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Interview: Frederic Terral, Brand Architecture

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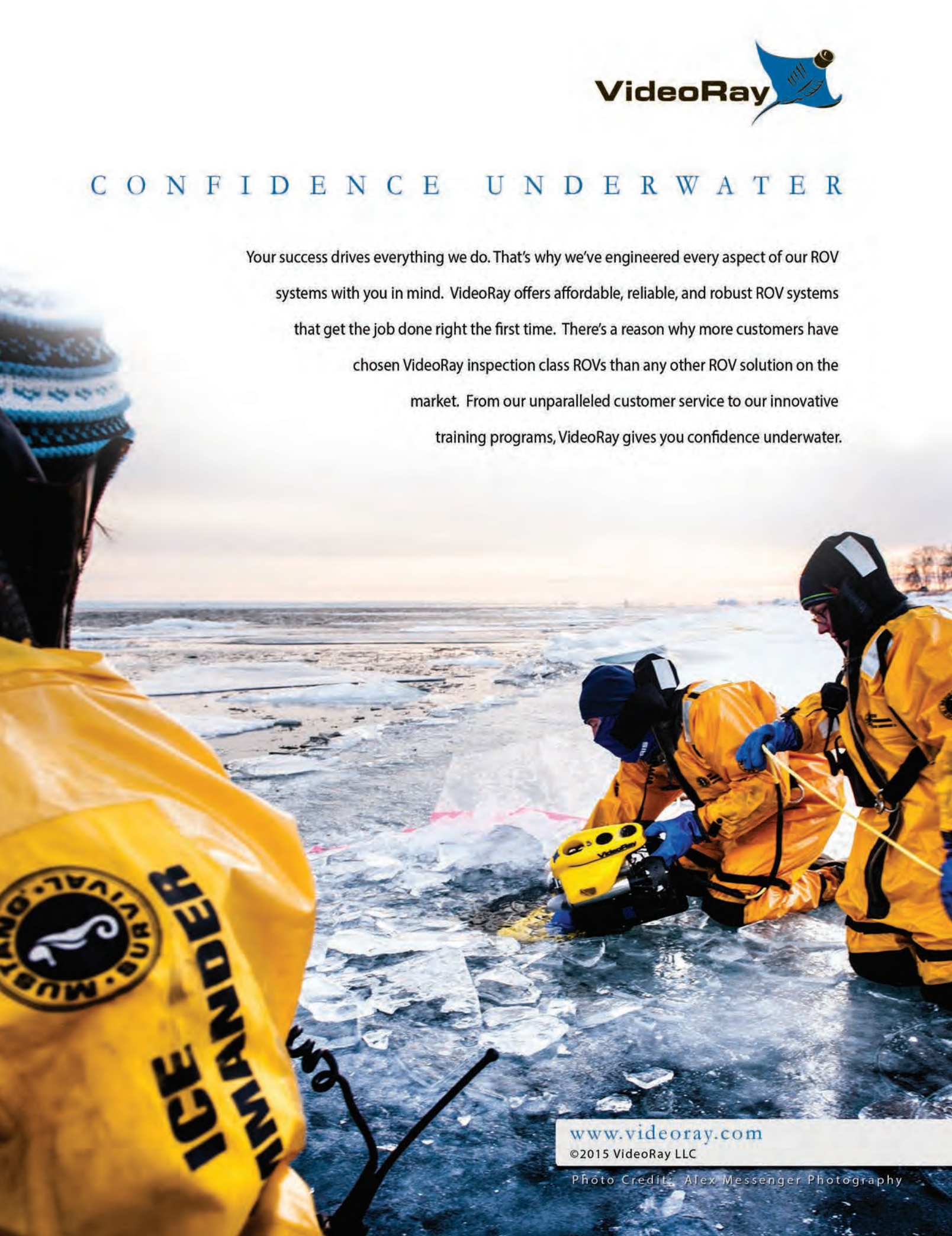

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The Authors

Kira Coley

Kira Coley graduated with a BSc. (Hons) Marine Biology degree from University of Portsmouth and has extensive experience as a Field Scientist in various locations. *p. 24 & 28*

Edward Lundquist

Edward Lundquist is a retired naval officer who writes on naval, maritime, defense and security issues. He is a regular contributor to Marine Technology Reporter. *p. 14*

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William Stoichevski ives and works in Oslo, and is a regular contributor to MTR. *p. 42 & 52*

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Autonomy is all around us, from the military drones buzzing the skies to my personal "Pet Series" Roomba, the latter an investment that was instrumental in keeping mine a happy home as we welcomed our second Labrador Retriever earlier this year. But autonomy on and below the water has been a bit slower on the uptake compared to air and land markets. The subject of autonomy in the maritime and subsea worlds is certainly not a new one, and there have been numerous leaps in capability over the last decades. But from my seat, the last 18 to 24 months have registered a significant uptick in the quantity and quality of projects moving autonomy forward in the marine environment. A few years back I was privileged to sit with former U.S. Navy CNO Admiral Gary Roughead for a discussion on unmanned maritime systems. The Admiral was crystal clear in his call to "solve the power issue" that he viewed as the chief constraint on moving further faster on the use of unmanned autonomous systems at sea. Autonomy is a thread that runs throughout this entire edition, but the main feature, our cover story on the Mayflower Autonomous Research vessel (MARS), starts on page 24. Per usual, Kira Coley distinguishes herself with quality copy for our pages, and her report on Project MARS is one that should resonate with anyone conducting business in this sector. Despite all of the good works conducted by the readers of this magazine, in my 20+ years serving the maritime and subsea markets I have often contended that the only time the mainstream media reports on maritime matters is when something has gone wrong. Raising the 'voice' of the industry is an ongoing and recurrent theme shared by many, an attempt to raise the profile and stature of this industry to perpetuate its continued growth. To this end I'm pleased to present an interview with Frederic Terral, CEO and President of Brand Architecture, a firm that has worked first with The Maritime Alliance in San Diego and more recently with NOAA to create innovative, compelling campaigns to raise the voice of this collective market. To my understanding this article coincides perfectly with the world-wide debut of the new Integrated Ocean Observing System (IOOS) look and logo. Jump to pages 34 and 34 for your sneak peek.

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SAAB TECHNOLOGIES

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Horizon Marine Adds Three

Horizon Marine has brought on three new hires in its Marion, Mass. office. Drew Gustafson joins Horizon Marine as a MetOcean Analyst with a B.A. in Earth and Oceanographic Science from Bowdoin College. Aaron Rosenberg received a B.S. in Marine Science from Boston University and dual M.S. in Environmental Engineering and Oceanography from the University of Connecticut. Aaron's focus to date has been in air-sea interactions as they relate to storm surge forecasting, numerical modeling and ocean observations. Michael Leber is a 2013 cum laude graduate of the University of Massachusetts-Lowell where he earned his B.S in Environmental Science/Atmospheric Science with a minor in Mathematics.

