year there could be thousands of bergs, ranging in size from several feet in height and weighing hundreds of thousands of tons to the smaller size, known as Bergy bits, but all equally as dangerous.

Keeping an eye on these floating giants is a full time job several months of the year and requires an action plan by those operating in this environment to thwart off any pending collision.

Suncor, Husky Energy, Statoil and the various shareholders of the Hibernia platform, presently operate off the Newfoundland coast, some at more ice risk than others, but all potentially a target.

"We require all of the operators to have ice management plans which are submitted to us as part of the authorization process and you can't get authorization to operate offshore unless you have an ice management plan," said Sean Kelly with the Canada-Newfoundland and Labrador Offshore Petroleum Board, who also noted the industry "just came out of a pretty heavy ice season."

He said ice management is just one of a number of plans required, all identifying potential risks and what the measures would be to address those risks.

Husky Energy, which operates the Sea Rose FPSO, a floating production vessel for the White Rose field, has dedicated ice observers on offshore facilities during ice season and liaise with a number of companies in terms of monitoring, said Husky's Colleen O'Connell. She said the number of icebergs Husky would deal with annually varies according to ice conditions.

And Suncor, the major partner and operator of the Terra Nova field, just over 200 miles southeast of St. John's, has an

ice management program that monitors and deflects icebergs when required. Support vessels can encircle the berg with a cable or net and change its direction or use water cannons or wash from a vessel's propellers to put the iceberg on a different course.

Neil Riggs, an iceberg expert and senior project manager, Autonomous Ocean Systems Laboratory (AOSL), Faculty of Engineering and Applied Sciences at Memorial University, in St. John's, NL, put some perspective on the iceberg count.

"If you draw a line of latitude from St. John's, going eastward, that is almost 48 degrees north latitude, that is the index line that the International Ice Patrol uses and the Canadian Iceberg Service to determine how severe an iceberg year is. So the number of icebergs that cross the line south, that is the measure. So if the number is a 1,000 or more or even a few hundred or more, these installations are in potential jeopardy," he said.

"These people who operate these things (offshore operations) are obsessed with iceberg management which means detect-

AOSL staff transporting the unmanned “spar shaped” vehicle to a test tank.

ing icebergs that are going to come upon you at some point," Riggs said. "They go quite far north to look for them and then they track them by aerial surveys and sometimes satellites. As the bergs get closer they are using modeling software to predict how the bergs are going to drift and come up with a probability that there could be a collision or what will be the closest point of the iceberg to the installation. They will deploy various mitigation strategies, depending on what the models are telling them. Mitigating may mean towing the icebergs to maybe going out and attacking them with a fire hose to make them go away or take a different drift path," Riggs said.

Nearly 100% of the icebergs heading down the Newfoundland and Labrador coast come from the west coast of Greenland, said Riggs. Actually, one glacier, the Jakobshaven glacier, is the most productive. The icebergs, some weighing millions of tons, calve off glaciers flowing into Jakobshaven fjord and then drift out into Baffin Bay. "They start heading northwards because that is the way the current flows and then when get around the Lancaster Sound area they basically hang a left and go west and start down Baffin Bay past the Labrador Coast and then to the Grand Banks," said Riggs. Their size is reduced considerably subject to melting in the water but can still be quite large when they reach the Grand Banks.

"Even the small ones can be dangerous. The big bergs can be detected with radar and other means. The smaller ones are not easily seen on radar and often confused with something called sea clutter which is basically reflections from the top of waves. A bergy bit, as they call them, might be two to four metric tons so you can imagine that thing moving a couple of knots and then striking the hull of ship. So the threat is wide in scope," Riggs said.

Tracking the Ice

Helping to determine iceberg flows and developing iceberg behavior modeling are what bring AOSL into the picture. AOSL has undertaken a long-term study into modeling the behavior of icebergs that includes acquiring real world data that will increase the accuracy of predicting the rate and direction of their drift. It will be information that will be available to offshore operations.

”What our lab is about is unmanned systems and using unmanned systems to solve problems for people,” said Riggs. “The unmanned systems we use are the autonomous underwater vehicles (AUVs) and more recently for us autonomous surface craft. The work we are doing here involves using a combination of both of these, using them to measure the above water and underwater shapes of the icebergs and also to measure the current field and in the vicinity of the icebergs as they are drifting along. We want to get that information as we measure it to the folks who want to use it as quickly as possible. It is all in the research and development stage but we are having some good results and hopefully we may be doing some trials in a year or two,” he said.

“One thing we are doing is learning about high persistence, that means unmanned systems that can stay out there for a long time without needing attention,” said Riggs, and AOSL has done some work in that particular field.

The concept was developed at ASOL by director Dr. Ralf Bachmayer and his team.

“It is an unmanned surface craft and it is in the shape of what we call a spar, like a spar buoy or telephone pole. We are now building a propelled spar that will be able to operate by remote control or under its own control. It will be equipped with a lot of instrumentation for measuring above water things like dimensions, size and shape of the iceberg but also weather, sea state, that sort of thing,” Riggs said. “It will also be equipped with a sonar system and other instruments for underwater that will be able to measure the shape of the berg, at least to a certain depth. We have other technology we are developing in concert with that (the spar) that will allow us to see the whole iceberg. We are adapting a particular type of underwater autonomous vehicle to be able to circumnavigate an iceberg underwater, like a corkscrew,” said Riggs. The vehicle is equipped with sonar and will be able to look at the sides of the iceberg as it circles around plus know its position. It will collect data that can be processed later into a shape and size estimation. With information collected from the surface craft and the sub-surface craft “we can put all the data together and come up with an estimate of underwater size and shape,” Riggs said. The technology also measures currents and other vital data pertaining to the icebergs with the view to get it to people who want to use it as quickly as possible.

