MARINE TECHNOLOGY REPORTER

November/December 2012 www.seadiscovery.com

2012 Photo Contest

Knifefish
Navy's Minehunting AUV

Kevin Lord
Melding Divers & ROVs

Innovator
MarineExplore's Rainer Sternfeld

Market Trends
Sensors & Instrumentation

Subsea Vessels
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Kristi Bernot

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YSI
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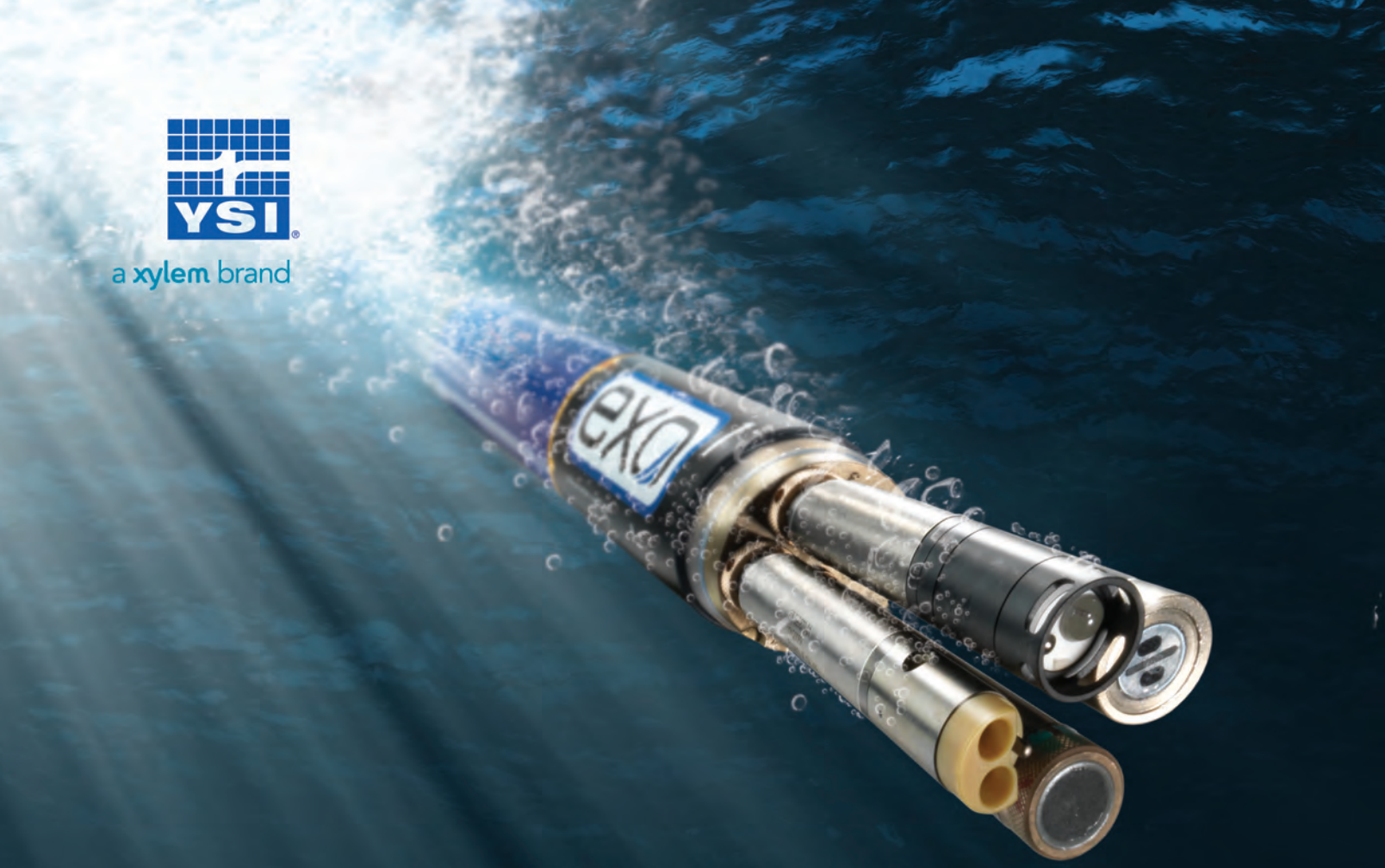

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Captain Edward Lundquist, USN (Ret.) is a principal science writer with MCR Federal in Arlington, Va. p.8 & p.44

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Mary Turnipseed, Ph.D. is currently the Arctic Fellow in the Gordon and Betty Moore Foundation's Marine Conservation Initiative. Before joining the Foundation, Mary was a postdoctoral researcher at the National Center for Ecological Analysis and Synthesis (UC-Santa Barbara). p.36

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Joseph Corrigan sits within Douglas-Westwood's Research team where his principal activities include quantitative analytics and macro-economic analysis, competitive analysis and supply chain mapping. Industry areas of focus most recently include Subsea Vessels, Offshore Field Development, IRM & Well Intervention, and Subsea Diving Systems. Corrigan is a graduate of the University of Cambridge and has a Masters degree in Chemical Engineering. p.22

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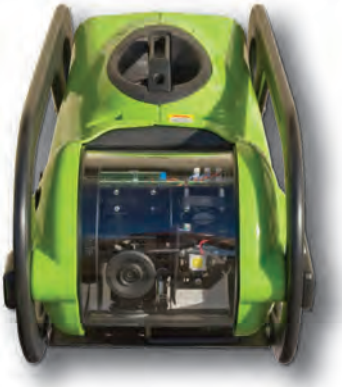
SeaBotix



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The events of late October/early November 2012 - or more specifically the devastation wrought by Hurricane Sandy on the entire New York City region - serves as a stark reminder to the importance of the cumulative work of the subsea industry. Personally and professionally we fared far better than many, as we lost power in our lower Manhattan office for just one week; phones for one month. A pittance really, when you consider the masses of people that literally lost everything. But the confluence of rising sea levels and the proximity of many of the world's financial and cultural hubs situated precariously close to the coast of the world, chatter here and around the world turns increasingly to engineering measures that can be enacted to at the least lessen the effects of Mother Nature's wrath in future instances. Your work in assessing, creating, engineering installing and maintaining such systems are central to this effort.

The end-of-the-year editions are perennially my personal favorites, not because of the looming holidays but rather it affords a chance to reflect on the year past and plan for the year to come. In this edition we offer several features which I hope will help you in your planning.

As most of you well know, the offshore Oil & Gas market is vibrant again, with drilling activities extending further offshore into ever hostile, deeper but potentially lucrative waters. Starting on page 22 Joseph Corrigan of Douglas-Westwood presents insights from a recent report on Subsea Vessel Operations, a report that projects spending in this niche is projected to leap an astounding 63% over the previous five year period.

I am thrilled to offer the words and works of a trio of experts - Joonkoo Lee, Mary Turnipseed and Lukas Brun - who walk you through market and technology trends in the Sensor and Instrumentation sector in a most informative and entertaining manner. This relatively short report is based on a much larger, more exhaustive study on the matter, available to anyone who is interested for free. Full details are found in the feature, starting on page 36.

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KnifeFish

Navy's new UUV Knifefish is a cutting-edge mine hunter

By Edward Lundquist

The U.S. Navy's Knifefish UUV is a cutting-edge mine hunter, with the ability to find and identify mines, even the most challenging undersea environments. Knifefish is the new Surface Mine Countermeasure (SMCM) Unmanned Undersea Vehicle (UUV), built by General Dynamics Advanced Information Systems of Mcleansville, NC,based upon a Bluefin-21 vehicle from Bluefin Robotics. The systems helps the Navy's meet an urgent requirement to reliably detect and identify buried mines in high-clutter environments.

The initial SMCM UUV System being acquired by the Navy includes a pair of Knifefish UUVs, along with launch and recovery and support equipment, as well as the advanced sonar payload provided by the General Dynamics Team. The plan is for each of the littoral combat ship (LCS) mine countermeasures (MCM) mission packages to contain one Knifefish system, with two of the lithium-ion battery-powered UUVs, as well as associated launch and recovery equipment, a support container, spare parts and support equipment. The system is designed for use with LCS, but it can also be used from vessels of opportunity. The Knifefish system recently passed its preliminary design review.

LCS is a relatively small, fast, agile surface combatant designed to address anti-access in the littoral or coastal regions of the world. The ship can be reconfigured with modularized mission packages for one of three focused mission: anti-submarine warfare, MIW and anti-submarine warfare.

The ship itself—referred to as the seaframe—has core capabilities including navigation; command, control, communications, intelligence, surveillance, launching and retrieving boats, aircraft and unmanned vehicles, and weapons for self-defense. The LCS MIW Mission package will carry systems to search, identify, and neutralize mines in the water column from the near surface, bottom, and the water column. The LCS mission package is comprised of modularized mission systems and support equipment; mission specialists; and support aircraft and crews. As systems are upgraded, or new ones become available, it will be possible to upgrade the mission package without making extensive modifications to the ship.

Knifefish employs a low-frequency broadband synthetic aperture side-scanning sonar to look for mines that are in the water column, or "proud" mines that are resting on the sea floor or partially buried.

"The Knifefish does not use acoustic imagery like most sonars. The Knifefish Low Frequency Broadband (LFBB) sonar is better able to find buried mines and resolve mine contacts from non-mines in high clutter environments than acoustic imagery sonars," said Capt. Duane Ashton, a program manager for unmanned maritime systems with the Program Executive Office for the LCS. "Knifefish provides capability that we don't have with UUVs today,"

Currently, the Knifefish must be recovered and its data processed and compared against the mine threat library is stored onboard LCS. The database allows Knifefish to identify just about any kind of mine-like object it could encounter, including virtually all known types of sea mines. Each reflection from an active transmission has unique characteristics that can be identified and classified. The system will compare any

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objects it locates with the database. "It knows what an anchor or a refrigerator looks like, and can rule them out" Ashton says. "And it knows with a high degree of certainly when it has found a mine-like object."

The library will be updated as new threat mines are deployed. "A future product improvement will allow the UUV to perform the mine identification processing on board the vehicle," Ashton says.

If the LCS mine warfare mission specialists determine that a mine has been located, classified and identified, the mine can be plotted and avoided, or destroyed by using the Airborne Mine Neutralization System or EOD divers.

Each UUV will search its preprogrammed area independently for up to 16 hours, but both can operate simultaneously if desired, Ashton says.

When underway on a mission, the vehicle periodically provides the mission specialists on the LCS host platform with its GPS position and "wellness" update," by means of a satellite link and a small antenna. The UUVs do not communicate with each other.

After each mission, Knifefish is designed to be turned around quickly so it can get back in the water for the next assignment, said Tom mason, General Dynamics Advanced Information Systems program manager for Knifefish. "The UUV will have a subsystem called the Removable Data Storage Module (RDSM) which will contain all of the data recorded by the mission. The RDSM will be taken from the UUV and downloaded to shipboard processors for post mission analysis. While the UUV is executing the next mission, the previous mission batteries are recharged and the RDSM prepared for reuse. To support this requirement, both the RDSM and batteries can be swapped out with ready spares."

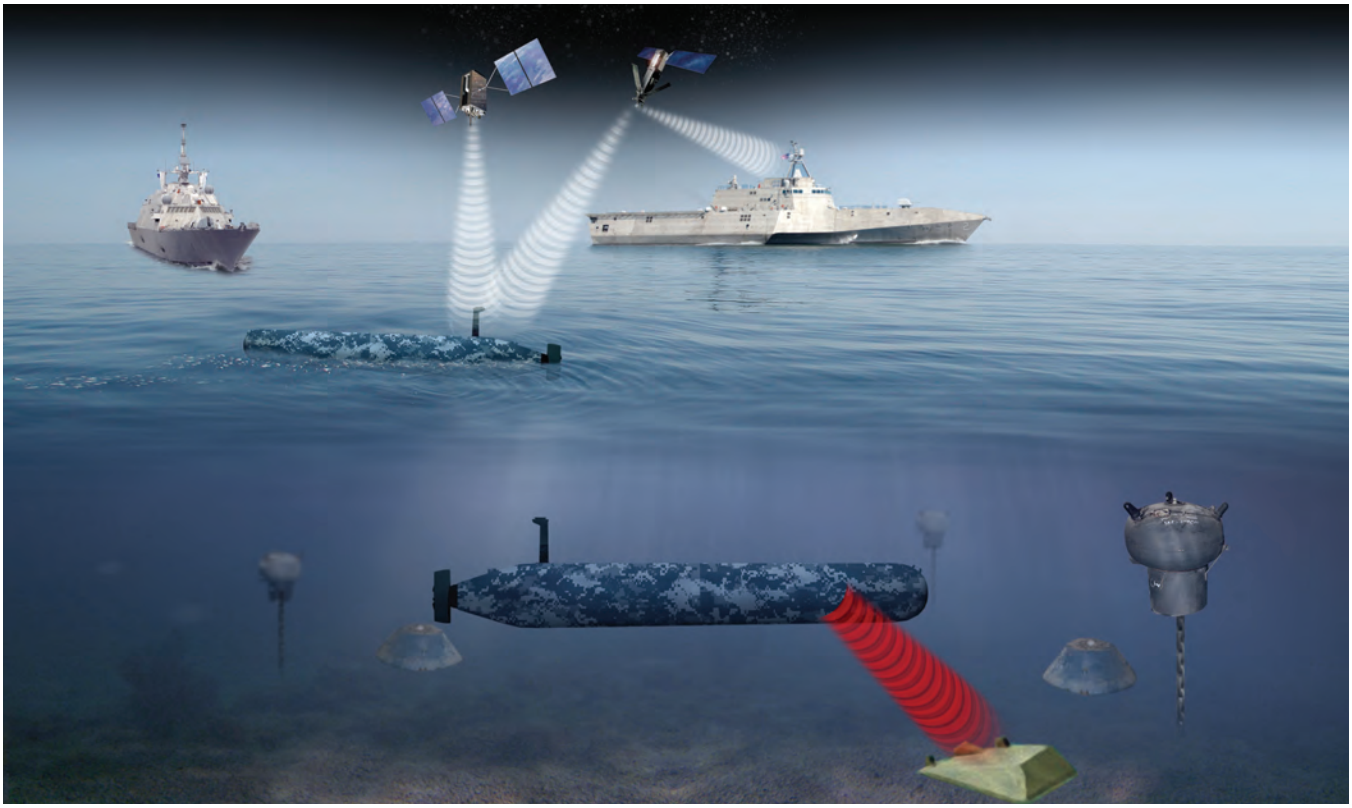
Knifefish is 22 ft. long, 21-in. in diameter, and it weighs 1,700 lbs.

The SMCM UUV started as a Science and Technology (S&T) program run by the Office of Naval Research, has transitioned to an acquisition program. The investment in S&T has paid off. Ashton says ONR helped develop the prototypebeing used for testing while the Engineering Development Manufacturing (EDM) systems are being developed. EDM system testing will be followed by developmental testing, and finally operational testing.

Knifefish LCS developmental testing will occur in FY15, he says. Operational testing will occur in FY16, and Knifefish could be operational by FY 2017.

General Dynamics Advanced Information Systems is the prime contractor and systems engineering lead, responsible for payload and mission module integration. The vehicle is provided by Bluefin Robotics. Ultra Electronics Ocean Systems is providing the low frequency broadband (LFBB) synthetic aperture sonar processing, with design and system engineering support from the Applied Research Laboratory of Penn State University (APL/PSU).

The Naval Sea Systems Command is the contracting activity for the prime contract with General Dynamics Advanced Information Systems.



UI 2013 A Preview

Underwater Intervention is once again set to take New Orleans by storm, scheduled to take place January 15-17, 2013 at the city's ubiquitous Morial Convention Center.

Underwater Intervention is a not-for-profit industry conference and exhibition, jointly owned by the Association of Diving Contractors International and the ROV Committee of the Marine Technology Society.

The event is highly anticipated every year as it seamlessly melds a comprehensive technical conference with traditional exhibition and a full slate of social activities, all designed to ensure that subsea industry executives have ample opportunity to meet, greet, exchange ideas and conduct business.

In 1993, the first Underwater Intervention was hosted in San Diego, California. Now, 21 years later, Underwater Intervention has grown to encompass more industries in addition to Commercial Diving and Remotely Operated Vehicles. It now includes Manned Submersibles, Instruments and Sensors, Sonar and Acoustics, Ocean Engineering, Marine Salvage and Shipwrecks, AUV and UUV Technology

In January 2012, Underwater Intervention, held in New Orleans, covered more than 25,500 square feet of exhibit space, and hosted more than 2400 attendees from over 35 countries, and our technical program offered 110 presentations from industry leaders throughout the world. This year's conference – UI 2013 – will include more technical program subject offerings for UI 2013 to satisfy the needs of our respective industries, such as Deep Water Projects and Decommissioning.