ROVOP wins $3.5m in Orders

ROVOP has revealed more than $3.5m worth of new contract wins in the last month from its Houston and Aberdeen offices across the oil, gas and offshore wind markets. Work scopes for the projects, extending into Q3 2016, include inspection, repair and maintenance (IRM) on several major operators' platforms, pipeline route survey in the Mediterranean and supporting the installation of an offshore wind platform off Germany. In addition to this, the company has also signed a multiyear frame agreement with a major vessel owner for ROV services.

MetOcean System Ordered for Dudgeon Wind Farm

Miros won a contract to deliver a MetOcean system to the Dudgeon offshore wind farm project.

Miros' scope of supply includes a complete meteorological system, including SM-050 WaveRadar for wave monitoring. The MetOcean system will be located at an offshore substation to collect weather data for the whole windfarm. The Dudgeon Offshore Wind Farm will be built in water depths of 18-25 meters, located 32 km off the coast of North Norfolk, U.K.

MacArtney, Focal Partner in Asian Pacific

Focal Technologies Corporation, a Moog Inc. company, entered into a sales and service partnership with Focal global marine partner MacArtney Singapore Pte. Ltd. for service and support to Asian Pacific customers. The sales and service partnership agreement will become effective from October 1, 2015 and will see MacArtney Singapore leverage experience as a Moog Focal product service provider to serve as a one-stop service hub for the Singaporean region.

L-3 Klein to Host Side Scan Sonar Seminar

L-3 Klein Associates, Inc. will host a Side Scan Sonar Operations and Maintenance Training Seminar from October 20-22, 2015. The three-day seminar will be conducted at L-3 Klein's Facility in Salem, N.H. The training will include two days of classroom instruction and one day of on the water training. Lunch will be provided daily. The seminar is geared toward operators and managers seeking a better understanding of side scan sonar techniques. The course is open to any user of side scan sonar regardless of brand, experience or occupation.

www.l-3klein.com

AXYS Technologies Acquires FLiDAR NV

Canadian-based and privately-held AXYS Technologies signed a definitive agreement to acquire 100% of the FLiDAR NV shares. In 2009, AXYS developed the WindSentinel floating LiDAR, which has since evolved into a dual-LiDAR platform. Belgium-based FLiDAR was formed in 2011 as a joint venture between 3E and Offshore Wind Assistance (part of the DEME group) to provide floating LiDAR offshore wind measurement technology.

"AXYS and FLiDAR share the vision of delivering the highest quality data to offshore wind developers of fixed and floating wind farms worldwide," said Terry Tarle, AXYS President & CEO. "By combining the strengths of both companies, this alliance will enable current and future clients to benefit from a deeper expertise in wind resource data collection, a wider offering of offshore measurement solutions, and an agile service team able to cover projects globally. "

Tech Integration Enables Glacier Survey

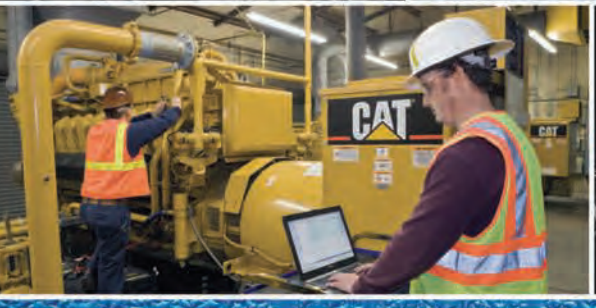
Seafloor Systems has collaborated with SonTek/Xylem for integration of the HyDrone-RCV with a SonTek M9 ADCP acoustic Doppler current profiler to help gather glacier data.

Two integrated HyDrone catamaran platform systems were shipped to IMAX videographer Sean Casey, who will return to Alaska for a month-long filming of Dawes glacier. Casey is producing an IMAX documentary for National Geographic called "Extreme Weather." One of the film's main sequence follows a glaciologist to Alaska where she and her team collect data on: the amount of ice and water that is being ejected from a glacier; track the speed of which it is melting; and determine how much water the glacier is adding to the ocean.

The HyDrone–RCV system—released in June 2014—is a remotely controlled multipurpose vessel designed to survey in uncertain environmental conditions and may be specified to individual customer requirements. The unit may be purchased with the desired depth sounder preinstalled, as an integrated total solution or supplied ready to accept existing equipment from the user's survey pool.

Photo: Seafloor Systems

FULL SPEED AHEAD



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Rim-driven ROV Thruster

Due to its simplicity, the rim driven thruster has for years been seen as the ideal thruster concept, but it has proved to be difficult to implement. Several attempts of implementing the rim driven thruster concept has failed over the years, but due to technological advances in materials science and production techniques, Copenhagen Subsea A/S reports that it has succeeded in implementing the concept resulting in an ultra-reliable thruster with unique features.

Due to the extreme harsh environment to which a subsea thruster is exposed – the realization of the rim driven concept has involved the utilization of materials with very specific characteristics. The development team behind the thruster has many years of experience with subsea equipment but had to look at other industries in order to find the right combinations of materials and production techniques, which could give the right compromise between reliability and performance required in the subsea industry.

Today one of the limiting factors in the utilization of ROV and AUV is the reliability of the thrusters. The thrusters are equally critical to the ROV operation as the rest of the sub-components - but due to the complexity of the thruster coming from moving parts; it is harder to achieve the same level of reliability as can be achieved in the non-moving parts of the system. The reliability of thrusters used in the ROV industry today is also a result of the small batch sizes in which they are produced. Copenhagen Subsea says it has successfully developed a series of industrialized thrusters with a significantly higher level of reliability. Features of the Rim driven ROV thruster include:

- **Low Acoustic Noise Signature:** Due to the fact that the rim driven propeller has a low tip speed of the propeller blades the noise emission from the propeller is significant lower than a normal propeller. Beside the propeller, the motor has no gears or other mechanical moving parts.
- **Lightweight Propeller:** Means that the moment of inertia of the thruster is small, which makes it fast to change the rotational speed of the thruster.
- **Compact Form:** The thruster is easy to integrate and the thruster has the same thrust in both directions.
- **Fluid Free:** There is no oil or other fluid inside the thruster.
- **Hub-less Propeller:** This gives the advantage of a low risk of entanglement. Small fractions of rope and seaweed can pass through the center of the thruster.