AOSL hopes to have the spar technology in the water for testing in early 2015 and have it ready for testing in the North Atlantic by summer of 2015.

Riggs said AOSL also works co-operatively with the National Research Council of Canada which has also developed new iceberg modeling.

“They have put together the biggest database of underwater shapes of icebergs probably in the world,” said Riggs. “They

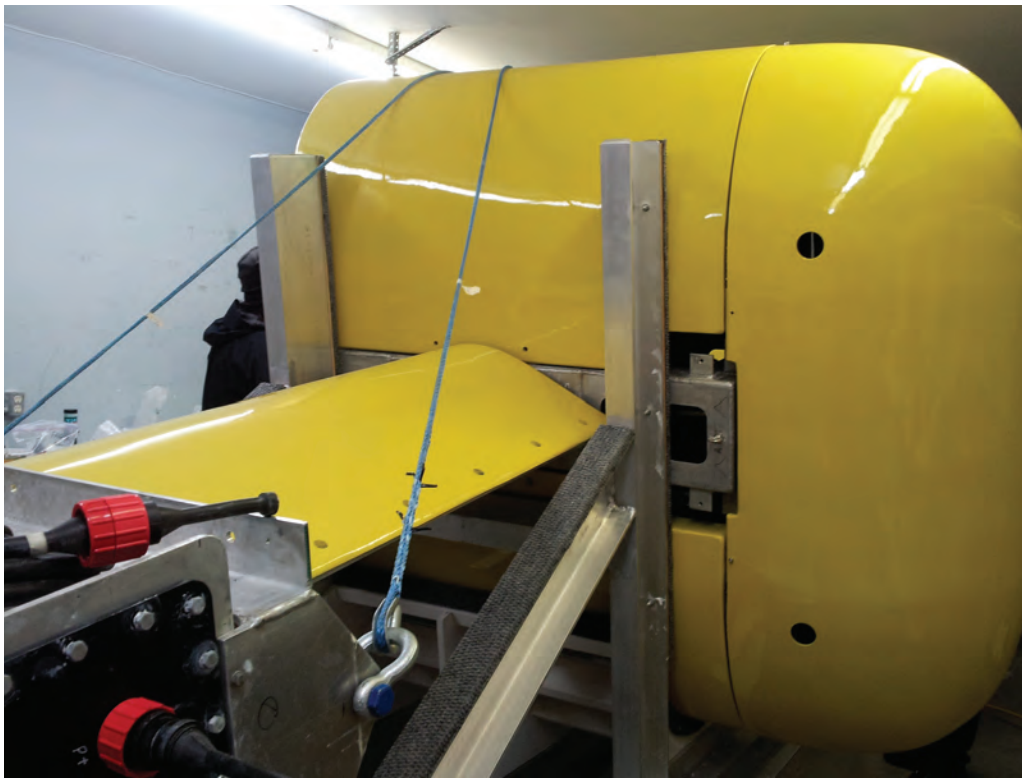
have shared that with us and we have used in our R&D work. Basically we have developed a technique in processing it in such a way that when we make a measurement underwater on the shape of an iceberg, we can use their experience in the data they have collected on how accurate our estimation is on the underwater shape and size."

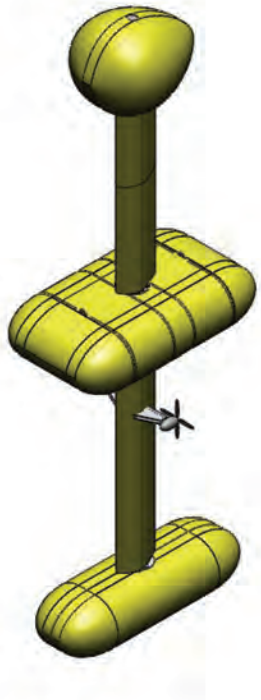
Aside from industry benefitting from the AOSL work, the International Ice Patrol (IIP), which falls under the U.S. Coast Guard and has a mandate to monitor iceberg danger in the North Atlantic and provide relevant iceberg warning products to the maritime community, may also see some benefit.

Michael Hicks, with the IIP, said the ice patrol "would benefit from the availability of actual iceberg drift (and deterioration) data to validate the iceberg drift model that we presently use as well as to assess the operational effectiveness of other models that come available."

He said the IIP has used satellite tracked beacons deployed on icebergs but that has not proven to be totally effective because iceberg surfaces are irregularly shaped and the icebergs tend to roll and break apart.

He said data from an autonomous vessel that can reliably detect and track and iceberg over a lengthy period would be a useful model for validation purposes.