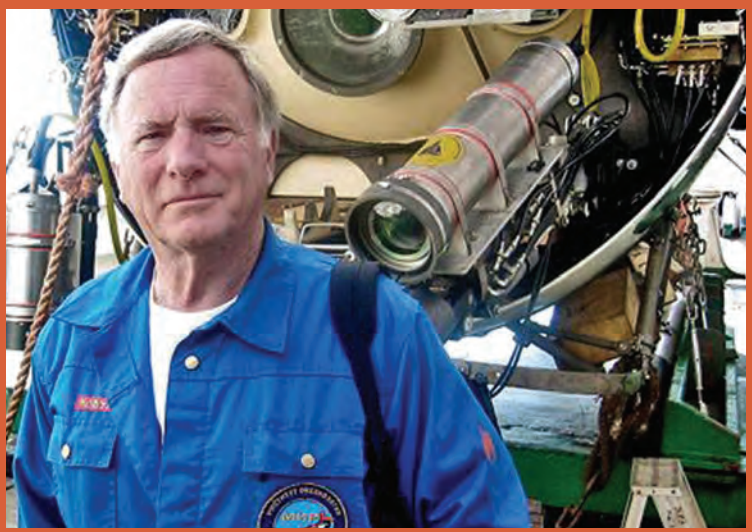
Conference Registration is open and online at **www.underwaterintervention.com**. Early Registration Discounts and Society Member Discounts apply until January 7, 2013. Onsite (At the Door) Prices will apply beginning January 8, 2013

Exhibitors: (Not a complete list)

Meet Don Walsh @ UI

The Annual Awards Dinner, with Randall Abadie of Shell Exploration will be our Keynote Speaker; will be held Tuesday night at the Marriott Convention Center. This awards dinner highlights and honors some of our industry leaders as well as some of our up and coming students. Also as a special appearance, **Don Walsh** (right) will give a presentation in the International Lounge on Wednesday shortly after lunch. If you want to hear from one of the very few men who have travelled to the deepest parts of the ocean, you will want to be present for this talk.For full conference & exhibition details:

www.underwaterintervention.com



Kevin Lord

Manager of Subsea Operations, Chet Morrison Contractors

In conjunction with the Underwater Intervention exhibition set forth to find an excellent source to speak in the first person on the diving industry, and more specifically the balance today between deploying man and machine. Kevin Lord is the Subsea Operations Manager within the Marine Construction Division of Chet Morrison Contractors. He began his commercial diving career in the Gulf of Mexico after serving four years in the United States Navy. In his 20 years in the industry, he has worked as a diver in both surface and saturation modes, as a diving supervisor, a project superintendent, project manager, and Operations manager. He has experience in both diving and deepwater projects, and has managed both diving and ROV divisions. Kevin currently serves as an executive board member on the U.S. Gulf of Mexico Diving Safety Work Group (DSWG).

By Greg Trauthwein, Editor

Please tell us a bit about your role as the Manager of Subsea Operations at Chet Morrison Contractors.

As the Subsea Operations Manager, I'm responsible for overseeing the day-to-day operations and projects within the division. We have a group of very knowledgeable and talented individuals that make up an extraordinary team that I'm proud to be a part of. At Chet Morrison Contractors we pride ourselves on our safe work culture, good communications, and continual improvement through training and auditing. I enjoy interacting with our employees and our clients, as I owe our success to both.

Specifically, can you provide our readers background on your experience using ROVs and AUVs?

My experience is primarily in ROVs. I've worked with ROVs on many occasions, including several deepwater projects where divers are not an option. Even on shallower projects that I've managed, ROVs were used to inspect pipelines and platforms. For example, they're a great tool after a hurricane for inspecting downed structures in order to get an initial survey for planning purposes.
Some specific ROVs I've worked with:

- **TXL Work Class ROV – Hydraulic**
  - o 100 HP, capable of working to depths of 2500 m
  - o Rugged, durable ROV with proven dependability
  - o Worked well in construction when outfitted with 2 manipulators
  - o I specifically remember it had the Schilling T3 and the Perry Slingsby 5 function
- **TXLS Work Class ROV – Hydraulic**
  - o 150 HP, capable of depths to 4000 m
  - o Excellent ROV for heavy construction
  - o The manipulators I remember were the Schilling T4 7 function and a Schilling 5 function Rig Master
- **Quest Electric Work Class ROV**
  - o Equivalent to a 100 HP hydraulic ROV
  - o An environmentally friendly choice with an all-electric propulsion system

Chet Morrison CONTRACTORS

o Manipulators on the this specific ROV were the Schilling Orion seven function and Schilling five function Rig Master

o Very quiet ROV around divers (heard often from divers; *one guy said he wanted to put a cow bell on it so he knew it was around*)

Also, I managed the installation of steel flow line jumpers in deepwater (approximately 7000 feet) using 2 ROV's (Mississippi Canyon). On this project, we determined that the value of a second ROV for redundancy and for the extra set of eyes/manipulators on location far outweighed the daily cost and the mobilization. The client agreed and the project was successful. On another project, we were closing spools for the oil and gas export lines on two different spar platforms (Green Canyon and Alaminos Canyon) at approximately 500 feet using divers with ROV support. These two spar projects required a lot of rigging that was attached to the heave plate to allow the spools to be set in place. The ROVs assisted divers in inspecting the heave plates, installing crossover lines, positioning rigging, and deploying tools. The ROV was able to ensure that spools lowered from the surface were stopped at correct elevation, allowing the diver to stay in the safe zone during the lowering phase. The ROV was a valuable tool for interacting with divers on these projects.

Obviously there are pros and cons to using man or machine to work safely and efficiently under the water. From where you sit, what are the major "Pros" of incorporating ROVs/AUVs? What are some of the "Cons"?

There are numerous "pros" to having an ROV support a diving operation, including: Having an extra set of eyes; Great lighting; You can attach hydraulic tools to ROV for diver use, such as impacts and grinders; to watch critical items, such as jumpers or spools, from the water interface to work site; and to increase productivity.

All the "pros" can turn to "cons" if a Simultaneous Operations (SimOps) plan is not developed and followed. A SimOps plan will identify risks and must clearly define procedures and establish the communication required to perform diving and ROV work simultaneously.

No special training is required to work with ROVs but at Chet Morrison we do develop Project Risk Assessments to identify and mitigate the risks. Divers are made aware of all the risks

"There are numerous 'pros' to having an ROV support a diving op … the 'pros' can turn to 'cons' if a Simultaneous Operations (SimOps) plan is not developed and followed."

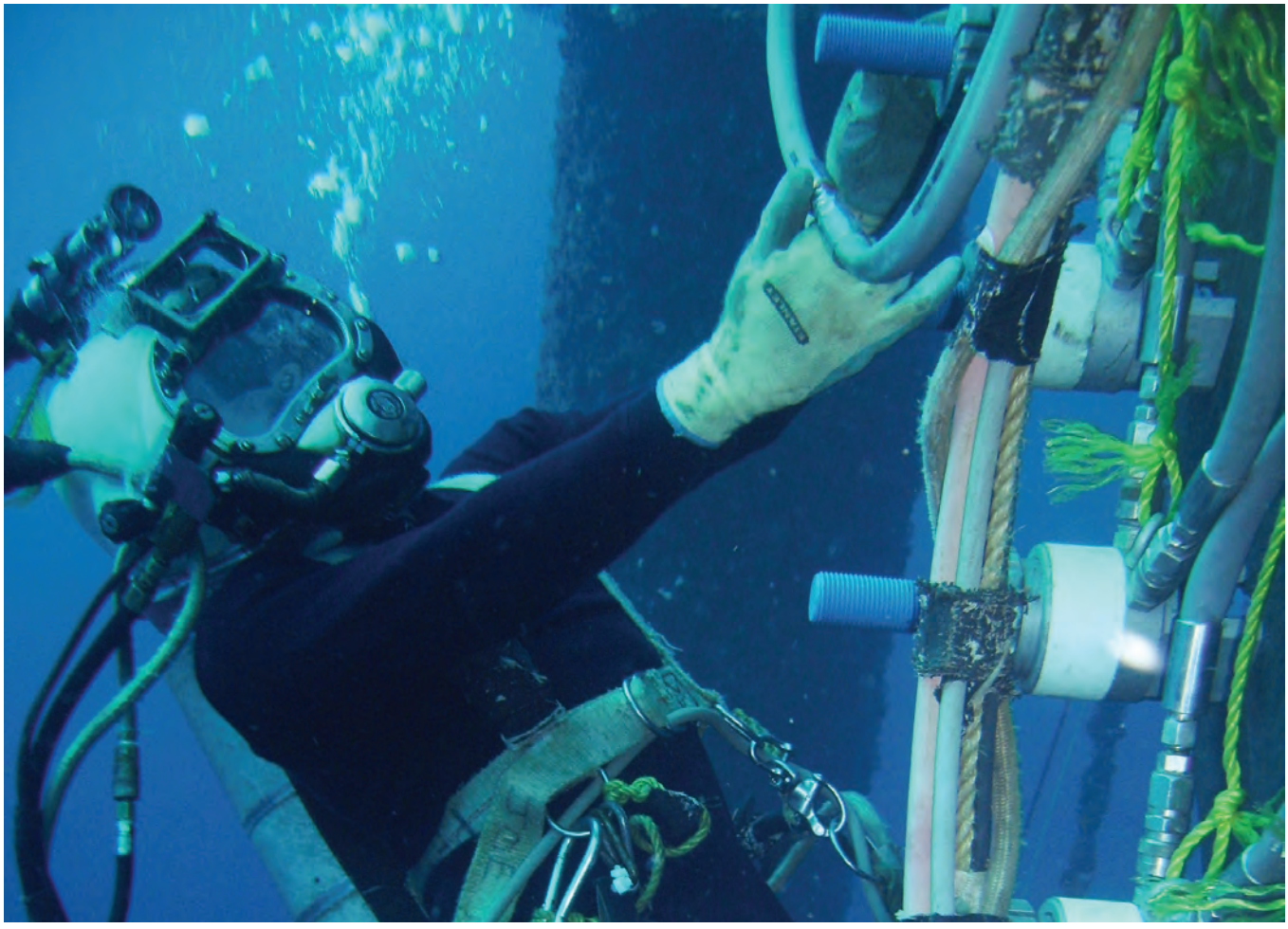
through this document at the project kick-off meeting and during the course of the project with the JSA.

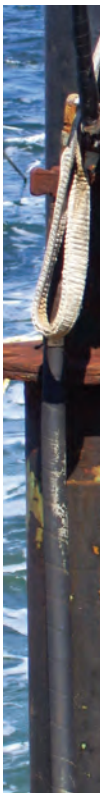
It's also important that divers and other personnel have clear communications and understand the chain of command. Both the ROV operator and the Diving Supervisor must have view of the ROV camera feed as well as the diver's camera feed, so they can communicate effectively. But it's crucial to understand that the Diving Supervisor is the final authority on the project while the diver is in the water and is responsible for ensuring the safety of all involved.

Removing divers from the water is a hot button topic for many people: As a diving company that deploys humans and underwater robots, how do you balance?

Getting divers to understand that ROVs are not going to take their job is the first step. Having a wide range of capabilities is what keeps companies a step ahead of competitors in a tough market, and at Chet Morrison Contractors we pride ourselves on our comprehensive approach to subsea work. Continuing to incorporate ROVs into our fleet on a regular basis allows us to grow as a company and will provide everyone, ROV operators and divers alike, with more work. An ROV can't operate without someone knowledgeable and capable at its controls. A diver requires a knowledgeable supervisor and a capable topside support crew to be successful. ROVs and divers have a lot more in common than one would initially think; they're part of a total team effort.

We get many different stories from many different views on the evolution of the capabilities of ROVs and AUVs. From where you sit, in you scope of experience, please describe how you





see ROVs and AUVs have evolved in the past 5 to 10 years as far as their capability to conduct a given job effectively and efficiently.

As the technology advances in the deepwater markets, the ROVs are advancing with it. As operators continue to develop deepwater subsea fields, they are looking for ROVs to be outfitted with tools customized and developed for their exact needs. It's fascinating to see the advancements made in recent years and I look forward to seeing how the industry continues to evolve in response to technological innovations.

As for the future of ROVs and divers, I definitely don't see ROVs replacing divers—in shallow waters anyway—in the near future. Subsea work environments with low visibility where a sense of touch is required will continue to be better suited to divers, even with advancements in cameras and sonar. I do, however, see fewer divers doing work in depths of 500 feet or more, at least not when ROVs can do the same work without the need for decompression. Overall, I think we'll see more integration and cooperation between ROVs and divers, which will ultimately contribute to making commercial diving a safer industry.

"As for the future of ROVs and divers, I definitely don't see ROVs replacing divers—in shallow waters anyway—in the near future. Subsea work environments with low visibility where a sense of touch is required will continue to be better suited to divers, even with advancements in cameras and sonar."

Laser Scanning the Cliffs of Moher

Surveying the Cliffs of Moher Using Vessel Mounted Mobile LIDAR

By Mark Reid & Mark Hudson

The Cliffs of Moher is one of Ireland's top visitor attractions and a designated UNESCO Geo Park. O'Brien's Tower stands proudly on a headland of the majestic cliffs. From the cliffs you can see the Aran Islands, Galway Bay, as well as The Twelve Pins, the Maum Turk Mountains in Connemara and Loop Head to the South. The Cliffs of Moher take their name from a ruined promontory fort "Mothar" which was demolished during the Napoleonic wars to make room for a signal tower.

The Cliffs of Moher is home to one of the major colonies of cliff nesting seabirds in Ireland. The area was designated as a Special Protection Area (SPA) for Birds under the EU Birds Directive in 1986

Coastway were approached in April 2012 to assist in contributing towards an Environmental Impact Statement for the future development of a specific area on the Cliffs of Moher and its immediate hinterland.

It is eventually planned to make the Cliffs of Moher a future UNESCO World Heritage program site. There are currently only two in Ireland; Bru na Boinne and Skellig Michael.

Scope of Work

The Cliffs of Moher, located on the western seaboard of County Clare Ireland, are 214m high at the highest point and range for 8 km over the Atlantic Ocean. The brief was to laser scan, prepare a 3D model and high definition video from the resultant point cloud data of a 2km section of the cliffs. As the cliff face is only accessible and visible by boat the biggest challenge for this project was how to laser scan from a moving platform and how to achieve sufficient resolution, coverage, and accuracy from a place of safety.

Data Acquisition

After considering the various options, Coastway approached Measurement Devices Ltd (MDL) a manufacturer and provider of ruggedized laser scanning equipment. MDL proposed a solution using the Dynascan 3D mobile mapping system that can be mounted on both vehicles and vessels and used to capture 3D LiDAR data of topography. The small size and compact nature of the Dynascan system meant that it could be quickly mobilized during a limited weather window and


MDL
DYNASCAN

easily mounted on a vessel of opportunity. A Dynascan M500 mapping grade system with a laser accuracy of +/- 50mm and a range of up to 500m was used for the project.

The unit and secondary GPS antenna were mounted on a boom at the front of the fishing boat allowing a sufficient field of view for the 360 degree Scanning Laser Module (SLM) to survey the cliff. In addition to the SLM the Dynascan contains a high grade Inertial Measurement Unit (IMU) consisting of gyroscopes and accelerometers that works to compensate for the motion, pitch and roll of the boat.

Accurate 3D positioning was achieved using the built in Real Time Kinematic (RTK) differential GNSS systems, which employ GNSS carrier phase differential techniques to provide real-time, centimeter-level, three-dimensional positioning. RTK correction signals where derived from a local RTK Base Station that was set up over a known Survey Control Point on the cliff top. The computed correction signals where then transmitted to the mobile GNSS receivers on the Dynascan over a UHF Radio Link. The raw data was also logged to be used for post processing in case of RTK shadow near the cliff and as a quality assurance measure.