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New ROV System from VideoRay

The new Voyager ROV system from VideoRay – which was scheduled to debut September 30, 2015 – aims to bridge the gap between economy and professional systems

As a member of the VideoRay's economy series, the Voyager is designed to bridge the power gap between the economy and professional ROV lines, while retaining simplicity, portability and affordability, the manufacturer said. The Voyager is depth rated to 76m and designed for basic underwater visual operations in a low current environment. According to VideoRay, the Voyager features all the capabilities of its Explorer ROV, with the added power of enhanced horizontal and vertical thrusters which increase the submersible's maximum speed to 2.9 knots. And like the Explorer, the Voyager provides a live video feed from a submerged robotic camera to a topside control panel. Weighing 34kg, the portable and lightweight Voyager ROV system relies on a standard power source (100-240 VAC). The Voyager ROV system includes the submersible, the control panel and 40m of professional performance tether. The Voyager also features a high resolution, 160° vertical tilt color camera, water depth readout, auto depth feature, compass heading readout and run time meter. The control panel has a 7-in. color LCD display and control knobs for the horizontal and vertical thrust, as well as the variable intensity halogen lights.

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New Ships Join the Research Fleet

Future chief scientists get shakedown at sea

By Edward Lundquist

The nation's newest oceanographic research vessel, the R/V Neil Armstrong (AGOR 27), has completed acceptance trials, and the U.S. Navy turned the ship over to Woods Hole Oceanographic Institution (WHOI) on Sept. 23, which will operate the vessel as part of the U.S. Academic Research Fleet (ARF).

"The U.S. Navy is proud to support the national research fleet by delivering state-of-the-art research vessels like the R/V Neil Armstrong," said Chief of Naval Research Rear Adm. Mat Winter about the event. "The Navy's innovative scientific mission will directly benefit from the fielding of this next-generation research ship focused on maritime technology discoveries and break-through capabilities."

Sister ship R/V Sally Ride (AGOR 28) will join the fleet next year and will be assigned to Scripps Institution of Oceanography.

The new ships will replace R/V Knorr (AGOR 15) and R/V Melville (AGOR 14) as part of the Navy's portion of the ARF. Both ships have reached their expected service life, but they are still capable science platforms.

"During their 45-year careers, they sailed millions of miles and supported significant oceanographic projects," said Program Officer Tim Schnoor, who oversees Office on Naval Research's (ONR's) oceanographic research vessel programs.

"These two vessels are destined for additional oceanographic service, as they will be transferred to the navies of Mexico and the Philippines respectively," says Schnoor.

According to Schnoor, the new deep-ocean, general-purpose research vessel will study ocean chemistry and geology, underwater acoustics, marine biology and ecosystem management, and marine technology development. "There is still much to be learned about our oceans and the Neil Armstrong will certainly be a part of many future discoveries."

With its crew of 20, the 238-foot vessel can conduct science expeditions up to 40 days for as many as 24 scientists and research staff.

"The Neil Armstrong and Sally Ride will support the current practice of oceanographic research with both shallow water and deep ocean multi-beam bottom mapping sonars, multiple acoustic-doppler current profilers, and the latest over-the-side handling gear for collection of ocean samples. The vessels themselves represent the latest in research vessel design and construction to support science operations, minimize cavitation noise impacting sonar operations, and maximize safety and stability for science operations in higher sea states," Schnoor says.

The six Navy-owned vessels are charter leased to U.S. oceanographic research institutions.

The U.S. ARF includes six Navy oceanographic research vessels known as Auxiliary General Purpose Oceanographic Research (AGOR) vessels. These vessels are purpose-built to commercial standards, classed by the American Bureau of Shipping, and certified by the United States Coast Guard for oceanographic research.

In addition to the new ships, the Navy's research fleet include R/V Thomas G. Thompson (AGOR 23), operated by the

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University of Washington: R/V Roger Revelle (AGOR 24), operated by Scripps Institution of Oceanography; R/V Atlantis (AGOR 25); operated by Woods Hole Oceanographic Institution; and R/V Kilo Moana (AGOR 26), operated by the University of Hawaii.

According to Schnoor, oceanographic research vessels within the U.S. ARF are owned by federal agencies (the Navy and the National Science Foundation) and state institutions, such as universities. Vessels are leased to competitively selected, oceanographic research institutions via charter party agreements or cooperative agreements for a period of five years, and are generally renewable with the same institution for the service life of the vessel. The vessels are operated and maintained by licensed mariners hired as university employees. Operations and maintenance costs are sponsored by federal agencies who sponsor the scientific research carried out on the vessel. Depending on vessel size and capability, and the scientific objectives, vessels generally complete from 10 to 25 separate cruises annually lasting from a few days up to two months.

Cruises take place the world over, in every ocean, major body of water, the Great Lakes, in U.S. and foreign exclusive economic zones (EEZs), says Schnoor. "Teams of scientists accompany the research vessel and crew on planned science cruises. The teams are headed by a chief scientist, and can include from a few to as many as 35 other scientists from the same or different institutions. The chief scientist is responsible for planning the research objectives of the cruise, ensuring the data and samples are collected, and assisting the crew in the operation of the oceanographic mission equipment. In an effort to maximize the effectiveness of cruises, and to economize on cruise costs, vessel scheduling is coordinated by the

R/V Sikuliaq

Research vessels like R/V Sikuliaq are built to conduct scientific observation and experimentation.

University-National Oceanographic Laboratory System (UNOLS) with the UNOLS vessel operators as part the U.S. ARF. For cruises pursuing science objectives in foreign EEZs, vessel operators coordinate cruise schedules and science objectives with the US State Department, which coordinates these requirements with foreign ministries."

"The assignment of Naval auxiliaries to academic institutions for oceanographic research purposes traces back to the post-WW II era when surplus Navy support vessels were donated to oceanographic institutions, and modified to support federally sponsored oceanographic research activities," says Schnoor. "Navy research vessels have been purpose built to commercial standards since the 1960's, and as with just about all Navy auxiliaries, they are not crewed by U.S. Navy personnel, but rather licensed, civil mariners."

UNOLS

The University-National Oceanographic Laboratory System (UNOLS) is a non-profit consortium of U.S. oceanographic research institutions, formed in the early 70's to assist in the effective and optimized scheduling and operation of the U.S. ARF. Membership includes both research vessel operating institutions and non-operator institutions.

A support staff and office are currently hosted at the University of Rhode Island Graduate School Of Oceanography, sponsored and funded by the National Science Foundation, the Office of Naval Research, and the National Oceanic and Atmospheric Administration (NOAA), the Bureau of Ocean Energy Management and the United States Geological Survey. UNOLS is governed by a chartered Council representing member institutions, and includes nine committees chartered to support the operations of research vessels and the scientific

endeavors supported by the vessels. The committees support the following areas of vessel operations: cruise scheduling, vessel operations, vessel technical enhancements and fleet improvement. Vessel-based scientific disciplines in deep submergence, seismic oceanography, airborne oceanographic research, Arctic operations, and ocean-based observing systems are supported by individual committees, which meet twice annually and provide direction and planning for optimizing science operations and future improvements.