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Incat-design DSV Delivered

Sistac Victoria, a purpose-built RINA-classed, DP-2 monohull dive support vessel intended for service in Brazilian offshore waters has been delivered to Sistac Sistemas De Acesso S.A. The vessel was designed by Incat Crowther in collaboration with the vessel's builder, SeaSafe Barcos Manufacturados S.A. in Angra dos Reis, Brazil. Four Scania DI13 main engines driving Hamilton HM 521 waterjets through ZF 665 gearboxes supplies propulsion power to the vessel. Diver safety and maneuverability were key drivers in the selection of waterjet propulsion, the designer said, adding that station-keeping and maneuverability are further enhanced by three Thrustmaster 30TT200 tunnel bow thrusters. Main electrical power is supplied by four Scania DI13, 375 ekW gensets. The Sistac Victoria's aft working deck includes multiple A-frame assemblies with integrated winches for ROV and dive bell launching and retrieving as well as a knuckle boom crane for handling deck gear and a small rescue/service vessel. The aft deck also features a lower platform at the stern to facilitate direct access to the sea by diving personnel. Completing the aft deck arrangement is a dive shop and dive control center, which is centrally located on the aft deck. The interior of the main deck house includes an emergency generator space, a decompression chamber, office, TV/entertainment room, meeting room, lunch room, galley with generously sized freezer, cooler, and pantry, and three single-berth cabins with ensuite bathrooms for senior personnel.

Below decks are accommodations for the 33 crew and dive personnel, which are designed as two-, three-, and four-berth cabins, each with their own ensuite bathrooms.

Photo: Incat Crowther

New Survey Vessel to Fugro

Fugro America, built by Thoma-Sea Marine Construction in Louisiana, was delivered to Fugro in mid-March. The new vessel is designed to Fugro's specifications, fitted with the latest geophysical survey equipment and houses some of the most advanced instrumentation in the field. Fugro Americas is optimized for working in the Gulf of Mexico, but is also suited for operations in other geographical areas, being permanently mobilized and available for rapid deployment to locations throughout North and South America as well as the Caribbean.

Fugro said the 59-m-long vessel is capable of carrying out a range of offshore services including high resolution geophysical and light geotechnical surveys in water depths of up to 4,500m. Fugro Americas is built to operate Fugro's new 4,500m-rated Hugin 1000 Autonomous Underwater Vehicle (AUV), Echo Surveyor VII, which was delivered in December 2014. Specialist equipment on the new survey vessel includes a dynamic positioning system and state-of-the-art survey systems, including a deep water EM302 multibeam echosounder to be used for gas seep surveys.

Strategic Delivers StratCat to Njord Offshore

Strategic Marine delivered a world's first to European windfarm service sector operator, Njord Offshore. This vessel builds on the success of the first eight 21m vessels built for Njord by Strategic Marine. The StratCat, a multipurpose service vessel capable of transporting up to 24 crew, is first in its class in three particulars.

The StratCat is the first of four in a series of 26m vessels ordered by UK-based Njord. Strategic, a member of the TriYards Group with facilities in Australia, Singapore and Vietnam, previously built eight 21m crew transport vessels for Njord which, like these larger new vessels, were purpose-made to spearhead the European windfarm service industry in quality, operability and crew comfort.

The StratCat cruises at 25 knots via quad installation of Volvo IPS drive units, each generating 700hp for total 2,800hp.

The vessel is also capable of achieving 23knots in redundancy mode with one main engine down. Its intuitive joystick docking (main control, two wing joysticks and rescue zone joystick) and dynamic positioning system allow precision control when maneuvering onto a wind turbine, exceeding all performance standards at sea and ensuring the greatest possible safety during crew transfers. The boat boasts 77 sq. m. of clear deck and container carriage space, a SWL 2.5ton @ 8m knuckle boom crane, accommodation for 10, shower facilities, full galley and mess, provides a state-of-the-art transport vessel with excellent comfort, handling and thrust.

Fugro Americas (Photo courtesy of Fugro)

Designing HD Camera Platform for the Future

By John Howes

April 2015 will see Imenco bring its latest camera platform, the SubVIS Orca, to market, which will feature HD over Ethernet compatibility.

Three years ago, Imenco reviewed the camera market and took the view that analogue cameras would become a thing of the past, with HD becoming the preferred format over time. When Imenco looked to enhance its new camera developments however, the company not only decided to update the hardware, but also sought to change the actual platform and run the digital format over an Ethernet-based system.

"Ethernet is an increasingly popular way of connecting with subsea equipment," said Jan Wulfsberg, Senior Applications Specialist at Imenco in Norway who has led the development of the new SubVIS Orca camera with his colleague John-Arne Birkeland. "Most sonar for example, are digital and 90% of them work over the internet. We decided to develop a future camera platform that could be added to this network."

"Network integration opens up new possibilities. You can let the camera take one picture at very low frame rate/high resolution or high rate/low resolution. You have all the possibilities that are normally only seen in fixed stills cameras. The main advantage of using Ethernet is that it is a fully proven system developed and paid for by the computer industry. The components are cheap and standardized. An Ethernet control system does not require the numerous racks of electromechanical switches that are the hallmark of many existing pieces of control equipment."

An Ethernet compatible camera can be simply construed as a simple building block within this network. It would be technically possible to plug such a camera into an office Ethernet cable system, type in the IP address and have a picture on any computer screen on the network, with the information recorded on high capacity hard disks.