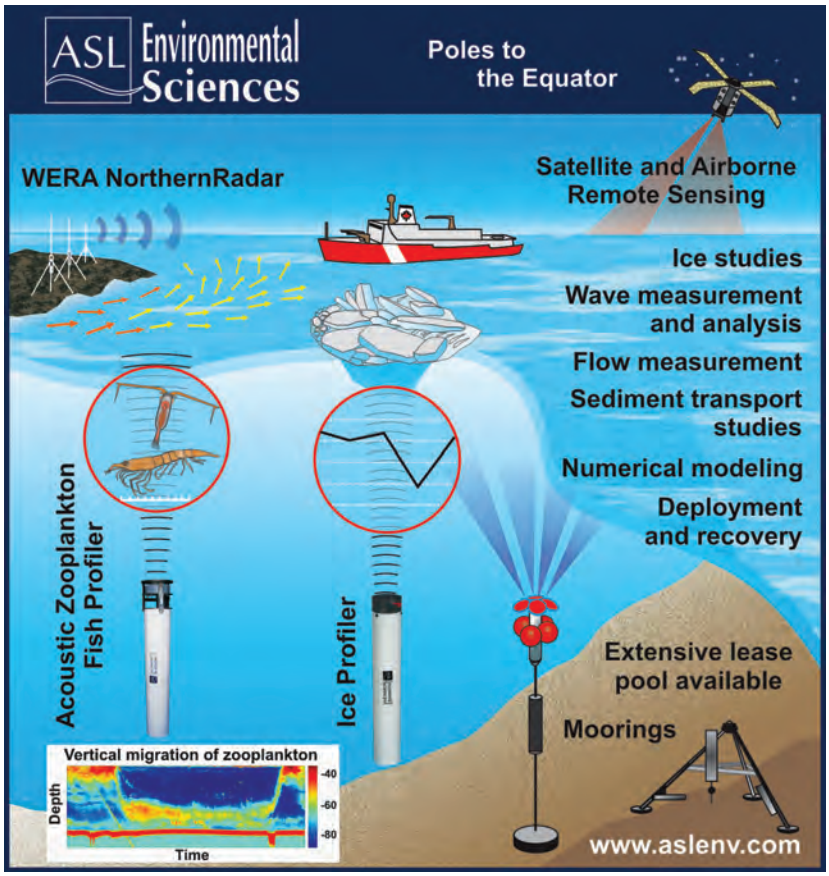
Qinsy acquisition software was used to provide real-time on the fly data processing and visualization of the acquired data allowing for coverage and quality to be verified during the survey. In addition to the laser point cloud photography was captured using a standard digital SLR camera.

Approximately 2km of the cliff face was surveyed over seven passes in different directions to ensure full coverage of the varied contours of the cliff face and bays. The actual survey data took less than hour to acquire. On completion of the vessel survey the system was transferred onto a vehicle and used to capture the topography on the top of the cliff. The data was collected on the same grid allowing for seamless integration between the two data sets. The entire equipment mobilization, data acquisition on the vessel and vehicle, demobilization, and data download was completed successfully within a single day.

Data Post Processing

The geo-referenced point cloud was handed over to Coastway for post processing. The initial data was imported into Leica Cyclone point cloud processing software. The data was reviewed and cleaned, producing a point cloud ready for mesh creation. The final data set was exported to a XYZ text file and imported into 3D modelling software package.

Within some of the bays there was a shallow reef meaning the boat could not get close enough to scan parts of the cliff face leading to some gaps with the laser data. Coastway there-



fore used the photos acquired and the Autodesk 123D software to create a 3D model to fill in the gaps. The combined cloud was remeshed creating a seamless model of the cliff face. The high resolution image was used to 'bake' the imagery onto the final mesh model.

Finally the 3D model was rendered with the imagery acquired and a fly through animation produced using 3D visualization software.

Surveyors:

- Jonathan Robinson (MDL)
- Alastair Delooze (MDL)
- Liam Murphy (Coastway)

Raymond Lord President, Donjon-SMIT, LLC

When Raymond Lord was named President of Donjon-SMIT, LLC just over one year ago, the native Houstonian brought with him more than 30 years of experience within the marine salvage industry, and he joins industry heavyweights John Witte and Douglas Martin at the joint-venture, casualty response and compliance group. Coming from his previous position as Vice President and Operations Manager for SMIT Americas in Houston, Lord now heads up one of the largest, and arguably the most visible nationwide marine service providers. Lord's leadership in this highly technical business involves leveraging the strengths of both SMIT Salvage Americas and Donjon Marine to best serve their diverse client base. This month, Lord weighs in on a raft of subjects for ***Marine Technology Reporter*** *readers.*

You've been at helm of Donjon-SMIT for just over one year now. What distinguishes Donjon-SMIT from its competitors?

Donjon-SMIT's best attributes are twofold. First, this involves the total commitment of both companies, Donjon Marine as well as SMIT Salvage Americas, to not only provide each vessel owner/operator with the documentation and administration to allow them to operate within US waters in full compliance with OPA90 regulations, but also to allow each owner operator the confidence that in the event of a true emergency incident Donjon-SMIT is fully capable of providing prompt professional service regardless the size and scope of the situation. Secondly, and as is the case with any organization, people are our greatest resource. The staff at DJS as well as both parent companies, Donjon Marine and SMIT Salvage Americas, are highly trained and dedicated to providing the highest quality service to our clients. Backed by years of hands on experience within the maritime industry they provide the key element when responding to an emergency situation.

How has Donjon-SMIT found the promulgated marine firefighting and salvage regulations to be in terms of an overall industry point of view?

Although the path in developing the newly founded SMFF regulations has been long and arduous, we believe that it has been a huge step forward to improving the nation's ability to respond to any emergency salvage situation within U.S. waters. For many years following the Exxon Valdez incident, the focus has been largely upon the oil spill response community and many salvors were able to operate with little or no resources, minimal experience and without the company structure that would enable it to conduct a full scale salvage operation if one had arisen. Those days are behind us with the new regulations. Each responder now is held accountable for their planning, their resources and their ability to react to a serious salvage incident. Vetting processes have been developed and are underway. Drills are now established (although some additional detailed requirements are still being developed) leading to the exposure of not only strengths but weaknesses within the salvage community that can now be addressed and improved upon. As with other regulations, they are work in progress. Each step is seen as an improvement in the salvage response capability within the US and that, in the end, is the true goal.

In what areas are you going to focus on for growth in this year and beyond?

The standard procedure for almost all serious salvage operations is now to remove the threat of pollution whether the vessel is transporting an OPA 90 related cargo or is carrying only bunkers. In this regard we are closely monitoring the upcoming non-tank regulations and looking forward to expanding our client base extensively. Anticipating that once released the new non-tanker regulations will mirror most aspects of the present day SMFF regulations pertaining to tank vessels, we are encouraging present day non-tanker vessel owners to act proactively in the administrative process and enroll their vessels now instead of later.

Has the case of the Costa Concordia focused attention on professional marine salvage in the right ways?

The tragedy itself correctly illustrated the readiness, dedication and perseverance of the rescue responders in a potentially very dangerous circumstance. We hold the deepest respect for those dedicated to saving the lives of so many people that night. The salvage operation itself is in its very earliest stages but we remain confident that the salvors will do their best to protect the environment in all ways possible and to remedy this difficult operation in the swiftest and most professional manner.

Your firm's Compliance Decision Tool claims to "place emergency resources at your fingertips." How so?

Developed over the course of three years, the Compliance Decision Tool (CDT) serves several key functions within our organization. It allows Donjon-SMIT to graphically demonstrate our ability to meet SMFF regulatory planning standards. During an actual response, we can visually illustrate where our personnel, equipment and support craft are located in real time with easily calculable arrival times to any port in the country. As it is the vessel owner/operator's obligation to ensure that their chosen SMFF provider is capable of fulfilling all regulatory requirements, this tool gives that owner the confidence that Donjon-SMIT was their proper choice.

Tell us a little about your journey – marine salvage and business experience – that culminated in your current post as President of DonJon-SMIT.

After 10 years as a commercial diver in the US Gulf of Mexico, I worked on my first Smit Salvage project in 1984 raising a sunken car ferry in Mazatlan, Mexico. At that moment, I left the oil field of Louisiana for the international world of salvage diving. Working through the ranks within SMIT gave me the opportunity to apply my extensive field experience to the many other business functions within the organization. From Safety, Quality, OPA 90, Commercial, and finally Operations Management I approached each step as an opportunity and a privilege afforded to very few people, for which I remain grateful.

The preceding was excerpted from an interview originally published in the November 2012 edition of MarineNews, sister-publication to Marine Technology Reporter.

Subsea Vessel Operations Driven by Growth in Deep Water

Developments and Increased Operator Confidence

By Joseph Corrigan

DW forecast that approximately $77b will be spent on subsea vessel operations in field development, inspection, repair & maintenance (IRM) and subsea well intervention between 2012 and 2016. This is an increase of 63% over the preceding five-year period. Global vessel demand for these markets is expected to increase 33% on the previous five-years.

Global vessel expenditure grew from $8.7bn in 2007 to over $10bn in 2009 before dipping in 2010. During this period vessel contractors were largely protected from the financial crisis which strongly impacted some other sectors and were able to work off their backlog.

Subsea Vessel Operations

The latest edition of Douglas-Westwood's World Subsea Vessel Operations Market Forecast considers three main areas of activity: Field Development, IRM and Subsea Well Intervention.

Field Development:

Tasks carried out by vessels which can lift and install offshore and subsea infrastructure for new developments or connect additional subsea equipment to an existing production facility. The field development market is expected to see strong growth from 2012 onwards with vessel day demand totaling an estimated nearly 150,000 days with $4.2bn of expenditure over the forecast period. The sector suffered a slight decrease in activity between 2008 and 2010, as operators stalled projects due to the economic crisis. 2012 will mark the first year of growth after this period as confidence returns to the market and operators drive delayed projects into the installation phase. Future demand will be driven by developments in deeper waters. Oil majors have an urgent requirement to renew reserves to keep up with growing global demand for oil and gas and the largest prospects lie in deep water.

IRM:

Tasks carried out on offshore infrastructure below the water line in order to maintain production and ensure suitable HSE standards are met. Total demand for IRM vessel activity grew by 19% between 2007 and 2011 and expenditure reached $4.5bn in 2011 which represents nearly 28,000 vessel days. This continuing upward trend is being driven by the growing installed infrastructure base and is forecast to be worth $7.5bn by 2016.

Subsea well intervention:

Is an umbrella term for a number of distinct tasks which are designed to maintain structural integrity of wells or increase production. The use of intervention vessels will grow due to substantial cost savings over using rigs. From 2012 onwards the demand for riserless and rigless intervention vessels will increase dramatically. The vessel demand forecast over the period 2012-2016 is expected to total an estimated 23,000 days; an increase of over 130% compared to the previous five year period. This demand growth is driven by the realization of large cost savings possible through the use of intervention vessels and the subsequent increased adoption of the technology.

Subsea Vessel Supply

The last five years have seen an increase in the number of newbuilds entering the subsea vessel market. In the present build cycle subsea vessel numbers increased by over 70% and some types are now in oversupply, but availability of some others is extremely low. In some regions this is driving artificially high vessel day rates and an operator preference for highly versatile multipurpose vessels capable of covering a range of work scopes.

Vessel Contractor Competition

The market for vessel contractors is highly fragmented. DW has identified nearly 450 vessels from over 80 different contractors. While there has been some consolidation in the industry with the Subsea7/Acergy merger, the vessel market is comprised of a significant number of international vessel contractors and smaller regional players. The industry possesses high barriers to entry. New competitors face the challenges of the complex nature of project execution involved in offshore developments, the requirement for highly skilled employees and limited access to cheap newbuild financing options.

Market Forecast

DW forecast strong growth over the next five years with

annual subsea vessel operations expenditure set to rise from $11.3bn in 2012 to $20.3bn by 2016. This growth is a result of confidence returning to the subsea industry, a move towards deep water in underdeveloped regions and ultra deep in some already developed, and the subsequent increased demand for higher specification vessels over increased operational timescales.

Conclusions

The nature of the offshore industry has evolved dramatically over the past 10 years with deepwater accounting for 24% of activity in 2011 compared to 6% in 2000. This trend has driven an evolution in the types of vessels required by the industry to support offshore field developments with cranes, deck spaces & dynamic positioning systems increasing in size, complexity and efficiency. The general outlook for the subsea vessels market shows long term growth potential and a very sizable business opportunity. Despite this, the market will retain its long-term cyclicality as vessel owners over-react to the upcycles. The best vessels will, however, always find a market and niche-players will continue to thrive in any downturn.

About the Author

Joseph Corrigan sits within Douglas-Westwood's Research team where his principal activities include quantitative analytics and macro-economic analysis, competitive analysis and supply chain mapping. Industry areas of focus most recently include Subsea Vessels, Offshore Field Development, IRM & Well Intervention, and Subsea Diving Systems. Corrigan is a graduate of the University of Cambridge and has a Masters degree in Chemical Engineering.

About the Report

The new second edition of The World Subsea Vessel Operations Market Forecast 2012-2016 analyzes the main factors that are driving demand for ROVSV, DSV, Flexlay, LWIV and Pipelay Vessels and provides supporting information analysing each key sector. The report builds on the success of the first edition to include a comprehensive supply-side competitive landscape with major players and their fleets, segmented by vessel type, day-rate analysis and geographic focus:
Report details:
http://www.douglas-westwood.com/shop/shop-infopage.php?longref=1022~0

The EXO platform is configurable for many different applications, including seamless integration into open water and oceanographic research and monitoring.

Next Generation of CTDs
Smaller, Smarter and Tougher

By Danielle Dumont

CTDs are the core sensors for oceanographic measurements, providing information on water quality, water density, and speed of sound. Many CTDs are designed to operate in specific applications such as vertical profiling or long-term monitoring and include capabilities such as data logging, high-speed sampling, antifouling systems and additional sensor inputs. Although such systems can offer broad capability and good sensing performance, they are often large, expensive, and challenging to set up, maintain, and transport.

YSI Inc. (a Xylem brand) has introduced the EXO monitoring platform, designed specifically for challenging marine applications, to meet the need for a smaller, low power and more flexible CTD.

"EXO offers a major leap forward in the size, power draw, flexibility and maintenance of a small but powerful CTD. More than 20 YSI engineers have worked on this platform for over three years to create something truly exciting for the marine sensing community," says Rob Ellison, Executive Director of R&D, YSI.

The EXO platform has a smart sensing system that allows users to quickly configure a system with the sensors of interest for a particular application. Onboard power, data logging, and non-toxic antifouling simplify set up and system size. System maintenance is streamlined through smart sensors and universal sensor ports, allowing users to carry only calibrated sensors (5/8-in. diameter, 5-in. length), to the field rather than the entire monitoring system. The small sensors can be removed from the system and recalibrated; they store their calibration and metadata inside and re-

connect to the system seamlessly. The stored metadata also allows centralized calibration of sensors and easy field-swapping as well as affordable redundancy.

High-Accuracy Sensors

Building an EXO system with the desired sensors - such as fDOM, chlorophyll fluorescence, cyanobacteria fluorescence, turbidity, optical dissolved oxygen, pH, and ORP - is as easy as plugging the sensor into one of the smart ports via the Impulse wet mate connectors. An auxiliary port is also available for easy integration of a third-party sensor or for daisy-chaining multiple EXO sondes.

"One of the biggest headaches is integration," says Ellison. "So, an exciting feature of the EXO platform is its smart ports, which automatically recognize the sensors plugged into them and communicate this data to the data logger or DCP, thus streamlining what was once a complex set-up process."

The EXO2 platform, designed for long-term monitoring, offers six sensor ports in addition to the CTD as well as a central port of the antifouling wiper and an auxiliary port. The EXO1 platform is designed for shorter term monitoring, profiling and sampling applications with three sensor ports in addition to the CTD. Either platform can be configured quickly in the field for a broad variety of applications.

Rugged Materials for Extreme Environments

The materials used in EXO provide unprecedented reliability in field applications, such as long-term monitoring and vertical profiling to 250-m depth.

EXO1 and EXO2 sondes use unique combinations of polymers, metals and other rugged materials for strength and durability. Cutaway view shows the patented reinforced internal structure.

Titanium sensors, sapphire sensor windows, and wet-mateable connections result in an instrument that will stand the test of time and reduce the total cost of ownership. Highly durable Xenoy polymer stands up to high pressures underwater without leaking and resists the corrosion of saltwater. Additionally, the materials perform reliably in higher temperatures, up to 80°C.

Xenoy

Many of EXO's polymer components are molded from Xenoy resin. Xenoy was chosen because of its strength, impact resistance, chemical resistance, and low water absorption. YSI has been using the material for several years on field products with success. Xenoy is more environmentally friendly to mold than PVC and has better epoxy adhesion properties than acetal resin. "We researched other undersea products and found that dive lights used Xenoy successfully. From this, we refined an alloy mix for the polymer to especially suit the EXO instruments," says Ron Metzger, Lead Mechanical Engineer on the YSI development team for EXO. The mix includes adding another alloy to the polymer for UV resistance and degradation.

Metzger continues, "Xenoy's molding properties allowed us to fill both thin and thick wall parts to create both an ergonomic shape for easier gripping as well as a unique, patent-pending reinforced interior structure." The internal honeycomb-like structure of the EXO2 sonde imparts superior strength against external water pressures at depths of up to 250 m. The slimmer EXO1 has an internal stainless steel sleeve overmolded in Xenoy polymer. Xenoy is used as the exterior surface in place of metal in high-pressure underwater applications without being subject to corrosion like most metals.