According to Jon Alberts, UNOLS executive secretary, the research community is looking forward to the new Neil Armstrong and Sally Ride. "The new ships will take advantage of advances in technology. They will have more efficient propulsion systems, have improved crew and science staff habitability, be more environmentally friendly and be quieter research platforms. The ships will have better navigation systems and state-of-the-art dynamic positioning. Automated handling systems will streamline launch and recovery of scientific instrumentation, requiring fewer people and conducting those evolutions more safely."

UNOLS is working with NSF to plan and develop the next regional class research vessel to replace the existing coastal class of vessels.

ONR, NSF and NOAA will sponsor the next meeting of the International Research Ship Operators (IRSO) in October, to be hosted by Scripps Institution of Oceanography in La Jolla, Calif. UNOLS will coordinate the agenda and logistics of this annual gathering. The IRSO meeting brings together operators from around the world to share lessons learned, discuss common problems and solutions, and learn about new ship builds. "We're making a concerted effort to coordinate research vessel schedules across nations to maximize utilization and help each other whenever we can," Alberts says. "We're also facilitating barters where nations can use ships that may already be conducting missions in their geographic areas of interest, thereby reducing transits to the far corners of the globe.

Chief Scientist Cruises

Alberts says UNOLS institutions is conducting Chief Scientist two training workshops and cruises this year, sponsored by both the National Science Foundation and ONR, to provide early career scientists, post-doctoral candidates and graduate ocean science students an opportunity to prepare themselves

R/V Neil Armstrong

The nation's newest oceanographic research vessel, the R/V Neil Armstrong (AGOR 27), has completed acceptance trials, and the U.S. Navy turned the ship over to Woods Hole Oceanographic Institution (WHOI) on Sept. 23, which will operate the vessel as part of the U.S. Academic Research Fleet (ARF).

(Photo courtesy of Gary McGrath, WHOI)

as the next generation of chief scientists. "They spend a few days alongside the pier in a workshop setting to learn how to plan shipboard field work, how to request ship time, and the mechanics of leading a research cruise. They then they go out for a week or so to go through steps executing a planned science mission underway."

The next program will take place in Lewes, Delaware, home port of the University of Delaware's R/V Hugh Sharp, and will include a five day cruise on the Hugh Sharp to locations along the eastern seaboard as well as Delaware Bay and Chesapeake Bay.

The focus of the November program at UDEL will be a UNOLS Robotic Platforms Chief Scientist Training Cruise, will focus attention on integration of robotic platforms (i.e. ROV, AUV, UAV) into the training cruise. While there will be platforms provided, participants are encouraged to bring their own platforms and systems, providing an opportunity to operate their own instrumentation and collect preliminary data to potentially initiate their own novel research projects or programs."

"This cruise and a pre-cruise information workshop will instruct early-career marine scientists—including senior PhD students, postdocs, and first or second year faculty members–on how to effectively plan for, acquire, and utilize time at sea for multi-disciplinary research and education," he says. Participants have found the training to be valuable.

Diane Adams, PhD, of the Institute of Earth, Ocean and Atmospheric Sciences at Rutgers University in New Jersey, says the chief scientist training cruise provided an opportunity to get a behind the scenes look at what it really takes to prepare and run a cruise. "Often, we get the hands on training on the at sea technical work, but there are important tricks for the management and personnel side that make a cruise a success."

Amanda Nicole Netburn, a PhD candidate in biological oceanography at Scripps Institution of Oceanography at the University of California San Diego, says many students do not become actively involved in research cruises until it is time to start loading the ship, which it turns out is typically a year or more after the planning begins. "The UNOLS Chief Scientist Training program taught me that there is so much more to the process of planning and executing a successful expedition that will greatly benefit my own research programs into the future. Participating in the program was an enlightening opportunity to learn about the details of cruise planning all the way from

making ship time requests in proposals to always walking off the ship with all data in hand."

"There is no better way to learn about this process than working directly from UNOLS and NSF staff, the Marine Technicians, and experienced PIs. I believe my future research cruises will be far more efficient than they otherwise would be due to the knowledge with which I am now equipped through this training," Netburn says. "On top of all that, I collected ancillary specimens of deep sea fishes for my research, met a group of bright and friendly young scientists, and got to spend a few more days of my life in my favorite place in the world- the sea!"

Arctic Research

UNOLS has a standing Arctic Icebreaker Coordinating Committee that works closely with the Coast Guard and the polar science community. "The committee serves as a liaison between funding agencies and the Coast Guard to make the best use of the USCGC Healy as a research vessel, and to improve its science capabilities," Alberts says.

The Coast Guard has two heavy Polar-class icebreakers that also have science capabilities, but has struggled to keep at least one of them operational. President Barrack Obama recently called for new icebreakers, but building new ships for the polar regions is costly. "We expect we'll be asked to help develop science mission requirements for the new icebreaker class," Alberts says. Speaking in Alaska, President Barak Obama called for an accelerated procurement of new Coast Guard icebreakers. "These heavy icebreakers will ensure that the United States can meet our national interests, protect and manage our natural resources, and strengthen our international, state, local, and tribal relationships," the president said.

But the vessels will cost an estimated $1 billion each, and Congress has not approved the funding.

R/V Kilo Moana

The ONR small waterplane area twin-hull oceanographic research ship R/V Kilo Moana takes part in the second Radiance in a Dynamic Ocean (RaDyO) program, an at-sea research experiment in Honolulu. Twenty-five researchers participated in the RaDyO experiment. Results from this project were expected to enhance our knowledge of imaging through the air-sea interface and through-the-surface optical communications.