"When approaching the basic design, we had three main options," said Wulfsberg. "Firstly we could take an off-the-shelf computer board and camera, and insert these fundamental components into a large subsea pressure canister. The second option would be to purchase a closed circuit television (CCTV) Ethernet camera and enclose it in a subsea housing. While some companies have chosen to follow these paths, we thought that they would not allow us to fully control the camera, and how the way it handles video signals, in the manner we would have liked."

"The third option was to take the optical module and purpose-build a computer solution around it." That is precisely what Imenco has done with its new SubVIS Orca camera. "We have effectively built a computer which, in many ways, is analogous to a smart phone, based on the same technology, but without a screen. It employs low power components that have become available at a reasonable cost through mobile phone telephony," said Wulfsberg. "One of the main reasons we decided to invest in building our own computer was to have better control over latency."

Latency is the time taken for a signal at the camera to be received at the monitor. For a subsea camera, it can be practically described as the delay between an action happening underwater, for example, with a manipulator arm, and what the control room sees. The lower latency, the more control the ROV pilots have. Imenco set itself a target of no more than 150 milliseconds. At the moment, results are coming in at 100 milliseconds.

On top of this platform, Imenco intends to build a range of new models, starting with a main ROV camera.

"When we talk with the ROV manufacturers and operators, they recognize that assimilating functionality or smartness into their digital video gives them a competitive edge," said Wolfsburg. "Building the computer system gives us the ability to incorporate applications in the same ways that 'apps' are used in mobile phones." This is helped by having access to the raw format before it is encoded. "A permanently placed camera, for example, can be used to detect leakage while elsewhere the settings may be tailored to recognize collision. While it is not possible to carry out exact measurements, it is possible to make estimates based on what else is in the picture."

While these apps will be available to users, and that third-party software developers may launch others, Imenco anticipates that some companies will integrate the platform into their own

in-house systems. "For this reason, we have made it an open source system," said Wulfsberg. "It is likely that operators will have a good understanding about what they intend to use the platform for. If they want to make changes, we can work together with the customer. However they will also be able to make their own software modifications. The platform allows them to interface with it quite easily."

Typical of these is video picture and enhancement. Imenco intend to introduce options for computer analysis, based on what is displayed in the video. This will help the operator when making decisions. It will do more than just give the ROV pilot a picture. Imenco see that its main benefit is what happens in the back office.

Imenco is currently assembling cameras that companies can integrate with their own control systems for testing. The final versions will be slightly smaller than the prototypes. The basic shape looks slightly like a classic old flashlight with a broader front than the main housing. The SubVIS Orca measures about 140mm at the largest diameter and is around 230mm long. Because the computer electronics sits within the camera body, this limits Imenco's ability to make much smaller versions. Similarly with the lens shape. When Imenco set out to design its next generation camera, the lens became a key consideration.

"The need to improve the lens system is something we learned the hard way," said Wulfsberg. "Over the years, we tried to get the stable supply of water corrective lenses that are necessary for subsea cameras."

When a ray of light passes into a lens, its path deviates because of the refractive index of the glass. This is not significant when the camera operates in air because, if the ray deviates, 10 degrees on entering the lens, it deviates back by the same amount when exiting, effectively cancelling each other out.

"This is not the case, however, when one side is surrounded by water," said Wulfsberg. "The water/glass interface effectively causes the light ray to deviate by about 15%. While a typical camera lens requires a viewing angle of around 72 degrees, the natural refraction in the glass means that the effective viewing angle drops to nearer 50 degrees."

"Designing a lens to produce an effective viewing angle of 72 degrees can produce a fisheye effect, even in a high quality lens. On land, it is possible to buy panoramic lenses that better compensate for the fisheye effect, but we've never found anything that can do that subsea."

"These are far from optically perfect because when the camera zooms, the lens moves mechanically so the focal point in the camera changes. In some cases the image that this produces is acceptable but then soon deteriorates with serious edge distortion."

The solution Imenco has chosen is a double lens system. The first concave glass lens is designed to correct for the water. The second lens is, therefore, incorporated to compensate for the errors that the first lens introduces, and bring the entire image into focus.