Titanium

EXO sensors are made from grade 2 titanium, or commercially pure titanium. Titanium is commonly used for deep-sea instrumentation because of its corrosion resistance and strength at deep depths. EXO sensors are laser-welded shut and fully sealed, providing excellent leaking resistance. Metzger notes, "These are great properties but titanium is an expensive material; however, the investment is worth it for the improved quality and durability that oceanographic users require."

Connectors that Resist Corrosion

EXO's wet-mate connectors for sensors and cables resist

corrosion when wet. Moisture and dampness are ever-present when deploying and swapping instruments in the field. However, robust Impulse connectors (aluminum-bronze alloy plated in gold) provide superior corrosion resistance, even if the user drops the instrument with an exposed four-pin sensor connector directly in the water.

Tight Seals Are Leak-proof

Laser-welded joints on the sensors plus double O-ring seals prevent leaks in all water environments, from shallow to deep. All parts go through rigorous pressure/temperature testing before they leave the factory. Other tough components include exclusively designed Neoprene and urethane rubber shields on the connectors.

Sapphire glass on optical sensor windows is hard and durable and bonds well to metal for a tight seal on the probe face. The material is optically clear for the wavelengths used by EXO sensors and it won't interfere or fluoresce. The sapphire glass's smooth surface also resists biofouling and stands up well to regular sweeps from the anti-fouling wiper system.

Anti-fouling Makes a Clean Sweep

Built-in antifouling systems protect the integrity of the water quality data when the equipment is submerged in highly productive waters. A central wiper with a large brush on the EXO2 actively sweeps away fouling organisms from the sensors before the organisms get a foothold. This wiper has low power requirements, an optimal design for continuous monitoring. Where the sensors connect to the instrument body, EXO uses blended copper-brass alloy components to resist biofouling build-up. Copper is a passive anti-fouling agent and does not use harmful chemicals to clear biofouling. On the body of the instrument, Xenoy is well-suited for rigorous cleaning, such as scraping off barnacles, and can be taped or painted with common anti-fouling paint without "crazing," or cracking over time.

EXO Water Quality Monitoring Platform Specifications

EXO1 Sonde
Smart Ports: 4
Peripheral port: 1
Size: Diameter: 4.70 cm (1.85 in)
Length: 64.77 cm (25.50 in)
Weight 1.65 kg (3.63 lbs)

EXO2 Sonde
Smart Ports: 7
Peripheral ports: 2
Size: Diameter: 7.62 cm (3.00 in)
Length: 71.10 cm (28.00 in)
Weight 2.65 kg (5.83 lbs)

Sensors
Blue-green Algae Phycocyanin
Range: 0 to 100 µg/L PC; 0 to 100 RFU
Linearity: R2 > 0.999
Detection Limit: 0.04 µg/L PC
Response: T63<2 sec
Resolution: 0.01 µg/L PC; 0.01 RFU

Chlorophyll
Range: 0 to 400 µg/L Chl; 0 to 100 RFU
Linearity: R2 > 0.999
Detection Limit: 0.09 µg/L Chl
Response: T63<2 sec
Resolution: 0.01 µg/L Chl; 0.01 RFU

Conductivity
Range: 0 to 200 mS/cm
Resolution: 0 to 100: ±0.5% of reading or 0.001 mS/cm.; 100 to 200: ±1% of reading
Response: T63<2 sec
Resolution: 0.0001 to 0.01 mS/cm

Depth (non-vented)
Range: 0 to 250 m
Accuracy: ±0.04% FS (±0.10 m)
Response: T63<2 sec
Resolution: 0.001 m

Dissolved Oxygen-Optical
Range: 0 to 500% air saturation
Accuracy: 0 to 200%: ±1% of reading or 1% saturation; 200 to 500%: ±5% of reading
Resolution: 0.1% air saturation
Range: 0 to 50 mg/L
Accuracy: 0 to 20 mg/L: ±0.1 mg/L or 1% of reading; 20 to 50 mg/L: ±5% of reading
Resolution: 0.01 mg/L
Response: T63<5 sec

fDOM
Range: 0 to 300 ppb Quinine Sulfate equivalents (QSE)
Linearity: R2 > 0.999
Detection Limit: 0.07 ppb QSE
Resolution: T63<2 sec
Accuracy: 0.01 ppb QSE

ORP
Range: -999 to 999 mV
Accuracy: ±20 mV in Redox standard solutions
Response: T63<5 sec
Resolution: 0.1 mV

pH
Range: 0 to 14 units
Accuracy: ±0.1 pH units within ±10˚C of calibration temp; ±0.2 pH units for entire temp range
Response: T63<3 sec
Resolution: 0.01 units

Temperature
Range: -5 to 50°C
Accuracy: -5 to 35°C: ±0.01°C; 35 to 50°C: ±0.05°C
Response: T63<1 sec
Resolution: 0.001 °C

Turbidity
Range: 0 to 4000 FNU
Accuracy: 0 to 999 FNU: 0.3 FNU or ±2% of reading; 1000a to 4000 FNU: ±5% of reading
Response: T63<2 sec
Resolution: 0 to 999 FNU: 0.01 FNU; 1000 to 4000 FNU: 0.1 FNU

Calculated parameters: Salinity, Specific Conductance, Total Dissolved Solids, and Total Suspended Solids.

Complete sensor specs can be found at **www.EXOwater.com**

Big Success in a Small Package

The EXO water monitoring platform is small and lightweight. Its low power consumption* positions it well for continuous data collection at challenging and remote marine environments. And its robust materials rate the system to a depth of 250 meters - suitable for many coastal and estuarine applications.

EXO's welded titanium sensors and high-impact body are designed for high pressure and depths to 820 feet (250m).

The new platform has been well accepted; YSI booked more than $2m in orders for the EXO instruments in the first three months following its release.

"We're excited to bring this new, advanced platform to the water monitoring community," said Tim Finegan, Director of Environmental Monitoring, YSI. "We began the development of EXO by listening to user feedback and now we're able to deliver a solution that meets a variety of water monitoring needs - including deeper depths; more rugged materials to extend deployment times; and streamlined calibration procedures to save users time."

**Typical EXO2 power draw (CTD, DO, Turbidity, pH, Chlorophyll, Cyanobacteria, fDOM) at 12V: ON = 109 mA; SLEEP = 0.17 mA. System is on for ~10 seconds per sampling period.*

About the Author

Danielle Dumont is the Marketing Communications Manager for YSI's environmental monitoring products. She has been with the company for 11 years.

Marinexplore

Cutting Ocean Data Processing Time Fivefold

The growing fleet of robotic ocean sensors coupled with the emergence of new and affordable monitoring technology has increased exponentially the amount of data collected from the world's oceans. This puts decision-makers and researchers who work with these data in a completely fresh situation.

The challenge is: How to benefit from the abundance of the ocean data while keeping data acquisition, its management and processing budgets within reasonable limits?

It was early 2011, when Rainer Sternfeld worked on manufacturing profiling data buoys. Sternfeld, who has experiences on enterprise software, remote sensing and product development, had built with his team in 2009 a prototype data buoy. The buoy collected data properly, but processing and analyzing the data was a long and time-consuming process.

"I realized then that the bottleneck of the ocean data market was not in collecting the data, but in processing the data," said Sternfeld. Then, he conceived the idea for Marinexplore.

As Sternfeld discovered, most public ocean data is disconnected, often archived, and sometimes never used again. He

found that professionals who rely on ocean data are isolated from each other, and spend most of their exploration time on data processing. For example, when he spoke separately to two researchers on the opposite coasts of the small Baltic Sea, both of who were making measurements in the same area, they never had heard of each other.

Sternfeld, who had worked for ABB as the Baltic States Business Development Manager, leading it to win and establish world's first nation-wide fast-charging infrastructure for electric cars, was surprised that the methods and tools used for the ocean exploration were outdated and failed to take advantage of the latest technologies.

"I asked people, why there are no fast and intuitive software solutions for working with ocean data, and they all just answered this is the way it's always been," said Sternfeld.

"After all that insight I got few important things figured out. First, it was clear that intelligent mobile devices are becoming the new standard of the instrumentation industry. Further, cloud computing and big data are disrupting the computing and collaboration paradigm in the world. And end-user expectations to software usability have changed dramatically during last 10 years." summarized Sternfeld his findings and continued "What is needed is a solution that cuts data processing time at least fivefold and which enables secure data management between partners, subcontractors, and federal agencies. Both for open and proprietary data. We are going to solve this problem."

Launching Marinexplore

With a vision for bringing ocean data exploration and analysis into the 21st century, Sternfeld launched his new business, Marinexplore, in February 2012. By July he had an alpha version of the first product.

By the beginning of October the company got funded by investors from the U.S., Norway, Singapore, and Estonia. In October the company also came out with a significant upgrade in the product, integrating several satellite based data sources and releasing tools for working with data overlays.

Sternfeld has two co-founders. André Karpištšenko, acting as a Technology Lead of Marinexplore, came from Skype, the

"After all that insight I got few important things figured out. First, it was clear that intelligent mobile devices are becoming the new standard of the instrumentation industry. Further, cloud computing and big data are disrupting the computing and collaboration paradigm in the world."

technology flagship of Estonia, having founded the Data Research Team there. Kalle Kägi, the Product Data Manager of the company, was working previously on the data buoy with Rainer.

He assembled a team of top technology and science experts in the U.S. and in Estonia. The company has already started attracting top talent in the industry, hiring in September Roberto de Almeida, who created widely used open source libraries Pydap and scipy.io.netcdf.

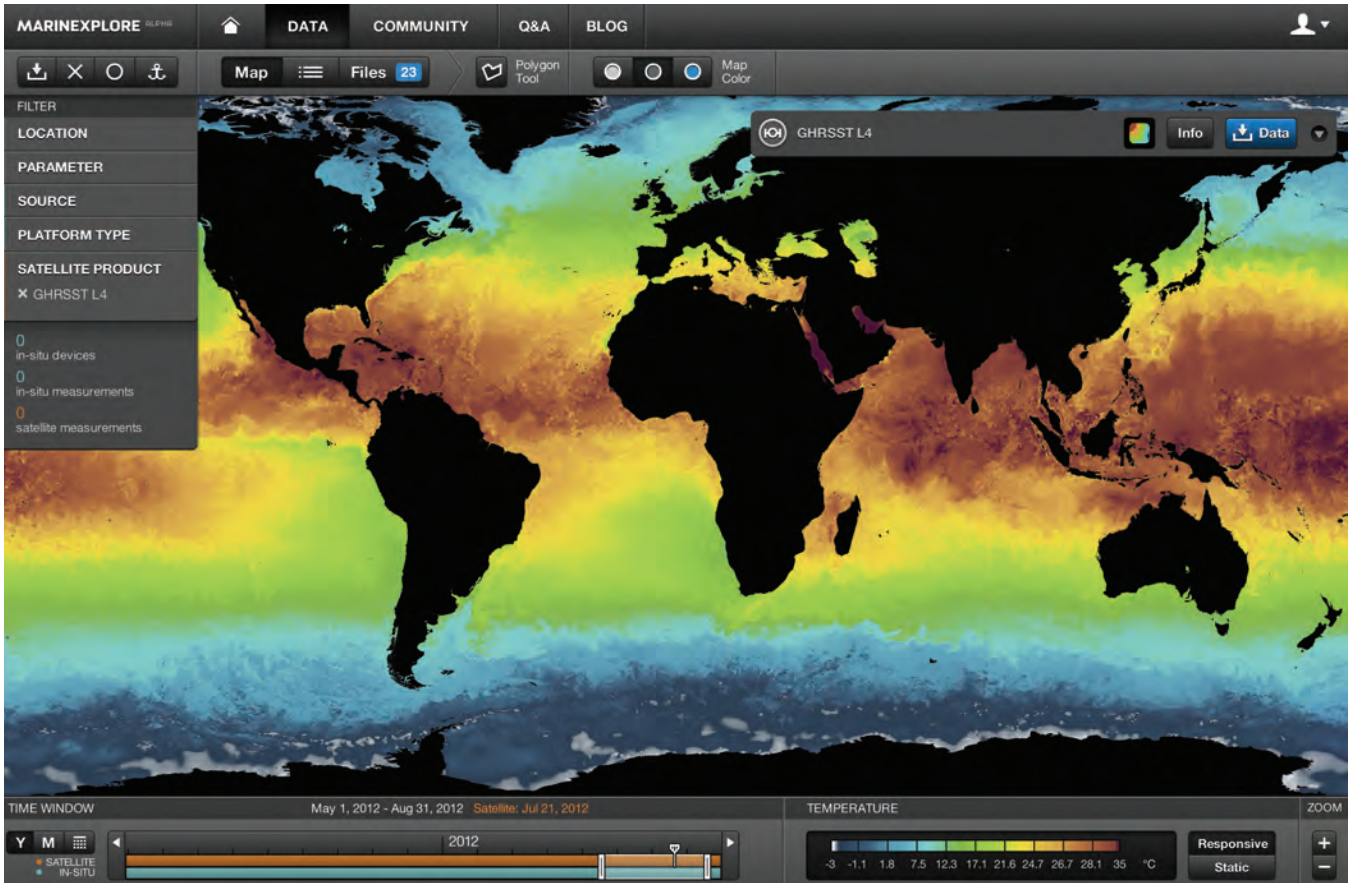
Organizing Ocean Data

Marinexplore addresses the two biggest issues around managing marine-related big data: how to access the vast amount of data that reside in isolated silos, segregated and disconnected from each other; and how to make the time-consuming handling and processing of all this data more efficient.

"To solve these problems, Marinexplore is creating the world's first ocean big data platform, dramatically cutting processing costs for offshore energy, fisheries and environmental analysis industries. To date there is no universal tool that organizes ocean data, and enables users to share public information securely across the globe." said Sternfeld. Making data management significantly more efficient means someone will have less work to do. By Sternfeld it's an opportunity not a problem, saying "Marinexplore will empower the professionals with cutting-edge tools to focus on their real expertise. Now, people can finally focus on making really useful conclusions based on data instead of spending days with Excel and Matlab."

The company has already aggregated over 1.2 billion in-situ measurements from more than 24,000 ocean-borne devices and two satellite products, organized into an easy-to-use user

Product view when satellite product is switched on (Sea Surface Temperature).



experience. Oceanographic measurements from a growing list of public sources include NASA GHRSST model data, NASA Aquarius salinity data, NOAA NDBC stations, GTS buoys and drifters, Argo floats, and Liquid Robotics wave gliders.

Focus on design and visualization

The first thing that grabs the attention after diving into Marinexplore tool is the design. While most map-based ocean data tools are similarly designed, Marinexplore's tools incorporate the latest technology; the simplicity and look & feel of today's web applications.

The menu is minimalistic and the interface is dark, bringing the map and data thereon to the focus. Sternfeld confirms that was intentional, adding, "We just wanted to eliminate all unnecessary to save space for what users are looking for – ocean data. Design, usability and data quality are key to our approach, because ultimately we are designing a process, not a tool."

The ocean community has so far relied on traditional data serving solutions, like FTP servers and other data access protocols, which in the usability terms mostly means the data can be accessed as a list of files. Marinexplore's solution is based on visual search. Each oceanographic measurement comes with coordinates indicating the depth and location, so each data point can be tied to a GIS system. Sternfeld explains, "It is much more intuitive for the humans to search geographic measurements using a map rather than browsing an endless table consisting of numbers."

The system includes four filters for finding the necessary data on the map – location, parameter, data source and device type. There's also a dynamic time filter that can be accessed with a slider or calendar. Besides default locations, a polygon tool can be used to choose any custom area according to the users preferences.

After filtering desired dataset, one can switch to the table view, which lists all the selected devices, allowing checking any necessary details related to the measurements. The filtered dataset can be downloaded with one click, CSV and NetCDF formats can be chosen.

In addition, Marinexplore has the ability to display simultaneously satellite product overlays and in-situ devices.

The data tool has graphs. Clicking on a device on the map opens a popup in the screen. This popup contains data about the device, but it also plots graphs for a number of parameters. Data graphs enable easy pre-screening of the data a user is interested of, which helps to avoid unnecessary downloads.