U.S. Navy Photo

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GLOBAL CLASS SHIPS			
University of Washington	THOMAS G. THOMPSON	Navy	274
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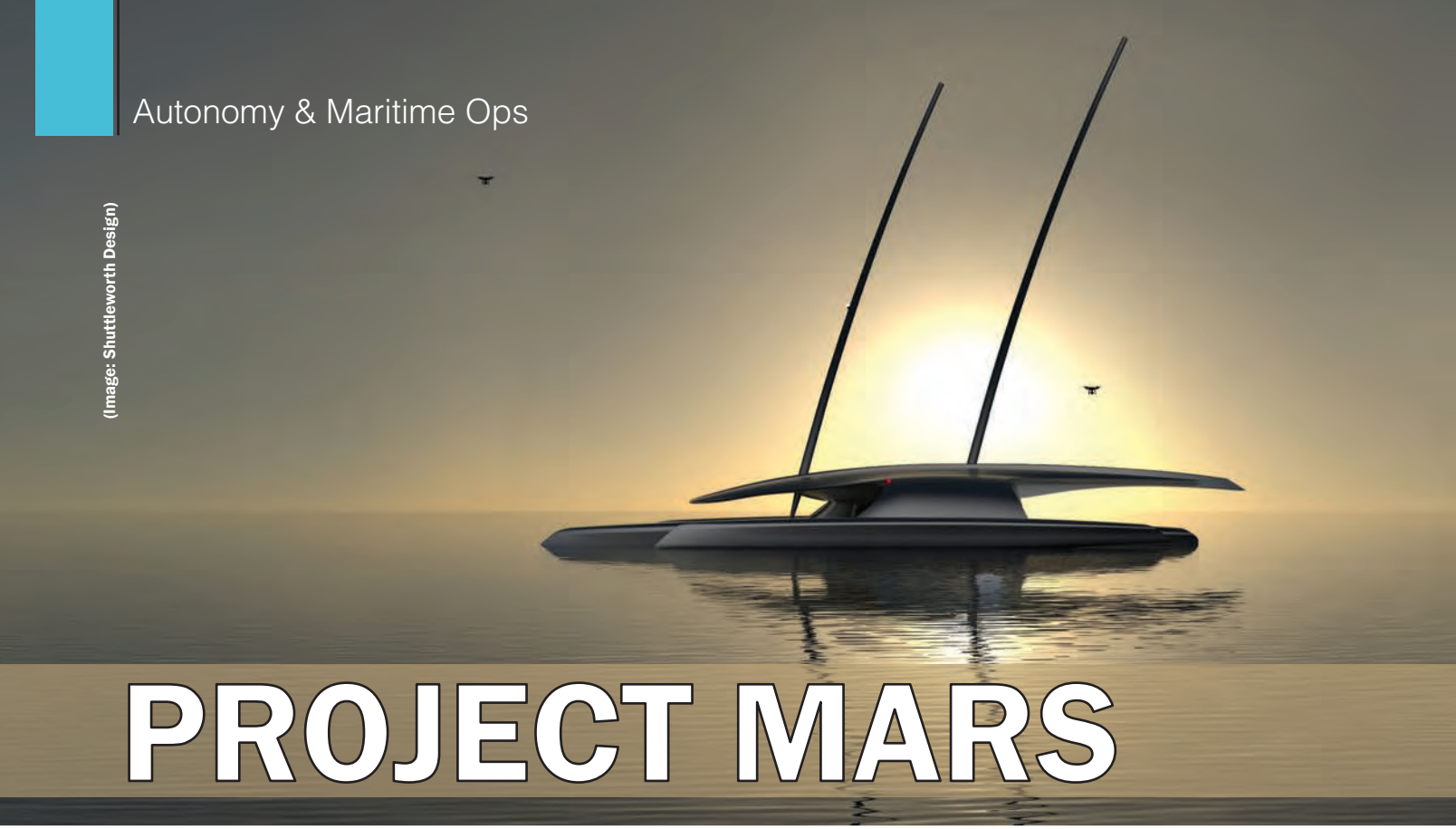


(Image: Shuttleworth Design)

PROJECT MARS

The future of Autonomy

By Kira Coley

Innovation and technological advancement is central to propelling maritime industries into a new era of efficiency. While the idea of autonomy is now a welcome solution for several military and scientific applications, other sectors are yet to fully take the concept on-board. As autonomous systems are continually proven a success in the field, the spotlight has now turned to the maritime sector. World-first ventures are emerging with aspirations of proving the potential of autonomy and its ability to transform the future of ocean voyages. A new collaboration between Plymouth University and MSubs, has set a course to build the first fully autonomous state-of-the-art ocean research vessel that will demonstrate the possibilities of autonomy within the shipping industry.

The potential of autonomous vehicle technology to address the challenges of working in conditions that are dangerous or inaccessible has been recognized in recent years. The concept of autonomy has already reached many areas within the maritime sector, such as oil and gas, and particularly the military. While the terrestrial sector pushes on with drone technology, where major companies such as Amazon are investigating the potential of using drones for home deliveries, the shipping industry has yet to embrace it.

"Some might see the lack of interest as conservatism on their part, and engrained adherence to having 'eyes on' the bridge at all times," suggests Brett Phaneuf, Managing Director of MSubs. "But human error accounts for the majority of accidents at sea, so there needs to be a reassessment and a debate around this issue – autonomous technology should not be seen as some form of inherent threat to the safety of seafarers."

Plymouth University and Plymouth-based partner MSubs are now aspiring to build the first full-sized autonomous unmanned ship to sail across the Atlantic in 2020 – replicating the 'Plymouth to Plymouth' Mayflower route. Designed and developed in collaboration with internationally acclaimed

and award-winning partners, the Mayflower Autonomous Research vessel (MARS) has the potential to transform and influence the future of world shipping, and inspire a new generation of ocean explorers and researchers.

"The idea arose organically from discussions taking place between some of our academics and Brett Phaneuf of MSubs," explains Professor Kevin Jones, Dean of the Faculty of Science and Engineering, Plymouth University. "Plymouth University has a number of academics who conduct research into the capability and usage of underwater autonomous vehicles (UAVs), and we have a great working relationship with MSubs, a company that has a great track record of winning international contracts, particularly in defense. At that point, the conversation was a conceptual one around technology and its adoption in the industry."

The concept was pushed forward by the Mayflower 400 anniversary in 2020, which the city of Plymouth will be celebrating with a huge range of events and initiatives.

"This historic symbolism of a ship crossing the Atlantic was greatly apparent to us, and we began to ask ourselves, what if we could mark that occasion with something transformative; something that referenced that landmark sailing but pushed forward the boundaries of marine technology?" said Jones. "Rather than looking back 400 years, we could look forward to the next 400. So now we have this focus on September 2020, we will need to move quickly to ensure all of the funding, development and testing is completed."

THE DESIGN

MSubs will be leading on the construction, using its expertise in building autonomous marine vessels for a variety of global customers. The contemporary vessel, designed by the multi award-winning Shuttleworth Design, will operate as a research platform, conducting numerous scientific experiments during the course of its voyage. MARS will also be used as a test bed for new navigation software and alternative forms of power, incorporating huge advancements in solar, wave and sail technology.

Phaneuf explains, "One of the key aims has always been to ensure the Mayflower Autonomous Research vessel is powered from renewable sources, and that will include solar power and wind power. There are some significant advancements in both solar panel technology and storage of that energy taking place right now, so we would be looking to tap into that emerging technology. We'll also be drawing upon the University's expertise in oceanography and navigation."

Committed to working with renewable energy sources, the design of the vessel will be developed with these limitations in mind. The solar cell area required for effective motoring is too large for efficient sailing and safety in large waves. To overcome this, the design will likely include a folding wing system to increase the solar cell area by 40% in calm conditions.