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Editorial Calendar

MARINE TECHNOLOGY REPORTER

Issue	Editorial	Bonus Distribution	Ad Close
January/ February	**Underwater Vehicle Annual: ROV, AUV, and UUVs** **Market:** Subsea Engineering: Oil & Gas **Tech:** Harsh Environment Systems for Arctic Ops **Product:** Scientific Deck Machinery	**Arctic Technology Conference** March 23-25, Copenhagen, Denmark **Subsea Tieback** March 3-5, New Orleans, LA	January 21
March	**Oceanographic Instrumentation: Measurement, Process & Analysis** **Market:** U.S. Navy Strategic Initiatives **Tech:** Ocean Business 2015 Technology Spotlight **Product:** Sonar Systems & Seafloor Mapping	**Ocean Business** April 14-16, Southampton, UK **Sea-Air-Space** April 13 - 15 National Harbor, MD	February 18
April	**Offshore Energy Annual** **Market:** Seismic Vessels & Systems **Tech:** Deepwater Positioning, Mooring & Anchoring **Product:** Subsea Vehicles and Systems for Pipeline Survey & Inspection	**Offshore Technology Conference** May 4-7, Houston, TX **AUVSI 2015** May 5-7, Atlanta, GA	March 27
May	**Underwater Defense** **Market:** Offshore Renewable Energy: Wind, Wave & Tide **Tech:** International Naval Technologies **Product:** Remote Sensing & Environmental Monitoring	**MAST Asia** May 13-15, Yokohama, Japan **UDT** June 3-5, Rotterdam, NL	April 24
June	**Hydrographic Survey** **Market:** Comms, Telemetry & Data Processing **Tech:** GPS, Gyro Compasses & MEMS Motion Tracking **Product:** Interconnect: Underwater Cables and Connectors		May 27
July/ August	**MTR100** **The 10th Annual Listing of 100 Leading Subsea Companies** **Market:** Offshore Europe Tech & Trends	 **Offshore Europe** September 8-11, Aberdeen, UK	July 21
September	**Ocean Observation: Gliders, Buoys & Sub-Surface Networks** **Market:** Oil Spill Monitoring & Tracking Systems **Tech:** Seafloor Engineering & Remote Operations **Product:** Geospatial Software Systems for Hydrography	**OTC Brazil** October 26-29, Rio de Janeiro, Brazil **SeaTech Week** October, Brest, France	August 21
October	**AUV Operations** **Market:** Research Vessels **Tech:** ROV Technology: Workclass to Micro Systems **Product:** Underwater Tools and Manipulators	**Oceans 2015** October 19-22, Washington DC **SNAME** November 4-6 Providence, RI	September 25
November/ December	**Subsea Engineering & Construction** **Market:** Fresh Water Monitoring & Sensors **Tech:** Offshore Inspection, Maintenance & Repair (IMR) **Product:** Underwater Imaging: Lights, Cameras & Sonars	**Underwater Intervention 2016** New Orleans	November 26

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New Winch/Lift and Throttle Controls

Customizable Winch and Throttle Controls

Bokam Engineering, Inc., offers a new line of snap-action and place-and-hold single-axis winch and throttle controls. It is designed to provide lateral single-axis controls for a wide range of applications including top side winch, lift and throttle control functions in marine environment-exposed applications. According to the developer, the new line combines the reliability and survivability of the solid state sensor products with a life cycle expectancy of 10 billion life cycles, featuring Bokam's patented rotational motion mechanism and programmable modular microprocessor based electronics. The modular controls come in a wide range of outputs and meet the requirements of practically any control system. With various modular interface handles the building block configuration can be built to meet the interface and mechanical needs of various installations and human factors requirements. Various mounting interface and enclosure packages are available with configurations range from IP56 to IP66 (survivability in heavy seas) and IP69K (survivability during/after high pressure, high temperature wash-down) configurations found in marine applications.

New Joysticks and Hand Controllers

Customizable, Submersible joysticks and controls

Bokam also introduced a new line of submersible and hazardous environments joysticks and controllers. The new line provides both a force or position proportional joysticks and input devices, with a life cycle expectancy of 10 billion life cycles with Bokam's patented rotational motion mechanism and programmable modular microprocessor based electronics. Various mounting interface and enclosure packages are available with configurations range from IP56 to IP66 (survivability in heavy seas) and IP69K (survivability during/after high pressure, high temperature wash-down) as well as fully submersible and explosive atmospheres configurations found in marine applications. Self certified to Class I Div II.

Advantages include:

- Solid-state all welded force proportional joystick
- All stainless steel construction
- Fully submersible system
- Internally potted zero-volume construction with EB welded evacuated construction
- Modular removable interface and grip elements that can be changed in the field if required.

Silicon Sensing System's IMUs

Two all-new IMUs from Silicon Sensing Systems Limited are enhancing their successful range of MEMS inertial products featured at Ocean Business. DMU10 provides a low-cost 6-DOF solution delivering sub-15 /hr and 50µg output stability. First of a family of High Performance IMUs (HPIMU) due for release in the summer of 2015; DMU30 combines dual-axis capacitive MEMS accelerometers with novel blending of outputs from VSG3QMAX and VSG5 gyro sensors on each axis. DMU30 creates a non-ITAR, MEMS IMU alternative to more costly 'FOG-grade' IMUs for use in exacting marine motion sensing applications.

www.siliconsensing.com

FarSounder Updates Navigation Sonars

The release of SonaSoft 3.0 represents an upgrade to its real-time forward-looking sonar capabilities. New in SonaSoft 3.0, FarSounder has improved its 3D sonar display, the developer said. According to FarSounder, improvements include target persistence via new image stabilization techniques, updated color map-

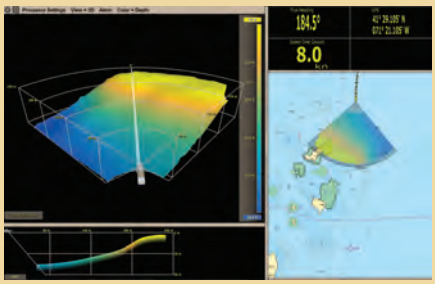


Image: FarSounder

ping fusing depth and signal level information, improved Auto Squelch mode, expanded chart overlay including full 3D image and one-to-one scaling of 3D images. The software update is compatible with FarSounder's existing products and is available to all current and new navigation sonar customers.