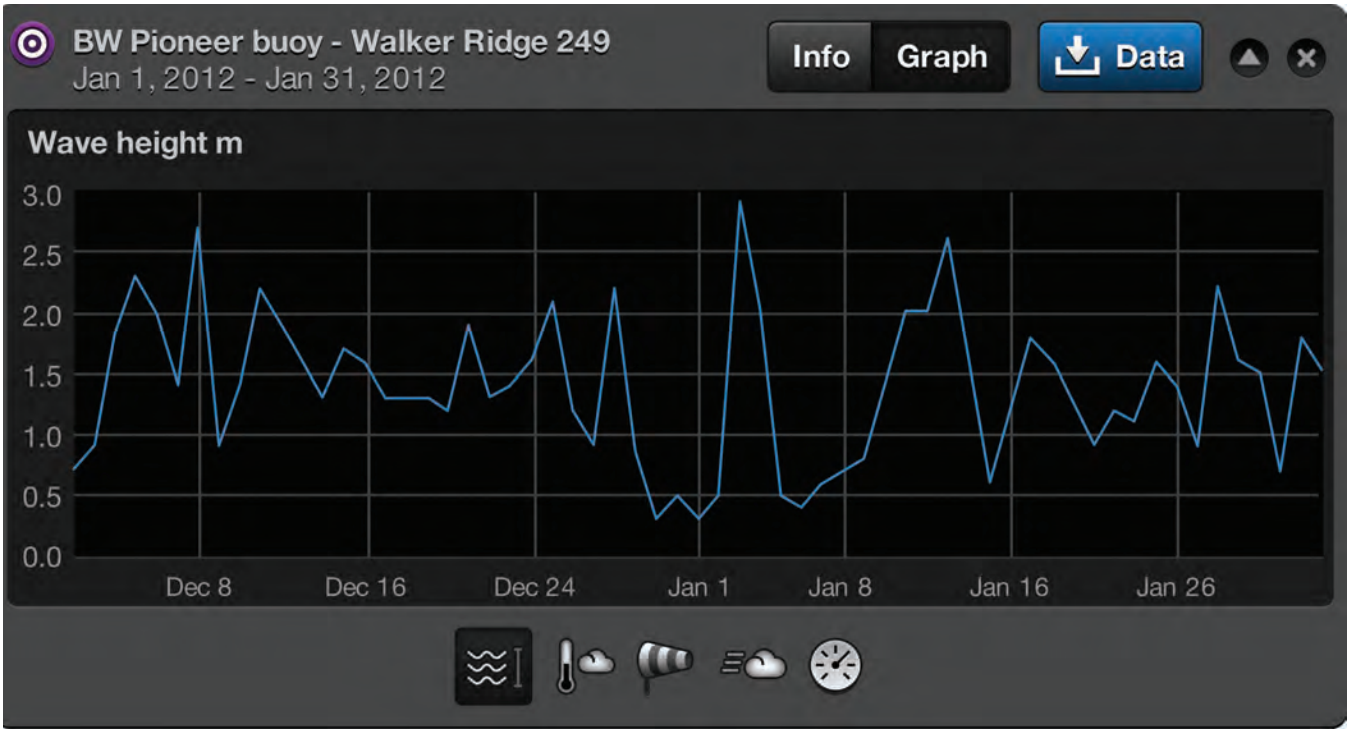
Everything Aggregated

Sternfeld states that the most powerful feature of Marinexplore is streamlined data aggregation. This allows a user to flexibly select a combination of oceanographic data sources to work with, creating unified datasets literally within seconds. Up until now, assembling a custom marine dataset was very time-consuming. For example, an aquafarming operator looking to extend to a new location needs broad spectrum of data. Each fish species has specific ranges for key oceanographic parameters, which support its habitats, like temperature, salinity, and chlorophyll. With Marinexplore, these data can now be analyzed in a fraction of time it used to take.

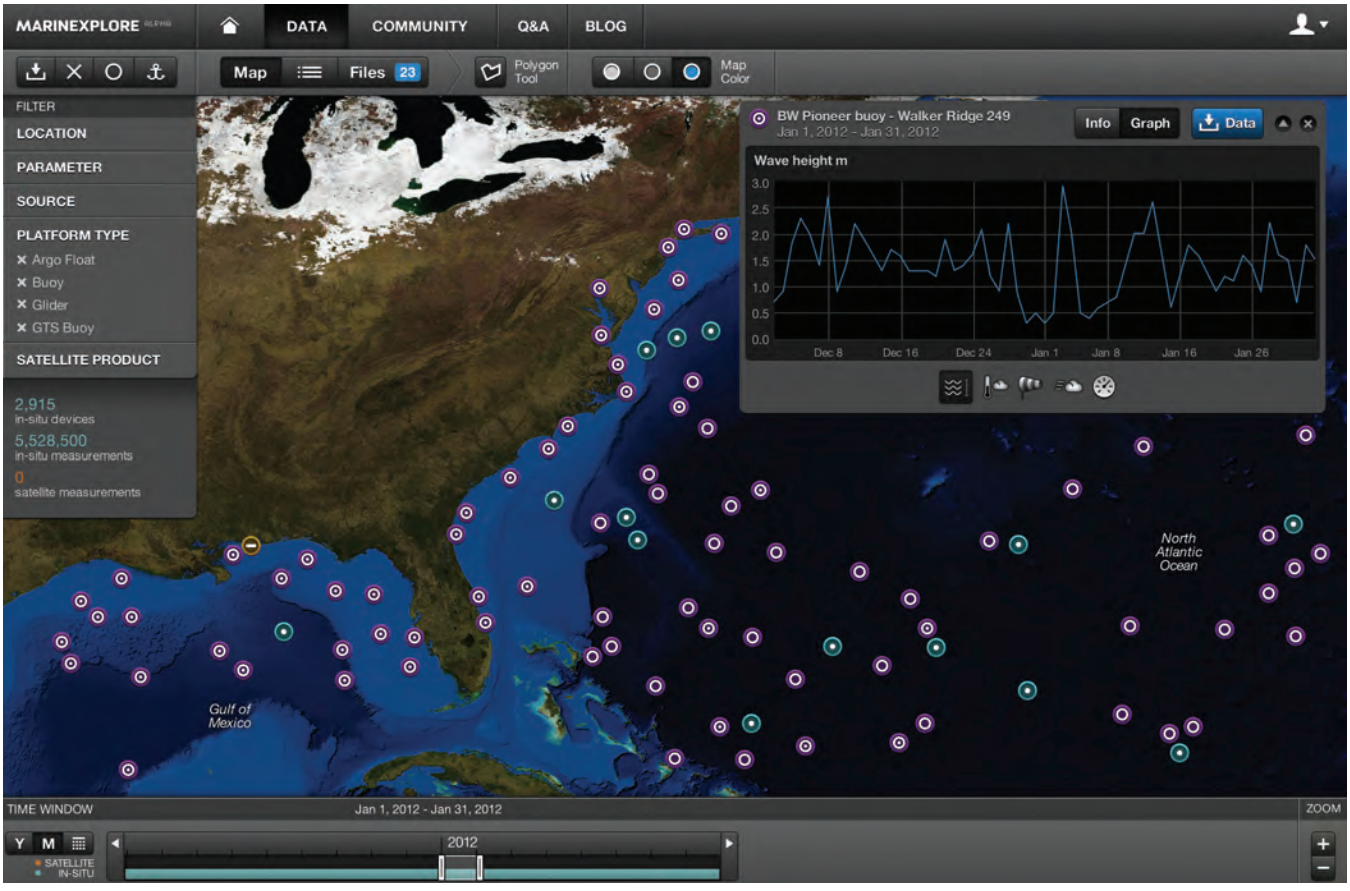
This also means, if the polygon tool is used for selecting specific area on the map while all data sources are switched on, the system is able to aggregate both in-situ and satellite sources. As one of the main issues for people working with ocean data is the quality,

Sternfeld tells they plan to introduce automatic validation rules and data quality checks that will be collaboratively improved together with the ocean community relying on Marinexplore.

Bringing all ocean data sources together raises the question of access and data rights. Although huge amount of oceanographic measurements are collected with the help of public funding, many researches still resist making the datasets freely available due to ongoing researches or copyright concerns. According to Sternfeld, Marinexplore has a solution for that: "We are working on private data management layer and the data owners will have full control over their rights and interests."



Zoom in of a Xview pop-up window (graph & other details for a in-situ platform, opens when user clicks the platform on the map).



Product view when in-situ stations switched on, a Xview window for one platform open.

Ocean Data Community

What makes Marinexplore completely different compared to other ocean data tools, are its community and co-creation features. As an ocean data collaboration platform, Marinexplore wants to bring together the whole ocean community.

This is an important component of the company's charter, according to Sternfeld. "Today people working on the specific task are collaborating usually with a couple of colleagues from around the world. For the benefit of all of us on this planet—and considering that 90% of the oceans are unexplored – we need to be much more open and collaborative with information and communications related to the oceans."

Much like LinkedIn, the Marinexplore community creates a virtual community for people working on oceans. Users can add work history, skills, and expertise. But Sternfeld says it's not that straightforward.

"The public profile is the tip of the iceberg. When I say 'collaboration' I mean collaboration. People will be able to explore and discuss data privately or publicly, sharing results in the real time and co-creating new content. It has happened elsewhere in the business software world. There's no reason why it shouldn't be so with the ocean data and community."

The main channel for the Marinexplore ocean community is the co-creation section of its website. Sternfeld believes co-creation will eventually be good means for the ocean community to making discoveries and developing new models. "And it will also help to create context around the data the users are looking for. Current registered users include members of the oceanographic and marine technology community, environment, offshore industry, and more," said Sternfeld.

A Look into Future

"Marinexplore is a system integrator that creates tools to manage different types of data on top of existing modern analytical data computing platforms. This is how we can increase the productivity and quality of end applications. So we are not actually creating something completely new but just putting pieces the right pieces to together" said Sternfeld.

The company is currently choosing pilot project partners for the API it is developing. "We are looking for ways to improve decision-making applications and to utilize other benefits that will be possible thanks to a well organized spatial data repository," said Sternfeld.

While many businesses are planning to shift their focus on ocean resources, tough competition and raising compliance requirements do not make conquering the new frontier any easier.

Sternfeld doesn't want to go into the details when speaking about other future developments of the Marinexplore but he's convinced in one thing: "We've entered into an era of big data. The tools used for ocean data have not yet entered this era. Marinexplore is going to introduce this era to the ocean community."

Market and Technology Trends in Underwater

Sensors & Instumentation

By
Joonkoo Lee, Hanyang University (South Korea)
Mary Turnipseed, University of California - Santa Barbara (U.S.A.)
Lukas Brun, Duke University (U.S.A.)

Underwater sensors and instrumentation have been developed for a broad range of activities – including mapping the seafloor, communicating underwater, locating underwater objects, and observing underwater animals and plants – carried out by government, industry, and the scientific research community. The Duke University Center on Globalization, Governance & Competitiveness (CGGC) recently completed a study on the global value chains of ocean technologies, including underwater sensors and instrumentation, for a consortium led by Nova Scotia's Department of Economic and Rural Development and Tourism (ERDT). Excerpts from the report on the market and technology trends in acoustic and non-acoustic underwater sensors and instrumentation are provided in this article.

Market trends in sensors and instrumentation

[Please note: trade information for underwater sensors is captured by the Harmonized System (HS) code 9014 and 9015 of the United Nation's Comtrade database. Unfortunately, these data are inextricable from data tracking "above-water" sensors; HS 9014 and 9015 capture all navigational and survey

Table 1: Leading exporters of navigational and survey instruments, 2011

Total (HS 9014 & 9015)		Navigational instruments (HS 9014)		Surveying instruments (HS 9015)	
World Exports	**$16.0 billion**	**World Exports**	**$5.8 billion**	**World Exports**	**$10.1 billion**
USA	21.6%	Germany	16.4%	USA	26.4%
United Kingdom	13.4%	France	13.9%	United Kingdom	13.4%
Germany	11.3%	United Kingdom	13.5%	France	9.5%
France	10.7%	USA	13.3%	Germany	8.3%
Canada	5.1%	Italy	9.5%	China	6.3%
		Canada	4.2%	Canada	5.6%

Source: Duke CCCG, compiled from UN Comtrade

instruments. Thus, all trends in trade that we report are for both underwater (acoustic and non-acoustic) and above-water sensors.]

The world's exports of navigational and survey instruments nearly doubled in 2001-2011, from $7.5 billion to $16 billion. In 2011, 63% of the exports, $10.1 billion, were accounted for by surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, while navigational instruments represented 37%, or $5.8 billion.

As shown in Table 1 (page 36), the United States was the world's leading exporter in navigational and survey instruments, representing 22% of exports in 2011. It was followed by the United Kingdom, Germany and France. Canada was the world's fifth largest exporter of underwater instruments in 2011. In navigational instruments, Germany, France, the United Kingdom and the United States form the leading group of exporters. In surveying instruments, the United States (26.4%) is the leader in exports, followed by the United Kingdom, France and Germany. Canada accounted for 4.2% of the navigational instrument exports and 5.6% of the surveying device exports in 2011. Among the top 20 exporters, Germany, China and Canada increased their share in the world market in 2001-2011 by 6%, 3% and 2% respectively. Meanwhile, the United Kingdom and the United States lost market share during the same period by 10% and 7%, respectively. China's exports of surveying instruments in 2001 was only a half of what Canada exported, but in 2011 the value of China's exports surpassed Canada's exports, accounting 6.3% of the world exports.

In terms of imports, the United States is the largest import market for navigational and surveying instruments, representing 17.4% of the world imports in 2011. It was followed by the United Kingdom (10.8%), Germany (7.0%), Canada (6.7%), and China (6.6%). For each subgroup of product, the United States and the United Kingdom are the two largest import markets, while China imported more surveying devices than navigational instruments in 2011. Canada represented 8% and 6% of the world imports in each sub-category (see Table 2, page 38.) Among the top 20 importers, China's and Singapore's markets have expanded the most in recent years.

Table 2: Leading importers of navigational and survey instruments, 2011

Total (HS 9014 & 9015)		Navigational instruments (HS 9014)		Surveying instruments (HS 9015)	
USA	17.4%	USA	18.0%	USA	17.0%
United Kingdom	10.8%	United Kingdom	12.2%	United Kingdom	9.8%
Germany	7.0%	Germany	9.3%	China	8.7%
Canada	6.7%	France	8.6%	Canada	5.6%
China	6.6%	Canada	8.3%	Germany	5.3%

Source: Duke CCCG, compiled from UN Comtrade

Their share of world imports increased in 2005-2011 by 2.2% and 1.4%, respectively. Meanwhile, import markets for underwater instruments in the United Kingdom and France declined during the same period in terms of their share in world imports by 4.6% and 1.3%. Overall, these figures demonstrate the dominant position of Western economies in navigational and survey instruments as both exporters and importers.

However, developing countries are becoming important markets for underwater sensors and instrumentation. The most rapid market growth for navigational and surveying instrumentation is found outside Western developed economies. Table 3 (below) shows the countries with the fastest growing markets for underwater instruments in 2005-2011. Among the top 20 importers in 2011, Colombia's imports grew fastest over the period, recording a 452% import increase, followed by Indonesia (279%), Russia (245%) and Brazil (158%). In navigational instruments, China, Russia and Hong Kong experienced the most rapid growth of their import markets, while Colombia, Norway and Russia have emerged as rising markets of surveying instrumentation. Brazil will likely be a strong growth market for underwater acoustic technologies such as side-scan and multibeam sonars in the near future as it develops its offshore oil resources. China has significantly expanded their imports, and, to a lesser extent, their exports, in the past decade. Some global lead firms have started to manufacture sensors in emerging markets to tap into the growing demand for acoustic and non-acoustic sensors and instrumentation. One example is Kongsberg Maritime's sensor factory in China, which was established in 2009 to sell its products to a growing number of customers in China and across Asia.

Technology trends in underwater sensors and instrumentation

New market demands, technology development, and firm consolidation have changed the global market for underwater sensors and instrumentation. Technology and manufacturing advances have led to the miniaturization and increased energy efficiency of instruments. A greater number of devices

Table 3: Fastest growing overseas markets for navigational and survey instruments, 2005-2011

Total (HS 9014 & 9015)	2005-11 Growth% (2011 imports)	Navigational instruments (HS 9014)	2005-11 Growth% (2011 imports)	Surveying instruments (HS 9015)	2005-11 Growth% (2011 imports)
Colombia	452% ($144m)	China	259% ($251m)	Colombia	544% ($100m)
Indonesia	279% ($163m)	Russia	225% ($59m)	Norway	264% ($257m)
Russia	245% ($341m)	Hong Kong	200% ($74m)	Russia	249% ($282m)
Brazil	158% ($202m)	Singapore	96% ($253m)	Indonesia	241% ($141m)
Norway	149% ($356m)	Italy	69% ($366m)	Germany	123% ($432m)

Source: Duke CCCG, compiled from UN Comtrade

are integrated and deployed on single platforms to increase the functionality of the platforms while reducing operational costs. Advances in research and development (R&D) and manufacturing are driven both by consolidated multinational firms, who offer a wide range of products for different end-markets, and by small and medium sized enterprises (SMEs), who meet the needs of narrow market segments or provide niche products that integrate with other firms' platforms and systems. We briefly discuss each of these trends below.