The configuration of the hull was designed to account for a low motoring speed and reduce wind. A trimaran was chosen because it provides the most efficient hull form for low speed vessels. Without the need for accommodation, the center hull has been kept low to the water and the wings and deck are separated and raised above on struts. This allows waves to break through the vessel and significantly reduces roll induced by wave impact. The outer hulls are designed to skim the water reducing resistance by 8%.

"Nothing of this size and complexity has ever been built for the civilian sector, and the questions we will be looking to answer are how do you generate and store enough power to ensure a vessel of this size can keep moving in all conditions? How do we manage the trade-off between the need for surface area to be devoted to solar panels and other instrumentation, perhaps connected to the research?" explains Phaneuf. "And from a technical standpoint of a different nature, how do we help start that debate over regulatory issues? We can put a rover on Mars and have it autonomously conduct research, but we can't yet sail an unmanned vessel across the Atlantic Ocean."

THE SCIENCE

MARS will conduct wide ranging meteorological, oceanographic and climate data gathering and research. The vessel is intended to house one or more modular payload bays, much like a Space Shuttle, which will allow for flexibility on what research can be conducted into the future.

"It's too early to talk specifics, but in time we do envisage the vessel hosting a full suite of METOCEAN sensors to conduct basic but persistent oceanographic, meteorological and climatological research. We will have an ADCP and DVL so we can look at current, a CTD will be periodically deployed so we get the salinity/temperature/depth at regular intervals, including sea-surface temperature and then a range of atmospheric data," suggests Professor Martin Attrill, Director of the Plymouth University Marine Institute. "There is the potential to include deep-water bathymetric equipment, as there is a clear need for more data on the deep ocean, particularly in the polar seas. We will also look to host and launch gliders because they will really help us to address those challenges of how you conduct research in those conditions deemed dirty, dangerous or dull. Scientific investigation will define the long-term plans for the vessel."

In addition to scientist research, the team hopes the vessel will assist in conducting research on renewable energy and propulsion systems for marine vessels. This would include studies into the development of software for automated and

autonomous operations for extended duration, advanced satellite communications and co-operative behavior.

Data harvesting issues is also an area the group would like to see improved as well as the possibility of implementing 'goal oriented programming' to create dynamic mission plans that better serves the scientific goals of a specific mission without significant human intervention through direct operation of the Mayflower Autonomous Research Ship.

PROPELLING FORWARD

"There are a number of financial, technological and regulatory hurdles that we will need to clear along the way. At this stage, it is an aspiration not a realization. But we will be inclusive, talking to authorities to achieve that buy-in we'll need for regulatory change; welcoming partners whose expertise might help to deliver a particular aspect of the vessel," said Attrill. "We are adopting an aggressive rapid prototyping program that leverages the experience the participants have in design, manufacture and operation of marine systems. And we'll work with leading technology companies in the defense and civilian marine sector to integrate commercial and existing bespoke technology solutions from other areas of R&D."

The group are working towards readying a model in spring/summer of next year and launching that to the public. There will be a testing phase, with some of that taking place here in the Plymouth University Marine Building, using their cutting edge wave tanks. Following the year-long testing phase, the planned Atlantic crossing in 2020 will mark the 400th anniversary of the original Mayflower sailings from Plymouth, England to Plymouth, Mass. "If we can deliver the Mayflower Autonomous Research vessel, and obtain the various permissions required to have it sail across the Atlantic, then we will have a lasting legacy for the shipping sector. We are hoping to play a vital role in the introduction, management, de-risking and technological advancement in use of unmanned and automated systems. While this may have a different morphology and commercial purpose, it will nonetheless need all of the same sensors, equipment and software and meet the same regulatory issues. Crossing the Atlantic is, we hope, the start," said Jones. The multi-million pound project is part of the University's 'Shape the Future' fundraising campaign, recently launched at the House of Lords. Initial funding has been provided by the University, MSubs, and the ProMare Foundation, and corporate and private sponsorship will be sought for ongoing support.

ACKNOWLEDGEMENTS

Professor Kevin Jones, Dean of the Faculty of Science and Engineering, Plymouth University
Brett Phaneuf, Managing Director of MSubs
Professor Martin Attrill, Director of the Plymouth University Marine Institute

SUPR-REMUS:

The Next Generation of Plankton Sampling

By Kira Coley

A vast number of marine animals live a sedentary existence or with limited mobility as adults. For these individuals, it is the dispersal of larvae that determines the settlement of future populations and the structure of ecological communities. Plankton research is hindered by observational difficulties, as traditional sampling methods fail to identify fine-scale distributions while accounting for changes in environmental gradients. Now, a group of Woods Hole Oceanographic Institution (WHOI) researchers and engineers have developed an innovative new system for sampling small planktonic larvae in coastal ocean waters, offering novel insights into the intricate world of plankton dispersal and demographic connectivity.

While species in larval stages have limited dispersal capabilities, many are able to influence their horizontal distribution by controlling their vertical position, affecting transport and spatial distributions on bottom habitats. For scientists, determining the fine-scale distribution of individuals in the

SUPR-REMUS on board the R/V Tioga, on its way to our Buzzards Bay site.
Credit: A. Govindarajan

water column, relative to environmental gradients such as temperature, salinity and circulation, reveals mechanisms of larval transport.

While understanding demographic connectivity in marine environments is crucial, research on larval dispersal has been hindered by the microscopic size of marine larvae and the inability to accurately observe their movements in large expanses of water. Furthermore, while distributional patterns and behaviours are species-specific, larvae are difficult to identify with traditional methods and knowledge on vertical distribution and behaviour is lacking for most species.

Historically, traditional sampling techniques such as nets and bottle samplers have provided essential insights into the distribution and abundance of plankton species. The limitations with pumps and nets used today are that they require sampling at predetermined stations or towing nets behind a ship. Samples using these methods combine organisms collected throughout horizontal or vertical tracks, making it impossible to detect small gradations or species-specific patterns in larval distribution.

"It is difficult to get fine-scale larval distributions in the field. For vertical distributions, the "MOCNESS" plankton net sampling system has been used, but this system works for open ocean areas, not shallow coastal waters. Also, larval distribution patterns may be species-specific, and it is very difficult and labour-intensive to identify larvae using traditional morphological examination under a microscope," explains Annette Govindarajan, Research Specialist at the Woods Hole Oceanographic Institution and lead author of the paper.

The need for autonomous larval sampling that can respond to environmen-

tal gradients is crucial for progressing this area of research. Adaptive sampling of this kind would greatly facilitate studies of larval transport, a process dependent on larval behaviour and physical variability.

Therefore, advancements in current sampling methods is required that can resolve these spatial scales and take multiple samples in the field.