www.farsounder.com

SubVIS Orca Camera Platform: HD & Ethernet

Imenco's new HD over Ethernet subsea camera, the SubVIS Orca, was scheduled to launch globally in early April 2015. Essentially a smart phone with a commercial subsea lens and housing rated to 400m, the camera will be apps driven and will be capable of communication with all sensors installed on ROVs. After testing by a major ROV manufacturer, five prototypes have been manufactured and are being shown.

www.imenco.no

SeaHow Skimmer System

New SeaHow skimmer systems – designed to collect both light and heavy oils efficiently – can be implemented to almost any workboat, starting with vessels only six meters long. SeaHow operates one of northern Europe's largest fleets of oil spill response vessels, and its hands-on experience for more than 30 years was central to the three years in developing its own line of SeaHow skimmers. SeaHow skimmers are suitable to vessels from 6m long to the largest vessels used in off-shore OSR. Skimmers are designed to be easy to deploy and operate, making it possible to turn virtually any work boat or larger vessel into an OSR vessel in case of an accident. "Most of the funds available for OSR equipment acquisition is today used for purchasing vessels, leaving little money for the OSR equipment itself," said Jari Partanen, CEO of SeaHow. "By using SeaHow skimmers you can use your existing vessel fleet and direct the investment funding to the OSR equipment itself." Currently most of the OSR equipment operated by OSR preparedness organisations only can collect heavy oil qualities. The EU Sulfur Directive, implemented from January 1, 2015, increases the use of light oils as vessel fuel in Northern Europe significantly. This puts a high pressure on organizations to update OSR equipment. The new SeaHow products are among the first skimmer products that can truly collect both light and heavy oils efficiently. "The capacity tests carried out by Lloyd's Register not only shows that the light oil collection capacity of the skimmers is excellent," said Hannu Hoviniemi, Director of SeaHow Business Development, "but it also shows an incredibly high efficiency. When collecting light oil from water surface, (more than) 90% of the collected liquid is oil."

e: hannu.hoviniemi@seahow.net

ORION Boosts STR's Portfolio

Subsea Technology and Rentals (STR) added Optimal Ranging's ORION pipe and cable tracker systems to its selection of underwater detection systems. ORION is Optimal Ranging's new flagship product for Underwater Utility surveying. Extending LIBRA's Fieldsens technology ORION now includes MultiSens and is available at STR in two, four and six sensor configurations. ORION is rated to a depth of 2,000m, suitable for near-shore and deep-sea ROV survey and mountable on other platforms such as a sled or wing. ORION is compatible with leading hydrographic survey software including EIVA, QINSy and HYPACK. The ORION underwater utility survey system brings the power of model-based processing to cable and pipeline Depth of Burial (DoB) surveys. The method is based on the optimization of data from multiple sensors against a model of the magnetic field expected from an underwater power cable carrying an AC tone (actively applied or passively present). System accuracy is estimated and presented in real-time.

www.str-subsea.com

Ultra-High Accuracy G2+ Positioning Service

Fugro introduced another advance in the field of GNSS augmentation with its high accuracy G2+ service, designed to benefit offshore operators around the

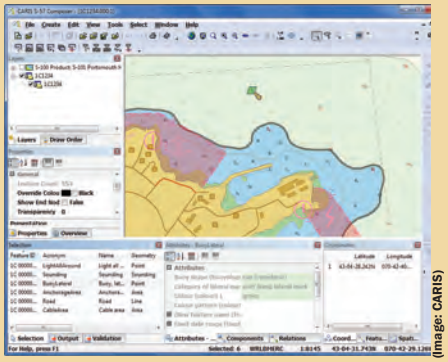
globe who require positioning and measurement accuracy at centimeter level. G2+ is an enhancement of Fugro's G2 service (based on GPS and GLONASS) and uses GNSS augmentation algorithms developed in-house. The code and carrier-phase signals transmitted by GPS and GLONASS satellites are monitored globally by Fugro's worldwide network of reference stations. These observations are processed centrally in real-time using the company's proprietary algorithms to generate precise corrections which are used to augment the standard signals broadcast by GPS and GLONASS satellites. Customers receive corrections via seven high-powered communications satellites, providing at least two independent G2+ data sources. According to Fugro, the new satellite positioning service will be particularly beneficial when seeking to measure latitude, longitude, elevation and speed with high accuracy in real-time.

www.fugro.com

Surveyor Interceptor ROV (SROV)

At Ocean Business in Southampton MMT´s key topic will be the new Surveyor Interceptor ROV (SROV). Together with its Norwegian partners Reach Subsea AS, MMT developed a new generation, survey ROV, named Surveyor Interceptor (SROV), which is specially designed for pipeline inspection and seabed surveys. The new SROV is designed to provide MMT´s clients with improved, accurate data to a much higher speed resulting in substantially better inspection quality at a lower cost per km. **(See related story on page 14)**

S-100 Support in CARIS S-57 Composer 3.0



(Image: CARIS)

CARIS S-57 Composer 3.0 includes tools for S-100 products.

CARIS released its CARIS S-57 Composer 3.0, a desktop application for the production of electronic navigational products, including Electronic Navigational Charts (ENC), Additional Military Layers (AML), Inland Electronic Navigational Charts (IENC) and Digital Nautical Charts (DNC). For the first time users can now experiment with creating S-100 features within an existing production environment enabling them to do much more than simply convert data. Users can gain familiarity with the new complex and multiplicity attribute types, work with information types, assign a S-100 portrayal to features and work with the expanding registry of S-100 product specifications.