Miniaturization and power efficiency: The global underwater sensors market is seeing a remarkable trend towards smaller and more energy efficient technologies. Firms increasingly are using advanced manufacturing technologies, such as MEMS (Micro-Electro-Mechanical systems) and nanotechnology, to reduce the size of instruments. As several navies today are employing smaller naval vessels, future military underwater acoustic technologies will likely be smaller, lighter, and easier to deploy and recover than the devices currently available. Additionally, increased energy efficiency allows longer deployments of underwater instruments. Since deployment and retrieval of underwater sensors can often be very expensive (i.e., ship or aircraft time, ROV/AUV operations), extending the operational duration of instruments underwater is a major factor pushing innovation in the industry. In addition to miniaturization and power efficiency, the market for underwater sensors is focused on developing shallow-water applications and devices with high resolutions.

Integration and deployment of multiple sensors on single platforms: Another key trend is the bundling of numerous sensors and instruments on a single platform, and consequentially, the importance of system integrators in the underwater sensor value chain. Systems integration is rapidly evolving. Improvements in software and hardware have facilitated the integration of multiple sensors on single platforms. Integrators are combining instruments into "sub-systems" to develop measurement, wireless/satellite communication, and data collection/processing/storage sensor suites. Integrators also are pushing the development of modular "plug-and-play" technologies easily integrated with a number of platforms brands and types (i.e., ships, moorings, and ROVs/AUVs).

Rugged sensors and instrumentation: The expansion of human activity in the Arctic Ocean and the deep sea has led to a demand for sensors and instrumentation capable of surviving extreme conditions. For work in these environments, end-users will increasingly demand equipment with greater energy efficiency, longer mission life, and capable of automated or remote control. The key technology challenges are increasing the reliability and resilience of sensitive instru-

ments on ships, underwater vehicles, and other marine platforms to allow for continued remote operation with minimal maintenance, repair or human supervision.

Market consolidation: An additional trend is the growing consolidation of the marketplace. In an effort to provide a wide range of products for many different end-markets, some large firms are buying smaller firms. Acquiring smaller, more specialized firms enables technological acquisition and helps firms to attain scales of economy in research and development, marketing, and end-market coverage. This trend will likely continue in the future, especially as a way for large firms to acquire innovative technology.

One example in the industry is Teledyne Technologies (profiled in the September issue of *Marine Technology Reporter*).

Since 2005, it has acquired 26 firms: in 2005, Cougar Components, RD Instruments, Benthos; in 2006 Rockwell Scientific, Ocean Design, CollaborX; in 2007, D.G. O'Brien, Tindall Technologies, Judson Technologies; in 2008, Impulse Enterprise, TSS International, Judson Technologies, Webb Research, Filtronic Plc (defense electronics), Cormon, Odom Hydrographic Systems, Demo Systems; in 2010, Optimum Optical Systems, Intelek plc, Hafmynd (Gavia's AUV maker), DALSA Corporation, and Nova Sensors.

In 2012, Le Croy, PDM Neptec, Blueview Technologies, and VariSystems were acquired by Teledyne Technologies.

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The full report is available free of charge at http://www.cggc.duke.edu/pdfs/2012-03 05_Nova%20Scotia%20OTReport.pdf

MARINE TECHNOLOGY REPORTER

2013 Editorial Calendar

January/ February — Ad Closing: Feb 1

Subsea Vehicle Report: Unmanned Underwater Systems

Market: Renewable Energy –Wind, Wave & Tidal Power Report
Product: Scientific Deck Machinery
Regional Report: Northeast USA

Bonus Distribution
Subsea Tieback
March 5-7
San Antonio, TX

March — Ad Closing: Mar 1

Instrumentation: Measurement, Processing & Analysis

Market: Sonar Systems & Seafloor Mapping
Product: Umbilicals, Cables, Connectors & Power Supply
Preview: Ocean Business 2013

Bonus Distribution
Ocean Business
April 9-11
Southampton, UK

April — Ad Closing: Apr 1

Offshore Energy Report

Market: Seismic Vessels & Systems
Product: Deepwater Positioning, Mooring & Anchoring
Report: Environmental Monitoring, Remote Sensing & Pollution Control

Bonus Distribution
OTC
May 6-9 Houston, TX

May — Ad Closing: May 7

Hydrographic Survey

Market: Salvage & Recovery
Technical: Seaflooor Mining
Product: Subsea Inspection

Bonus Distribution
Energy Ocean International
June 10-12 Warwick, RI
UDT 2013
June 18-20 Hamburg, DE

June — Ad Closing: Jun 3

AUV Operations

Market: Communications, Telemetry & Data Processing
Product : Deck Machinery, Winches, Cranes and Ropes
Report: Seafloor Engineering & Remote Operations

Submission Deadline:
Entries for the MTR 100 must be submitted to the editor by June 28

July/ August — Ad Closing: Jul 26

MTR 100

The MTR 100 is an invaluable guide for companies, government agencies, municipalities, research institutions and universities

Special Edition:
MTR 2013 Global Subsea Products & Services Directory

Bonus Distribution
AUVSI Aug 12-15
Washington DC

September — Ad Closing: Aug 28

Ocean Observation: Gliders, Buoys & Sub-Surface Monitoring Networks

Market: ROV Technology: Workclass to Micro Vehicles
Products: Underwater Imaging: Lights, Cameras, Sonar
Regional Report: Southern California
Preview: Oceans 2013

Bonus Distribution
Oceans '13
Sept 23 to 27
San Diego, CA

October — Ad Closing: Oct 4

Subsea Defense

Market: Naval Underwater Warfare Technology
Product: GPS, Gyro Compasses and MEMS Motion Tracking
Special Report: Training & Education Institutions & Facilities

Bonus Distribution
SNAME
Nov 6-8 Seattle, WA

November/ December — Ad Closing: Nov 22

Fresh Water Monitoring & Sensors

Market: Marine & Subsea Engineering & Construction
Product: Offshore Inspection, Repair & Maintenance
Preview: Underwater Intervention 2014

Special Edition: 2nd Annual Underwater Imaging Contest

Bonus Distribution
Underwater Intervention

Please note that the publisher reserves the right to alter this calendar. All features are subject to change in light of industry trends and developments.

Photos: Mara Tuchman

NATO

Center for Maritime Research and Experimentation

World-class laboratory and research vessels enable highly qualified international staff of scientists and technicians to conduct critical research to learn about the maritime environment

By Edward Lundquist

At NATO's world-class undersea research center, one can't help but admire the more than 50 years of success. But the scientists, engineers and technicians at the Center for Maritime Research and Experimentation (CMRE) are focused on the future.

The NATO Undersea Research Center (NURC) became CMRE in July 2012. According to CMRE Director Dr. Dirk Tielbuerger, this represents an opportunity to apply the center's knowledge and capabilities to the entire maritime domain. "This will better reflect our contributions to meet the needs of the 28-nation alliance, and to take full advantage of science and technology and our expertise in this domain."

Much of what NURC accomplished during the Cold War took place in the shadowy undersea realm, addressing the challenge of anti-submarine warfare. Not surprisingly, much of that research and development was kept deliberately at a low profile.

That's changing. CMRE is truly broadening its mission and capabilities. And the center wants you to know about it.

"Our Science & Technology (S&T) focus is to develop and then demonstrate how new concepts and equipment performs in the operational maritime environment," said Tielbuerger.

More than ever, NATO is reaching out to other nations to promote its mission of peace, cooperation and interoperability; being able to work together and forming coalitions; and establishing an environment of security. All partners benefit from this sharing and collaboration. CMRE exemplifies this spirit of cooperation.

Not surprising, CMRE has world-class facilities available for researchers. CMRE operates the ultra-quiet research vessel Alliance, and the smaller coastal research vessel Leonardo, for the benefit of NATO and member nations. "We invite researchers to see how we can collaborate on oceanographic and maritime research that is best conducted aboard a highly capable and quiet dedicated research platform," Tielbuerger said.

"Even when nations have the capability themselves, they gain a great deal from collaboration," said Chief Scientist Ed Gough. "The NATO nations, through our work here, have been able to leverage the work of partners to take advantage of innovation, discoveries, inventions and knowledge around the world."

"Science leads to technology that delivers capability," Gough said. "And new technology allows us to do science new science, which creates a virtuous cycle."

Smart Defense

NATO Secretary General Anders Fogh Rasmussen is promoting a new approach to defense spending in a time of economic crisis. It's called "Smart Defense," and it calls for nations to "pool and share capabilities, to set the right priorities,

(photo by Edward Lundquist)

CMRE scientists and engineers support the annual Student Autonomous Underwater Competition – Europe, where student teams build and operate unmanned underwater autonomous vehicle to complete a series of task in the CMRE basin in La Spezia harbor.

CMRE uses fixed sources, such as the 'deployable multistatic sonar' and oceanographic buoys, to study how sound spreads at sea. To better understand human-made underwater sounds and how they interact with marine life, CMRE and NRV Alliance conduct the Marine Mammal Risk Mitigation Programme to help detect and study marine mammals.

"We invite researchers to see how we can collaborate on oceanographic and maritime research that is best conducted aboard a highly capable and quiet dedicated research platform"

Dr. Dirk Tielbuerger, CMRE Director

and to better coordinate our efforts...ensuring greater security, for less money, by working together with more flexibility."

"It almost sounds as if we're trying to piggyback on the smart defense paradigm, but the pooling and sharing concept seems ideally suited to what we do," said Andy Pickup, the center's deputy director and chief operating officer.

Pickup says CMRE has capital assets in place paid for by NATO so that someone who wants to use them doesn't have to make that full investment. "If we get an arrangement where we can share the fixed costs amongst the group of nations, then our operating costs become lower than those around the world for a similar capacity. That gives nations the opportunity to come and conduct experiments, either individually or in collaboration with us and others using the assets which are being procured on their behalf or with their resources."

In addition to using CMRE assets for future work, researchers can benefit from the vast amount of information that the center has produced to date. There are vast quantities of data which can be accessed at CMRE or sent across the net. "The archive, the valuable data that we've generated, is available. So in many cases, they can kick start their own science by just using these reference data sets that we've produced. And we publish them for use by others. These data sets are a gold mine for scientists and engineers working in the ocean."

"The most valuable resource we have here, though, is the knowledge and the skills of the people," Pickup said.

EKOE

One important CMRE effort is called EKOE, or environmental knowledge and operational effectiveness, which seeks to take that oceanographic, hydrographic and meteorological information and put it in the proper context for a particular operation.

"Different technologies are used for sensing the environment, using that information to create numerical models that allow us to extrapolate—both in time and space—what the forecast conditions are, and what the uncertainty of that forecast may be," said John Osler, EKOE program manager.

"We want to be able to covertly collect environmental information without revealing our interest in a particular area. A ship is obvious and would reveal our interest, but autonomous vehicles can enter a 'denied' area where we don't have free access but we anticipate the requirement to operate," Osler said. "We recently used underwater gliders during the predeployment phase of a NATO fleet exercise to conduct the environmental characterization. That information was used in conjunction with a numerical model to provide the ocean forecast to the exercise participants. We had both military oceanography objectives as well as some fundamental science objectives, working with these new technologies and the ocean models."

The staff members come from many different NATO nations, and bring a multi-disciplinary approach to challenges. "We don't keep knowledge to ourselves, because NATO has

"You know when you're in the physical maritime environment because it tastes like salt. You know when you are in the synthetic environment when you are looking at a screen. Both are important."

Ed Gough, Chief Scientist, Center for Maritime Research and Experimentation (CMRE)

a policy of rotating its scientists," Pickup said. "Part of our challenge is not only exploiting the things that we've learned, but continuing to refresh that knowledge base."

Additionally, visiting scholars and interns from a wide range of academic disciplines representing academia, government and industry bring their perspective and insights to problem-solving, a win-win proposition.

"We're here to support the scientists," said Alain Maguer, who heads up the engineering department. "Scientists want to develop new concepts, and using technologies that might not exist yet. So we try to translate what they are telling us into something that we could design and fabricate here, or we could buy. We integrate all the pieces together, and, very importantly, we test the system at sea. We have the sea at our doorstep, and we have two ships, the Alliance and the Leonardo. We see what is not working properly and we are able to modify as needed. And then we test again."

The engineering department is 50 people, Maguer said. "We have or can build more or less all the equipment that we could dream of needing."

Maguer said the people in the engineering laboratories can turn prototypes into operational concepts quite quickly. "We cannot make production versions of these items, but we can test prototypes in an operational environment."

"We are a world class facility for calibration," Maguer said. "We have an acoustic, oceanographic and optic calibration facility."

"The beauty of this place is when you put the scientists together with the engineering capability. Our engineering component and the experimentation facilities make this one of the best places in the world in the maritime domain," Maguer says.

While the scientists come and go, the engineering staff does not. "We have recently hired some new people, but some of our engineers and technicians have been here 30 years. What is important is that the team—even after all those years—are still very enthusiastic about going to sea," Maguer said.

CMRE is in a unique position, says John Potter, project leader at CMRE. "It doesn't have conflicts of interest with commercial companies. And it's not a single nation. It has participation from 28 nations. It's a multi-national environment. So it's inherently cross-cultural, inclusive, open, and collaborative."

"And it's a one-stop shop," said Rob Been, ASW program manager. "You have all the nations—28 of them; you have a ship; you have an engineering department that can make your hardware; and you have the scientists that can work both on software and on principles, on detection algorithms, on communications and networking stacks, and architectures. It covers the whole spectrum. That's the power of the center."

From a business standpoint, Pickup said there's also a new emphasis on customers. "We've shifted this year to a system called Enterprise Project Management where all of the work is driven by projects. For customers to want to fund these

"We're looking at a more automated robotic solution. We're trying to eliminate tethers, and allow multiple vehicles to communicate with each other and work together while people are kept at a safe distance from potentially mined areas"

Warren Fox, program manager for the overall autonomous naval mine countermeasures program, CMRE

projects, we must offer them something that they can't do, or we can do better than others."

Real Artificial Intelligence

CMRE draws on its legacy of knowledge, expertise and experience in the undersea environment. But the research has applications in all aspects of the maritime domain. CMRE is studying autonomous unmanned underwater systems to find enemy submarines and neutralize underwater mines, requiring multidisciplinary approaches involving autonomy, artificial intelligence, and system interaction and collaboration.

"The systems today are limited to human-guided systems or systems that execute preplanned missions. Human operators must intervene to observe events, make decisions and guide the vehicle," said Warren Fox, program manager for the overall autonomous naval mine countermeasures program at CMRE. "They are very operator-intensive. "

"We're looking at a more automated robotic solution. We're trying to eliminate tethers, and allow multiple vehicles to communicate with each other and work together while people are kept at a safe distance from potentially mined areas," said Fox.

These systems must have the ability to learn about their surroundings, and be able to think.

"One of the big limitations on sensing the environment, which is the intelligence you need on which to make a decision for intervention, is dependent on how big an aperture you have. And that used to mean a physical aperture towed by a big ship, which could be kilometers long," said Potter. "Now, with lots of autonomous vehicles, you have an option for creating an aperture out of discrete elements that could also be kilometers along or across.

AUVs are smaller and cheaper than ships, allowing us to develop new intelligent-adaptive ways of gathering environmental data, forming a big-picture of what is going on and responding to it.

But that comes with some very significant challenges. Now that the technology of autonomous vehicles and robots is relatively mature, the challenge has really shifted toward their intelligent behavior. It's one thing to make a system autonomous. It's quite another to make it intelligent."

"Communication in that realm of the world is very difficult and prone to frequent disruption," said Been. "It's complex and dynamic due to the sheer physics of the problem. That means that the bandwidth is quite low for communications. And so, locally, these systems have to be intelligent. They have to know what to do."

"How do you have a collection of autonomous, intelligent assets control themselves as a team to produce more than the sum of the parts? That's not a solved problem," said Potter.

A recent experiment that exemplifies this multi-disciplinary approach sounds like a sci-fi scenario. "To say 'We've got all these autonomous underwater robots, and they can listen for and detect submarines, and cooperate with each other to hunt the submarines down,' sounds very Matrix-like. It's a very sci-fi kind of vision. And, indeed, it's a big leap forward to devolve the intelligent actions of hunting a submarine down to an automated system—it's a huge step in machine intelligence."

"We have just now reached the point where all the pieces have been tested and we're actually putting the whole thing together and having a couple of vehicles in the water in a very realistic scenario where they will do exactly what I just described," says Potter.

Operational S&T

"Our charter is to organize and execute an S&T program in the maritime environment. Which for me is made of two parts: the physical environment and its synthetic counterpart. You know when you're in the physical maritime environment because it tastes like salt. You know when you are in the synthetic environment when you are looking at a screen. Both are important," said Gough.