New Plankton Sampling System

Woods Hole Oceanographic Institution (WHOI) researchers and engineers have developed a novel sampling system which allows the collection of small planktonic larvae in coastal ocean waters, taking into account environmental parameters.

The sampling system combines three cutting edge technologies—an adapted Suspended Particulate Rosette (SUPR) multi-sampler, a REMUS autonomous underwater vehicle equipped with sensors, and identification of organisms by DNA barcode analysis.

The main objectives of the study were to couple the Suspended Particulate Rosette sampler (SUPR), designed by co-author Chip Breier for deep sea biogeochemical sampling, with a REMUS 600, and use this system to obtain the vertical distribution of barnacle larvae in Buzzards Bay.

"Plankton nets that take discrete samples, such as multiple opening-closing systems, are meant for use in open water," said Govindarajan. "Our goal was to sample in shallow water, and close to the bottom for larvae of coastal benthic invertebrates."

The team modified the SUPR sampler to fit in the front section of a REMUS 600, with additional foam and weights for buoyancy and trim. A flow meter measured seawater volume, which was pumped through external ports at predetermined times, and multiple 200um-mesh filters retained the plankton from separate samples.

The researchers targeted barnacles because their reproductive biology is well known, and the scientists knew when and where larvae would be abundant. Adult barnacles are sessile, but the planktonic larvae travel and disperse with water movements. Several barnacle species co-occur in coastal Massachusetts waters, but little is known of how their larvae behave and distribute differently in the water column.

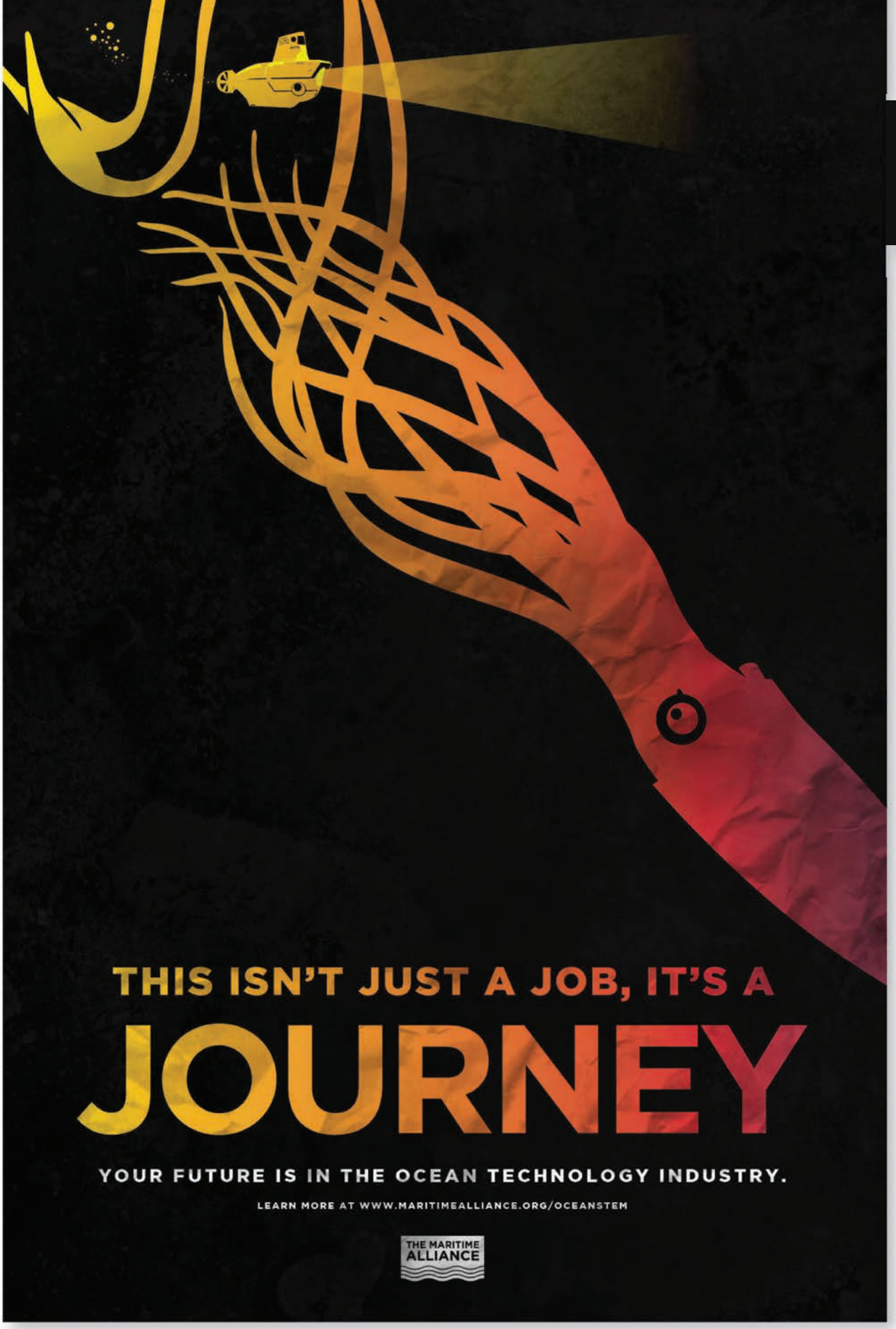
"Our new system, dubbed "SUPR-REMUS" can be used to obtain vertically discrete samples in shallow coastal water, unlike any other method. We programmed SUPR-REMUS in advance to initiate and terminate sampling at specific times. While sampling, REMUS collected environmental data including temperature, conductivity, and depth," explains Govindarajan. "SUPR-REMUS lets us take discrete samples, in a way that nets can't in shallow water areas."

Last March, the team launched the SUPR-REMUS to conduct transects perpendicular to the coastline. On the first mission it travelled between the surface to about 15m depth in a sawtooth ("yo-yo") vertical pattern over a 9.9 km distance. The second deployment was more complex: the AUV's upper and lower track boundaries were programmed relative to the surface and to the seafloor, over 11.2 km distance.

"The deployments were challenging as the weather at the time was frigid, but we were very pleased with how SUPR-REMUS performed," said Govindarajan.

"The system worked well for collecting barnacle larvae, many of which was collected and used for genetic analysis. We had timed the deployment to coincide with the time of year when we knew the larvae would be abundant. However in the future we would want to consider increasing the flow rate to sample more dilute taxa."

The work so far demonstrated the feasibility of using an autonomous vehicle based sampling approach. This new method has the potential to collect larvae of other invertebrates as well as zooplankton, and together with genetic identification, overcome many existing limitations, offering the potential of valuable new insights in understanding larval distributions and transport dynamics.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THE VOICE

Frederic Terral, CEO & President, Brand Architecture Inc.