Utilizing the same workflows for creating S-57 and VPF products, users will be able to create sample S-100 datasets from scratch or convert existing S-57 and DNC data.

The S-100 data can then be exported in formats like GML for immediate use in a range of geospatial applications. In addition to S-100 support, the latest release of S-57 Composer includes many new functions for feature mapping, extended support for Open Geospatial Consortium (OGC) and other data formats and a series of system improvements.

www.caris.com

In-situ Subsea Cable Repair

IMR specialist N-Sea used a wet repair habitat to complete an in-situ subsea cable repair. The habitat was developed by Moyle Interconnector Ltd. as part of the seabed repair project, with ESB International the owner's engineer for the project. The habitat allows repairs to be implemented in-situ below sea level, as opposed to the conventional method of recovering the subsea cable prior to repair. The diving scope was performed as part of a Moyle Interconnector project to carry out the repair on the Moyle Interconnector cable, a 500MW HVDC electrical interconnector, in the Irish Sea. The interconnector cable links the electricity grids of Northern Ireland and Great Britain through submarine cables running between converter stations at Ballycronan More in Islandmagee, County Antrim and Auchencrosh in Ayrshire. The fault area was located approximately 2.5km from the Scottish coast and submerged between one and three meters below the seabed, in approximately 25 meters of water. Explaining the technology and design behind the product, **CEO Gerard Keser (pictured below)** said, "The principle employed by ESB International is based on an incubator design which surrounds the cable section whilst providing a dry and conditioned repair option. We deployed our TUP Diving System (Transfer Under Pressure) along with one of our subsea support vessels, the Siem N-Sea, which allowed the cable to be repaired in its current position."

www.n-sea.com

(Photo: N-Sea)

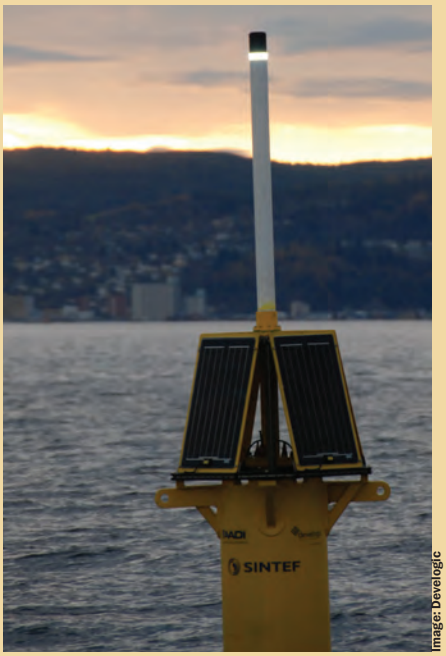


Image: Develogic

Develogic Exhibts Seafloor Lander

At the Ocean Business show in Southampton, U.K., develogic was scheduled to show a 6,000m rated compact seafloor lander with acoustic communication and sensor package, acoustic/seismic recording systems, acoustic modems, a real-time satellite gateway buoy with inductive/acoust c communication, a sound source and a video camera.

The German company develops and manufactures turnkey customized data acquisition and telemetry solutions for marine monitoring for customers including research institutes, navies and offshore renewable energy/oil and gas companies.

www.develogic.de

Turner Designs, PME Launch C-sense Logger

Turner Designs introduced a submersible logger designed to work with its C-sense pCO2 sensor. Designed by water quality instrument design corporation Precision Measurement Engineering, Inc. (PME), the C-sense Logger package records time, date, internal temperature

Image: Turner Designs

Xbox 360 Controller for J2 Subsea Valve Pack

J2 Subsea has launched an Xbox 360 wireless controller for a field-proven intelligent valve pack (iVP). Offered exclusively by J2, the Windows- based custom-built control software and gaming controller will improve operator training and ease maintenance activities on the iVP, the company said.

The software and controller were developed by J2 with Fathom Systems, which provides engineering solutions and products to the underwater engineering industry. According to J2, the software is the first available for this type of manipulator system. It supports the eight-station proportional iVP, which is based on standard valves and fulfils all hydraulic control requirements, including complex tooling skids, tracked vehicles and manipulator arms.

J2 and Fathom Systems worked together to develop the software and performed field trials for a year with a large ROV operator to prove the product ahead of its launch. During the testing phase, the ROV operator explained how easy the system was to use, how quickly the operators became familiar with the controls and highlighted how much was saved in repairs compared to the more expensive manipulator package.

www.j2subsea.com


(Image: Microsoft)


(Image: J2 Subsea)

and the partial pressure of gas in liquids. C-sense enables in situ pCO2 monitoring over an extended period of time in water, oil or water and oil mixtures in depths up to 600m. Applications include water quality monitoring, aquaculture, wastewater monitoring, reef monitoring, carbon capture storage monitoring and biofuel production. Integration with the C-sense Logger enables collection and internal storage of data at a variety of sampling rates, set by the customer. Data are offloaded to a computer via a USB cable for easy viewing and analysis. The logger and sensor are powered by the Turner Designs rechargeable battery pack, potentially powering the C-sense Logger to collect 3,000 samples before recharging is required.

www.pme.com
www.turnerdesigns.com

Two Dual-LiDAR Buoys Deployed

AXYS Technologies Inc. (AXYS) has deployed two dual-LiDAR WindSentinel floating LiDAR systems, utilizing the Offshore Renewable Energy (ORE) Catapult's offshore anemometry mast. According to AXYS, this will be the world's first deployment of a floating LiDAR system to feature two LiDARs, as each system has an additional Zephir 300, AXYS' first deployment of this sensor.