We have acoustic engineers, physicists, computer scientists and mathematicians all working to better understand the maritime environment and find solutions for maritime autonomous unmanned systems, underwater communications and maritime information," said Gough. "It's our job to help NATO operationalize that S&T in the maritime and turn it into what the commanders and decision-makers advantage. It opens up options for warfighters."

"We don't know enough about the ocean to know what it will do next. We're always working at the frontier," Gough says. "When we're at the frontier, we never really know what's next."

Scientists and researchers have frequent opportunities for at-sea experimentation and field testing. Year-round access onboard the ship encourages cooperation among top scientists and engineers from NATO's member nations.

NRV Alliance has a 400 sq. m. open deck work area and 500 cu. m. of storage. The vessel is also equipped with winches and other deck handling gear for deploying and towing the systems and instrumentation needed for acoustic and oceanographic research.

Natural Wonders

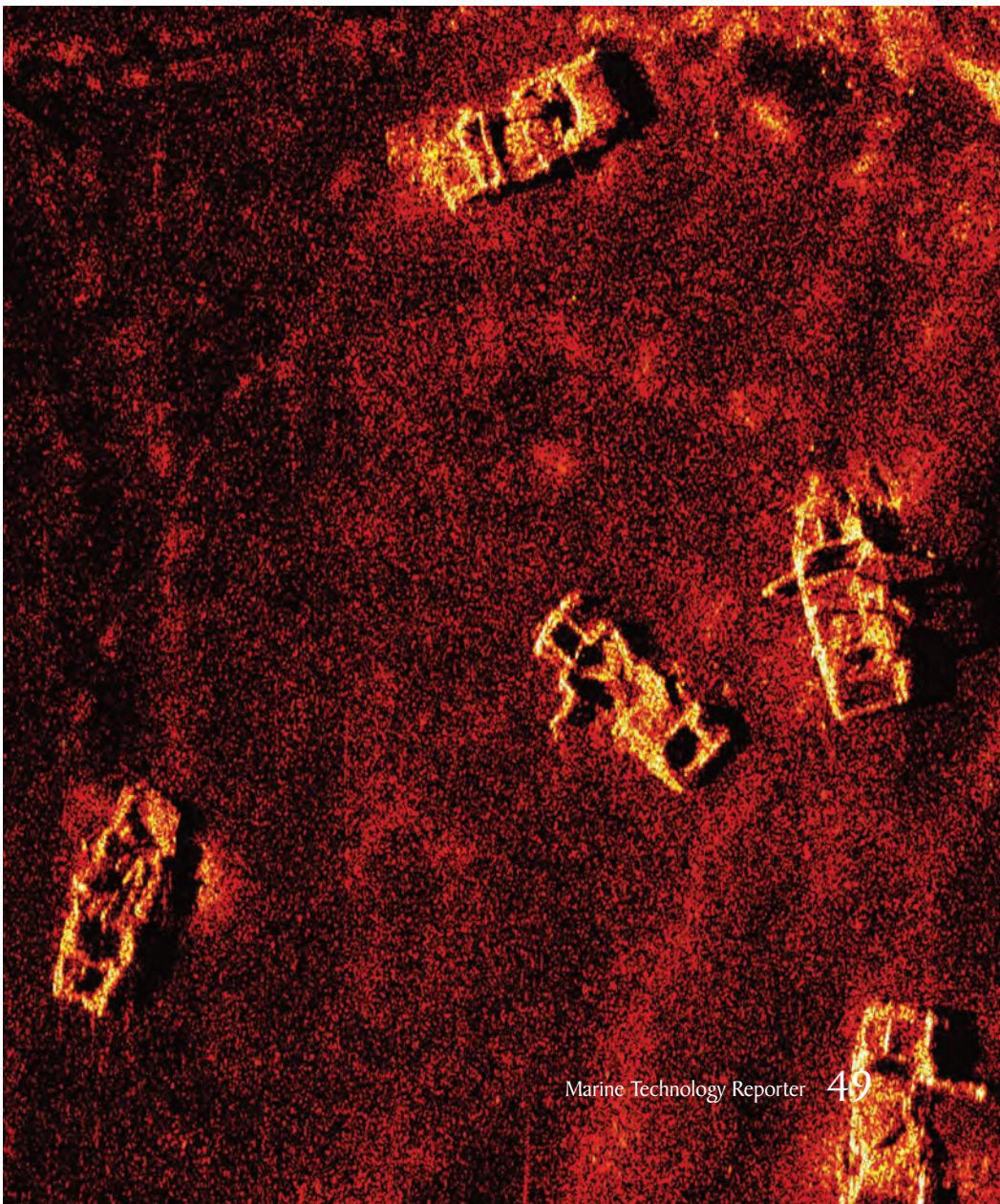
Vehicles & Equipment

What: ROV immersion and Ranger behind Ausias March seamount, Majorca Channel, Balearic Islands, Spain. Expedition Oceana Ranger 2010: Discovering seamounts
Where: Ausias March seamount, Majorca Channel, Balearic Islands, Spain
Who: Oceana Europe

***Marine Technology Reporter's* 2nd Annual image contest garnered entries from around the world, as readers document the beauty and wonder under the waves.**

Acoustic Imagery

What: Discarded automobiles in Bedford Basin imaged with Aqua-Pix, a 300 kHz wideband synthetic aperture sonar. Water depth is approximately 65 m.
Where: Halifax, Nova Scotia, Canada
Who: Jeremy Dillon



Vehicles & Equipment

What: Hydroid's REMUS 600 onboard the Meriel B. traveling down the Cape Cod Canal, Massachusetts prior to testing.
Where: Cape Cod Canal, Massachusetts
Who: Christine Williamson

Ocean Life

What: Clumps of gooseneck barnacles.
Where: West Coast of Vancouver Island, BC
Who: Keeha Levitan

Ocean Life

What: Crown jellyfish (Cephea cephea) beneath the surface.
Where: Central Red Sea, Saudi Arabia
Who: Till Roethig

People

What: Underwater maintenance in SCUBA.
Where: Ensenada, Mexico
Who: Chad Nelson

People

What: Tannic acid colors the water with a tea stain, when combined with spring water and sunlight it appears the water is set ablaze.
Where: Ginnie Springs, Florida
Who: Kristi Bernot

Dr. Gruber to Lead Battelle Undersea Systems Division

Dr. Patricia Gruber is bringing her knowledge in marine physics, oceanography and applied technology to Battelle where she will lead its Undersea Systems business division.

Gruber has held a variety of technology leadership positions in the field, most recently as Deputy Director at the Applied Research Laboratory, Pennsylvania State University. Prior to that, she served as Director of Research at the Office of Naval Research in Virginia as well as positions with Bell Labs and AT&T Solutions.

She holds a B.S. in Meteorology from Pennsylvania State University, an M.S. in Physical Oceanography from the University of Miami and a Ph.D. in Applied Marine Physics from the University of Miami.

Gruber will lead a large team of scientists, engineers, analysts and researchers in the Undersea Systems Division which is part of Battelle's National Security Global Business.

NOAA Seeks Members for Ocean Exploration Advisory Board

NOAA's Office of Ocean Exploration and Research (OER) is accepting applications from and nominations for individuals with appropriate professional backgrounds who are interested in serving on NOAA's Ocean Exploration Advisory Board. Board members will advise the under secretary of commerce for oceans and atmosphere on all aspects of ocean exploration.

"The individuals selected for this Board will help shape the future of our nation's ocean exploration program," said Robert Detrick, Ph.D., assistant administrator for NOAA research.

Ten board members, including a chair and co-chair, will be appointed initially to three-, four- or five-year terms. They will identify ocean areas that warrant exploration, and will explore issues related to ocean exploration technology development and enhancement, data and information management, and dissemination of results. Board members will also provide advice on the program's relevance to NOAA's strategic plan and other relevant guidance documents. Consideration will be given to those with scientific credentials, national reputations and expertise in fields relevant to ocean exploration including ocean science, engineering, technology, education, social science and communication.

Members will meet two times a year, exclusive of subcommittee, task force and working group meetings.

These special government employees are unpaid, but will be reimbursed for reasonable expenses incurred during duty.

For more information, view the Ocean Exploration Advisory Board notice in the Federal Register at: http://www.gpo.gov/fdsys/pkg/FR-2012-10-29/pdf/2012-26512.pdf. All required application materials must be submitted no later than 5 p.m. EST on Dec. 28, 2012, to Yvette Jefferson via mail, fax, or e-mail. Mail: NOAA, 1315 East West Highway, SSMC3 Rm. 10315, Silver Spring, MD 20910; Fax: (301) 713-1967; E-mail: Yvette.Jefferson@noaa.gov.

Bertelsen New MD of Atlas Hydrographic

Allan Bertelsen is the new Managing Director of Atlas Hydrographic GmbH. Until now, he had managed the business of the Danish subsidiary Atlas Maridan ApS. The activities of the ATLAS ELEKTRONIK Group for the commercial and civilian market will in future be concentrated within ATLAS HYDROGRAPHIC. This field includes the development and manufacture of unmanned, autonomous underwater vehicles and scientific surveying systems with which, for example, pipelines, offshore installations and the seabed can be monitored, surveyed and mapped. AT-

LAS MARIDAN will also be offering services relating to the deployment of unmanned underwater vehicles.

Volker Paltzo and Dieter Rottsieper, Managing Directors of ATLAS ELEKTRONIK, commented: "Allan Bertelsen has the necessary experience and knowledge to position the restructured ATLAS HYDROGRAPHIC within the relatively new business area of unmanned underwater vehicles, and to lead the company to success. In this way, the company will also be able to expand its offering in the existing core segment – hydrography – to a significant degree."

"Autonomous underwater vehicles are still poised at the beginning of their technical development and commercial possibilities. With its range of products and services, ATLAS HYDROGRAPHIC is well prepared to meet the needs of its customers and to develop this market further," said Allan Bertelsen about his new duties. His predecessor, Ulrich von Somnitz, will be returning to ATLAS ELEKTRONIK GmbH.

Liquid Robotics Hires Gysin

Liquid Robotics said that Gary Gysin has joined the company as executive VP of global sales and services, where he is expected to build upon the momentum for Wave Glider data services to scale the business for the next phase of expansion and growth. Gysin more than 20 years of experience leading public and start-up companies in IT communications, network and infrastructure systems involving complex hardware, software, and data services solutions.

CTG Invests in Engineering Department

Channel Technologies Group (CTG), a designer and manufacturer of piezoceramics, transducers and sonar systems, launched a new Engineering Department under the direction of Mark Shaw as the Vice President of Engineering. The new Engineering Department features a standalone research and development function, as well as newly appointed directors and managers focused on expanding CTG's technical leadership and commitment to developing innovative products.

"In order to remain one of the leaders of our industry, we need an engineering department committed to researching and developing technologies of the future," said Kevin Ruelas, CEO. "Under Mark's leadership, the CTG Engineering Department will continue to provide top quality designs and service that meet our customers' requirements while also introducing new research and development initiatives that will provide a

Hydroid Breaks Ground on New Facility

Hydroid has broken ground and begun construction on its new manufacturing and applied research facility in Pocasset, MA. "Outgrowing our old space gave us the opportunity to design a facility that will protect the environment and keep Cape Cod the wonderful place it is today, all while creating great jobs," said Chris von Alt, Hydroid's president and CEO. "Hydroid's leadership team has worked closely with the town of Bourne and the Cape Cod Commission to ensure this new facility does just that." The new HQ, located just a short distance away from Hydroid's current home, has 40,000 sq. ft. of floor space. The building will provide a venue for the company to further its mission of building AUVs for both military and commercial use, providing room for the company to grow substantially. Hydroid expects to hire at least 21 new employees during 2013.

www.hydroid.com

steady stream of innovative designs to meet the emerging needs of our customers."

Shaw assumes the position of Vice President after more than 23 years working at CTG. Shaw has more than 29 years of experience in the design and development of piezoceramic acoustics and sonar systems. He holds master's and bachelor's degrees in Engineering from Harvey Mudd College in Claremont, Calif. CTG also named three new directors that will report directly to Mr. Shaw:

- **Brad Hinnrichs**, Director, Programs, a certified Six Sigma Black Belt, joins CTG, bringing more than 15 years experience in program management, product development and continuous improvement in commercial, aerospace and defense industries.
- **Ender Kuntsal**, Director, Research and Development, is an internationally recognized engineer with more than 30 years developing advanced transducers and acoustic devices.
- **John Mather**, Director, Systems Engineering, with more than 36 years experience at CTG will oversee the development of successful systems in the position created to ensure overall efficient and effective design and manufacturing objectives are met.

In addition, the following managers will be serving key roles in CTG's expanding Engineering Department:

- **Mike Haun**, Manager of Ceramic Engineering, joined CTG in 2011 with over 32 years experience in developing piezoceramics.
- **Bob Pino**, Manager of Transducer Engineering, joined CTG in 1993 and has over 24 years experience in acoustic transducer design.
- **Mark Soler**, Manager of Manufacturing Engineering, joined CTG in 2012 with over 22 years manufacturing engineering experience
- **Randy Trent**, Manager of Design Drafting and Documentation Control, joined CTG in 1983 and has 30 years of drafting and engineering experience.

Senergy Management Changes

Senergy strengthened its management team with three senior appointments. The company, which provides fully-integrated project and asset development services across the energy industry, appointed Rhys Medler (pictured) to the newly created role of Vice President in Quality Health Safety Security and Environment (QHSSE) and Compliance.

He is joined by Dick Hall in the position of Alternative Energy and Power Engineering Global Coordinator and Tony Morton as Global Technical Head of Power Systems.

Nautronix Strengthen Sales Team

Nautronix appointed three Vice Presidents to its sales team. Subsea development manager, Dan Williams, (pictured)

is serving as the company's VP Sales, Commercial Acoustics, with direct responsibility for building the awareness of Nautronix ADS² technology in the global marketplace.

Tony Evans joined the company as VP Sales, NASNet, responsible for developing the awareness and understanding of NASNet positioning technology; the broadcast-only system for ultra-deepwater vessels and managing the field sales activities therein.

Nautronix also announced the appointment of Edward H. Smyth as VP Sales, Americas. Ed brings over 30 years of oil and gas sales and business development experience to Nautronix having spent the last 20 years in senior positions at ABB and Baker Hughes in Houston, Ed is well positioned to front the head of Nautronix Houston operations.

In addition to the new sales recruits, Nautronix appointed Suzanne Menzies to manage international marketing activities, reporting directly to Dan Williams.

MacArtney
UNDERWATER TECHNOLOGY

MacArtney Boosts Presence in Russia

The MacArtney Underwater Technology Group announced the entry of an agreement with JCS Tetis Pro, to function as MacArtney's official representative in Russia. Tetis Pro will administer the promotion and sales of MacArtney products on the Russian market. Through the provision of access to relevant and high-tech underwater technology segments, contacts, knowledge and strategic locations, the appointment of Tetis Pro as a MacArtney representative, marks a significant strengthening of MacArtney's presence in Russia, according to the company. In turn, Tetis Pro will gain access to MacArtney's products and global knowledge within the realm of underwater technology - especially

with regards to the steadily emergent Russian offshore industry.

Initially, Tetis Pro will to provide potential Russian oil & gas, ocean science, state agency and defence clients with direct access to well-known MacArtney products such as SubConn and Opto-Link connectors and LUXUS cameras. In support of this, Tetis Pro will permanently carry an extensive stock of SubConn connectors for immediate delivery. However, empowered by the MacArtney Group, Tetis Pro is in fact fully capable of supplying a full range of MacArtney products, services and system solutions.

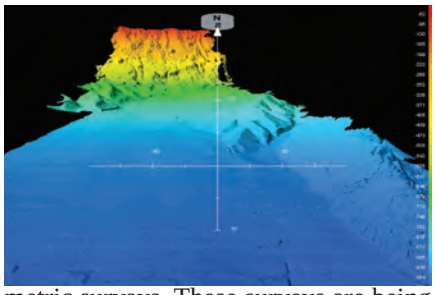
Expro Wins Contract

Expro won its first major subsea completion landing string contract in India. It secured the multi-million dollar deepwater completion landing string contract in India for a three year term, with options to extend for another two years. The scope of work involves the supply of two complete 7 3/8-in. electro hydraulic (EH) completion landing string systems along with two sets of topside controls equipment for a deepwater subsea development program in India.

Cadden Supplies ROV

Cadden, specializing in electronic measuring systems for geopositioning and oceanography, sold a remotely operated underwater vehicle to Copetech-SM last June. Equipped with a multibeam echo sounder, the system is being used to perform deep sea bathymetric surveys in the context of a vast seawater air conditioning project.

In June, Cadden supplied Copetech-SM with a complete system for performing high precision deep sea bathy-



metric surveys. These surveys are being performed in preparation for the SWAC (Sea Water Air Conditioning) project to be implemented in La Reunion by GDF Suez Energy Services.

The underwater vehicle sold by Cadden comes with a leased Sonic 2022 multi-beam echo sounder (R2 Sonic), a Lodestar attitude and heading reference system (Sonardyne) and a Doppler velocity log (LinkQuest).

Ashtead Agent

Ashtead Technology Offshore appointed an agent in the Middle East to support its continuing global expansion. The Aberdeen-headquartered company has completed an agreement with Abu Dhabi-based Technical Equipment Services (TES) who will promote Ashtead Technology's full rental equipment range to its customers in the region.

www.ashtead-technology.com

BMT's Acquires Oceanica

BMT Group acquired Western Australian marine and coastal specialists, Oceanica Consulting Pty Ltd., which the company believes will strengthen BMT's capacity and technical offering in Western Australia's buoyant market, while complementing the expertise and knowledge in the region of BMT's established Asia-Pacific subsidiaries, including BMT WBM and BMT JFA Consultants.

Established in 2000, Oceanica has provided specialist consultancy services for marine, coastal and estuarine environmental issues, working with corporate and government clients throughout Western Australia.

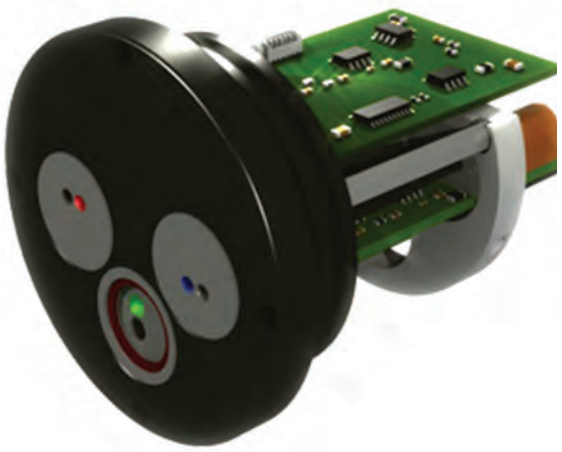
Peter French, Chief Executive of BMT Group said: "The western seaboard of Australia continues to present strong opportunities for growth in the maritime, oil and gas and mining sectors. Oceanica's expertise and excellent reputation for providing high-quality, impartial advice and services to support the effective management and protection of marine and coastal environments, further complements BMT's capabilities and we are very much looking forward to welcoming the team."

Under Pressure V4.60

DeepSea Power & Light updated its free Under Pressure software program which is used to aid in the design of pressure housings. Under Pressure is a menu-driven, interactive and user-friendly program designed for the working engineer or scientist. It evaluates structural capabilities, deflections, and weights of common pressure vessel geometries such as cylindrical tubes and spheres, as well as hemispherical, conical, flat circular, and flat annular end enclosures made from a variety of materials. The program uses equations from Formulas for Stress and Strain, sixth edition, by Raymond J. Roark and Warren C. Young. A design loop can be selected and the analysis repeated while a single parameter (e.g. wall thickness) is varied. Other features include graphic representation of the pressure vessel and on-line graphic display of radial and tangential stress distribution. Under Pressure 4.60 maintains the same user interface and calculations as previous versions while enabling the program to work within several Windows Operating Systems including XP, Vista, Windows 7, and Windows 8 x86 and x64 desktop versions. (Please note that Under Pressure 4.60 is not compatible with Windows RT for phones and tablets.) Under Pressure 4.60 contains its own internal data base module eliminating the need to use SqlServer, Access, MDAC, or .NET and simplifying the installation process. For a free download go to **www.deepsea.com** and select the Design Tools pull-down tab and then select Under Pressure and follow the download directions.

Featured Product

Cyclops Fluorometers for AUVs, Gliders & Floats



Turner Designs' new Cyclops Integrator is designed to allow easy system integration of its Cyclops Submersible Fluorometers and Turbidimeter into AUVs, gliders, floats and other platforms. One, two, or three optical sensors with configurations ranging from deep UV to IR along with the Cyclops Integrator electronics can be fastened to an optical head defined by the customer and ready for integration. Alternately, customers can purchase the Cyclops Integrator with sensors in one of the pre-defined Turner Designs optical head configurations. Data integration is reported to be simple with ASCII data automatically delivered at 1 second intervals only 3 seconds after power is applied. Standard optical kits are available for detecting: in vivo Chlorophyll, Crude Oil, Refined Fuels, CDOM/FDOM (dissolved organic material), Blue/Green Algae, Fluorescein Dye, Rhodamine Dye, PTSA Dye, Optical Brighteners, Tryptophan, and Turbidity. Cyclops Integrator packages can also be configured with custom optics for specialized applications per customer request. Sensors are pressure-rated to meet 600m, 1000m, or 6000m depths. Typical current draw is minimal, 100mA operational for three installed sensors powered with a 12V supply. An optional wiper motor can be added to minimize biofouling of sensors when deploying long-term.

EMail: sales@turnerdesigns.com
Web: www.turnerdesigns.com

LinkQuest Link 10000

LinkQuest delivered a TrackLink 10000 ultra long-range USBL acoustic tracking system with integrated acoustic modem function to the National Oceanography Center (NOCS), United Kingdom; the third TrackLink 10000 system delivered to the Center so far. The TrackLink 10000 system is an ultra long-range USBL tracking system capable of reaching a range of 11,000m using a directional transponder and a range of 7,000m using an omni-directional transponder. The acoustic modem function is fully integrated with the USBL tracking function so that the typical acoustic interference between communication and positioning systems is avoided. National Oceanography Center is going to use the newly purchased TrackLink 10000 system to support the positioning and tracking of the Autosub6000 Autonomous Underwater Vehicle (AUV). Autosub6000 is provided as a facility to the UK oceanographic science community for a variety of seabed survey operations using SONAR, photography and bio-geochemical sensors.

Email: sales@link-quest.com
Web: www.link-quest.com

ARROW: Tsunami Detection System

Mooring Systems, Inc. and Down East Instrumentation released of a jointly developed Tsunami Detection System following nearly two years of development work. The ARROW (Autonomous Real-time Reporting of Waves) system was conceived based on the need to address specific concerns with existing buoy based technologies now used for tsunami detection.

The ARROW system is fully submerged 100 meters below the ocean surface while in its "ready" state and throughout its two-year deployment cycle. If a Tsunami threat is detected, a hydrodynamic shaped pop-up buoy outfitted with an Iridium transmitter is released to the surface, and once at the surface, the tsunami threat data is transmitted via satellite to the warning centers.

The advantage of remaining fully submerged is the elimination of exposure to harsh environmental conditions on the ocean surface. Buoy and mooring damage caused by repetitive wave action and extreme weather is eliminated along with vandalism which has proven to be a serious problem in many world regions.

The ARROW system employs a technique of hydrostatically measuring the height of the water column using a high resolution pressure sensor and processing the data to determine if a tsunami wave passes above the sensor. The ARROW system uniquely sends the pressure data from the seabed located sensor to the processing electronics in the sub-surface buoy using a hardwired link. This link is also the sub-surface buoy's mooring cable configured using jacketed wire rope. The signal is carried inductively through the wire rope providing a robust and direct connection to the processing electronics located 100m below the ocean surface.

The fast ascent rate of the expendable pop-up buoy allows a quick response time between tsunami detection and satellite transmission.

Another unique aspect of this system is how the message is delivered from the satellite ground station. It is transmitted in e-mail form allowing the immediate alert message to be forwarded to all warning centers and any addresses designated by the government owning the system.

"The combined benefits of this system will allow easier to install and maintain tsunami detectors resulting in a larger network of coverage and warning capability."

Email: sales@mooringsystems.com
www.mooringsystems.com

New Fischer FiberOptic Connector

Fischer Connectors released its new push-pull FiberOptic interconnecting solution specially designed for premium optical performance in extreme environments. The Fischer FiberOptic with two (FO2) or four (FO4) optical channels features some advances. Fischer Connectors is able to offer a fiber solution that is extremely quick and easy to clean thanks to a removable mono-block mate adapter and to the possibility of rinsing the unmated connectors freely under water or in an ultrasound bath.

The Fischer FiberOptic connector is designed to perform perfectly in harsh and extreme environments. It has a high ingress protection of IP68 (2m/24hours) when mated and IP67 in unmated conditions. In addition, Fischer Connectors' FiberOptic optical performance is insensitive to mechanical strain on the connector. The spring optical contacts employed allow for filtering out any stress applied to the connector housings while keeping the typical advantage of a push-pull solution: quick, safe and easy locking.

www.fischer-fiberoptic.com

Birns Pisces 1000

Birns, Inc., introduced the underwater security light: the BIRNS Pisces. Designed to be rugged, the 130,000 lumen High Pressure Sodium Vapor (HPSV) lighting system is designed for a range of underwater security applications and for use alongside military submarine docks, but can be tailored for many different applications where long term use, powerful illumination and minimal maintenance is required.

The Birns Pisces' robust construction features a solid housing fabricated of 63AA-electropolished AISA type 316 stainless steel. With a tough 1.06-in. thick tempered glass lens further supported by stainless steel reinforcing bars, this system is custom-engineered to withstand long term immersion in seawater. The 1kW HPSV lamp operates in a dry, one atmosphere chamber, and has a 24,000 hour lamp life—and in concert with its high-reflectivity mirror-finish reflector—provides intense light output. This high intensity gas discharge lamp has no filament, making it nearly impervious to shock and vibration in situ. It can be re-lamped, tool-free, by hand in 60 seconds, with commercially available, low mercury (Toxicity Characteristic Leaching Procedure (TCLP) compliant; .06mg/liter) lamps. The system comes with two robust wet mateable Birns connectors, with gold plated contacts per MIL-G-45204.

www.birns.com

GL Garrad Hassan Releases WaveDyn

GL Garrad Hassan recently debuted WaveDyn, an independently developed wave energy converter design tool to be made commercially available. WaveDyn allows users to model a wide range of wave energy conversion device types. Its flexible, multi-body modeling approach, coupled with a hydrodynamic flow solver, and a range of additional modules, including Power Take-Off (PTO) and Moorings modules, allows the user to build models that match the physical properties of real machines.

WaveDyn will take its place in the company's software portfolio alongside the design tool for wind turbines, Bladed, and the tidal turbine design tool, Tidal Bladed.

Wave energy conversion brings with it a unique set of challenges, one of the most significant being the independent evaluation of the wide variety of different device types under development.

WaveDyn has been developed to provide one self-consistent and rigorous tool that can be applied to a wide range of concepts.

www.gl-garradhassan.com

(Images copyright - GL Group)

Statoil Adds EIVA NaviModel

By the end of October, EIVA will conclude the delivery of a NaviModel multi-user server license to Statoil. The digital terrain modeling software solution will be used in planning and maintenance of the extensive subsea infrastructure operated by the energy company.

Statoil relies heavily on software systems in the operation of subsea constructions throughout the world, which constitute a vital part of the company's activities. As the technological development continues at full speed, great demands are placed on the data quality and performance of the software applied.

With the increased data volume and high resolution results now seen from routes surveys and pipeline/cable inspections, it's important for Statoil to have tools to use the full potential in the data acquired, said Hagness, Leading Advisor at Statoil. To that end, Statoil turned to EIVA for the EIVA NaviModel solution through the purchase of a multi-user server license of the digital terrain modeling software and a software maintenance and support agreement.

www.eiva.dk

Featured Product

OptoLink Single Fiber Connector

The MacArtney Underwater Technology Group introduced the OptoLink Single Fiber Connector, a small sized but significant addition to MacArtney's OptoLink fiber optic connector range. Designed for subsea equipment manufacturers, the low insertion loss and back reflection make this connector suited for high speed data and video transmission. The rugged stainless steel design warrants the robustness and reliability of the connector, whether mounted on the deck of a vessel under harsh sea conditions, on an offshore platform, or at full ocean depth.
In step with the trend toward smaller equipment, the new addition to the OptoLink range has been developed to offer reliable and efficient fiber optic connectivity in a minimal sized connector. Especially in proportion to the fact that (as a standard) the OptoLink Single Fiber Connector features a full ocean depth rating of 6000m - the connector is very compact. In addition, the OptoLink Singe Fiber Connector is engineered for minimal weight. In practice, this entails that the connector applies a minimum amount of strain on for instance small and medium sized ROV's, thus allowing them to carry more equipment. The single fiber (single pass) OptoLink connector is available in a bulkhead (BCR) and cable mount (CCP) configuration with minimal attenuation between the mated connector pairs. Furthermore, it is available in both single and multi mode. The connectors have SS316 stainless steel housing as standard, however, other shell materials are available upon request.

www.macartney.com

Clear Signal Coating for Horizontal ADCP

Severn Marine Technology's (Annapolis, MD) Clear Signal BioFouling Control System has been used on a Teledyne RD Instruments (San Diego, CA) Horizontal Acoustic Doppler Current Profiler (HADCP) in the Port of Vancouver. The HADCP is used for gathering critical current measurements for ship navigation in the port. The Clear Signal coated HADCP has been deployed since April 2011. The Clear Signal is designed to greatly decrease biofouling accumulation, cleaning times, and as reported by the Port of Vancouver diving contractors, left no residual biofouling.
The Port of Vancouver had suffered extensive biofouling on its HADCP instruments causing unacceptable maintenance costs. The Clear Signal Biofouling Control System is a robust coating that the ,manufacturer says has been proven to withstand the rigors of port and harbor use.

Email: info@severnmarinetech.com
www.severnmarinetech.com

The New RBRsolo T

RBR Ltd. released the new RBRsolo T: RBR's smallest, lightest, and most versatile single channel logger. Tested in harsh environments to ensure performance, the RBRsolo T provides reliable temperature measurements even in the most unpredictable conditions. The RBRsolo T is ideal for long term deployments, bore holes, extreme environments, or anywhere where size is a concern. Even though the RBRsolo T is small in size, there is no need to sacrifice when it comes to deployment performance. The RBRsolo T can take up to 20M readings on a single battery, samples up to 2Hz, provides three years of sampling at five second intervals, has a depth rating of 1700m, and uses true USB data download for speed and convenience. The RBRsolo T is equipped with a pressure-protected thermistor which has a 0.8 second time constant, providing reliability under varying deployment conditions (initial accuracy ±0.002 °C). The temperature logger offers exceptional stability; drift is typically less than 0.002°C per year.

Email: info@rbr-global.com
www.rbr-global.com

WFS Tests Wireless Subsea Modem

A new wireless subsea modem has been trialed at The Underwater Center, a subsea testing and training facility in Fort William, Scotland. WFS Technologies trialed the Seatooth S100, a mobile, wireless subsea modem suitable for a variety of underwater applications from 100m - 4000m. The modem is designed to provide a reliable digital wireless communication link or logging device up to 5m range, even in challenging deep water conditions.

It is equipped with standard data communication interfaces, making it suited to sensor and underwater vehicle applications. It can be deployed swiftly on temporary or permanent installations to support safety and efficiency in a range of subsea applications including data logging, upgrading subsea equipment and wireless backup.

The key factor in the company's decision to test the new Seatooth S100 at Fort William was The Underwater Center's 1.5m liter indoor seawater tank which allowed the WFS team to both observe and monitor its equipment in one location without tidal drift.

Ian Crowther, Executive Vice President of WFS, said: "We are always on the look-out for good quality underwater testing facilities, and have tried various harbors, marinas and even an aquarium. No one else has been able to offer the facilities and professional set-up that The Underwater Center can. The Centre also provides a great chance to get good footage of the test pieces in the water – whether video or stills photography, which is great for showing to our clients."

www.wfs-tech.com

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d. Nonrequested Distribution (By Mail and Outside the Mail)	(1)	Outside County Nonrequested Copies Stated on PS Form 3541 (Include Sample copies, Requests Over 3 years old, Requests induced by a Premium, Bulk Sales and Requests including Association Requests, Names obtained from Business Directories, Lists, and other sources)	0	0
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e. Total Nonrequested Distribution (Sum of 15d (1), (2), (3) and (4))			550	425
f. Total Distribution (Sum of 15c and e) ▶			18,754	17,991
g. Copies not Distributed (See Instructions to Publishers #4, (page #3)) ▶			143	191
h. Total (Sum of 15f and g)			18,897	18,182
i. Percent Paid and/or Requested Circulation (15c divided by f times 100) ▶			97.1	97.6

16. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the Novemeber/December 2012 issue of this publication.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: Dale L. Barnett — Circulation Dept. — Date: Sept. 28, 2012

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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3	YSI Incorporated	www.EXOwater.com	Please visit us online

Anchors Aweigh.

The last of our photo contest shots this months come from San Andres , Colombia, and is simply entitled "Man & Anchor"

Submitted by: Juan Pablo Assmus

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