The WindSentinel systems will be deployed in the North Sea, three nautical miles off the coast of Blyth, Northumberland for a one month validation and research study at the ORE Catapult's National Renewable Energy Centre. They will then be moved to France for a 12-month campaign as part of a bankable energy assessment for two commercial wind farms.

www.axystechnologies.com

New Micro Field Buoy from OSIL

U.K.-based oceanographic systems company Ocean Scientific International Ltd. (OSIL) introduced a new, ultra compact buoy platform into its 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 (including CTDs, DO sensors, turbidity sensors, chlorophyll sensors, multiparameter sondes and hydrocarbon sensors) in the rugged protective deployment frame underneath the float. The hard anodized marine grade aluminum hull incorporates buoyancy, telemetry equipment (GSM/GPRS/3G), electronics (including data logger) and battery in a fully marinized and compact package. The buoy, once installed, can be left reporting and logging data unattended for one month before battery recharging and instrument cleaning is required.

www.osil.co.uk

CTD Solutions

(Photo: MacArtney)

MacArtney, Sea-Bird CTD Solutions for Turkish RVs

MacArtney Underwater Technology and Sea-Bird Scientific joined forces to deliver four complete oceanographic instrumentation solutions to research vessel operators in Turkey.

According to MacArtney, a key common denominator for the type of oceanographic package procured by these Turkish research clients is the combination of MacArtney CORMAC Q winches and Sea-Bird Scientific CTDs and water sampling systems. In addition, clients have opted to mix-and-match a multitude of different instrumentation options including the broad range of optical and water quality sensors from WET Labs and Satlantic offered by Sea-Bird - to form complete turnkey CTD packages corresponding with their specific scientific measurement needs. In extension of this, all installation, commissioning and training, performed by MacArtney, was also included in the packages.

The first of four Turkish research vessels to take delivery of the MacArtney and Sea-Bird CTD solution was the R/V Tubitak Marmara built by CEKSAN shipyard for the Scientific and Technological Research Council of Turkey. The second and third Turkish research vessels was R/V Seydi Ali Reis, a new scientific vessel operated by the Sinop University, and ARAMA 1, a newly built vessel operated by the Mediterranean Sea and Fishery Institute based in Antalya. Finally, a fourth system procured by an undisclosed Turkish client, for installation on a new research vessel, has been delivered, with commissioning planned to take place during 2015.

www.macartney.com

Above
A MacArtney and Sea-Bird CTD package, complete with CORMAC Q winch and sampler carousel - seen onboard the ARAMA 1

Inset
Delivering a turnkey solution: A MacArtney ocean science specialist oversees the winch and CTD system installation, commissioning and operators training.

MTR Marketplace

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The State of Alaska Department of Transportation & Public Facilities (DOT&PF), Alaska Marine Highway System (AMHS), Marine Engineering Section is recruiting for experienced applicants to fill Marine Engineering Assistant III Positions.

Position Description: Perform journey-level engineering duties by applying accepted engineering practices in the design, construction and maintenance of marine vessels and marine-related projects. Key Responsibilities include participation in the preparation of design and construction documents and estimates, project plans, specifications, estimates and schedules, perform duties as the on-site representative during construction, coordinate personnel assigned to the on-site project field office, perform inspections, maintain project records, and other duties as assigned.

For additional information on this employment opportunity, visit the State of Alaska Online Recruitment System, Workplace Alaska, which can be found at: **http://doa.alaska.gov/dop/workplace/** Search for **Engineering Assistant III** located under all job seekers, located in Ketchikan AK; or all job seekers, within Transportation and Public Facilities.

The State of Alaska is an EEO/ADA employer.

The State of Alaska Department of Transportation & Public Facilities (DOT&PF), Alaska Marine Highway System (AMHS), Marine Engineering Section is recruiting for experienced applicants to fill Port Engineering Positions.

Job Description: Responsible for coordination of repair and maintenance functions, will review and approve recommendations for short and long term work, procurement of materials and services for vessels. Coordinates inspection of machinery and vessel condition, performs as the Project Manager and acts as the owner's representative for annual overhaul projects, conducts investigation of machinery, maintaining records of engineering budget for each assigned vessel, and will interface with CG, ABS, & DNV.

Minimum Qualifications:
Have possession of a United States Coast Guard Engineer License, have Port Engineering experience in the maritime industry.
For additional information on this employment opportunity, please contact one of the following individuals:

Gregory Jennings, Senior Port Engineer
Email: **gregory.jennings@alaska.gov**
Office: **907.228.7295** • Cell: **907.570.1943**

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EvoLogics GmbH
Ackerstrasse 76,
13355 Berlin, Germany
tel.: +49 30 4679 862-0
fax: +49 30 4679 862-01
sales@evologics.de
evologics.de

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