Next month in San Diego The Maritime Alliance will convene its seventh Blue Tech & Blue Economy Summit, an event which brings together a small group of highly influential executives and government officials for two days of discussion and social function. The meeting in San Diego is envisioned as a platform to give the subsea industry voice, a loudspeaker to convey the promise and opportunity within the sector. With that we spoke with **Frederic Terral, CEO & President of Brand Architecture Inc.,** *which last year created for The Maritime Alliance (see pages 32 & 33) and this year created for U.S. IOOS (see pages 34 & 35) stunning campaigns to help raise the profile – the Voice – of this wonderous yet somewhat mysterious subsea industry.*

By Greg Trauthwein

IOOS Integrated Ocean Observing System

For our readers not familiar, please describe the business of Brand Architecture.

Brand Architecture Inc. (BA) is an award-winning branding and design agency that was established in 1999. Our team members are located in Orlando, Boulder and Austin. We are known for our design of the Coca-Cola sign in New York City, Times Square and for our rebranding of Outback Steakhouse. We also work with startups and small businesses. Most recently, we were honored with the task to rebrand the U.S. IOOS, NOAA Program Office. We love a design challenge and our passion to develop smart, creative solutions transcends industry and popular trends.

To date, looking at projects outside of the maritime realm – which project – are you most proud and why?

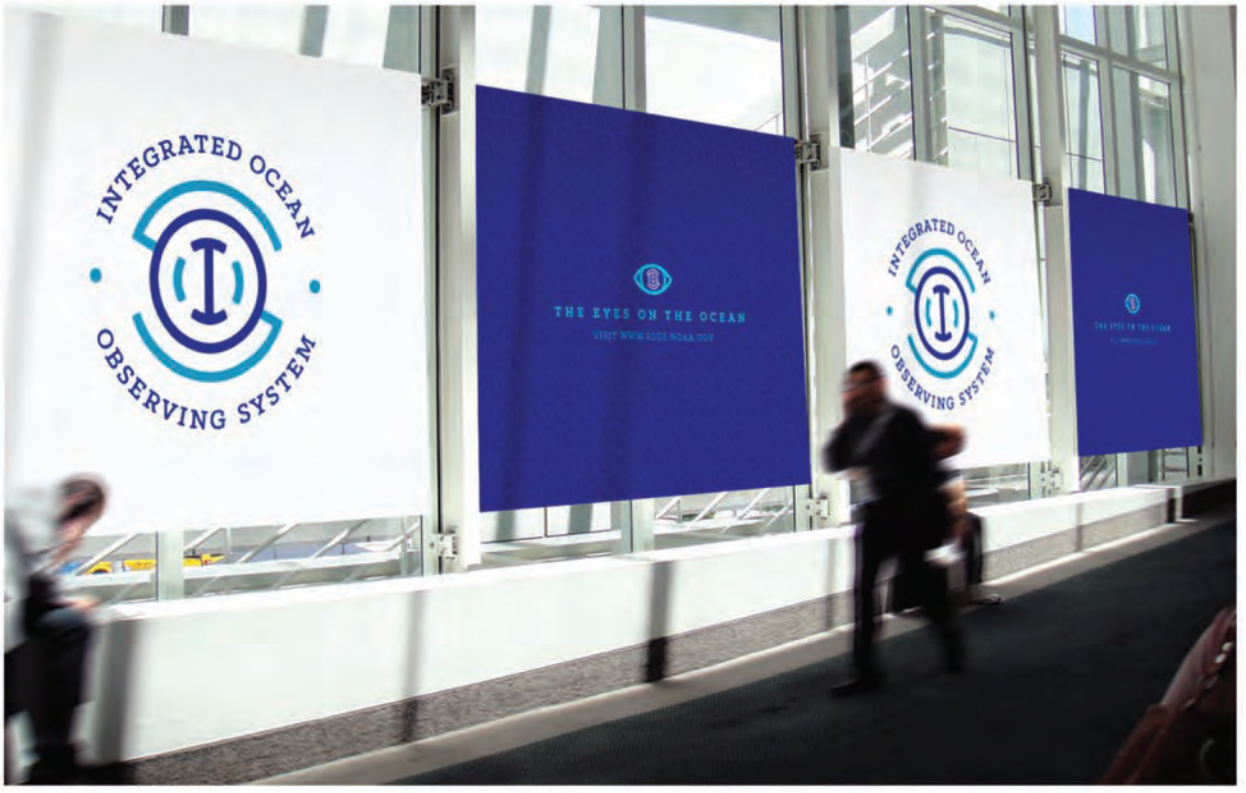
There are many projects we are proud of but the Coke sign in New York is certainly up there. We had never designed a sign before and we were competing against a dozen well known and much larger firms than ours, with more relevant experience than our company. Our eclectic, multidisciplinary team of designers, writers and illustrators worked seamlessly together to identify the simplest and most effective way to communicate the Coca-Cola brand essence. The final solution elegantly features Coca-Cola's Dynamic Ribbon Device as seen on millions of cans and bottles around the world. Ten years later our sign still glows brightly on Times Square, and it's still relevant today as it was the day the lights were turned on.

Last year we met at the Maritime Alliance's Blue Tech & Blue Economy Summit in San Diego. Your team had created some stunning material for Maritime Alliance. Can you tell us the back-story on how your firm and the Maritime Alliance came together?

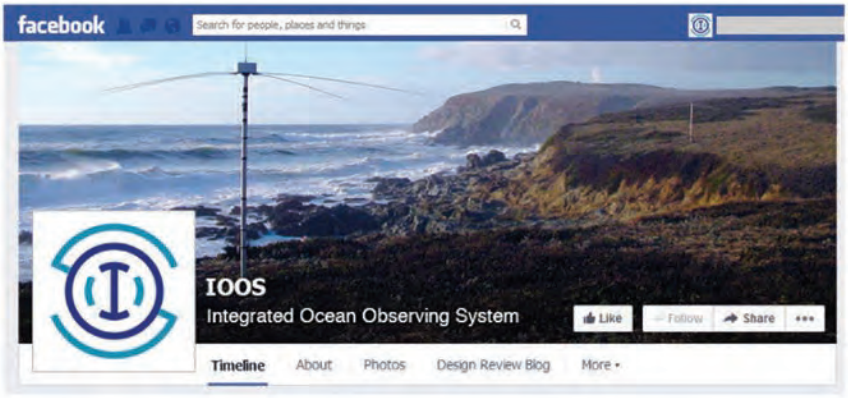
My partner and BA founder, Wright Massey, introduced me to Michael Jones about three years ago. Michael was exploring the possibility of creating a poster series from the Maritime Alliance to promote STEM careers in the Ocean Technology Industry to students considering their future career paths. Michael asked me if my team and I would be interested in working on such a project. My answer was an emphatic, "Yes!"

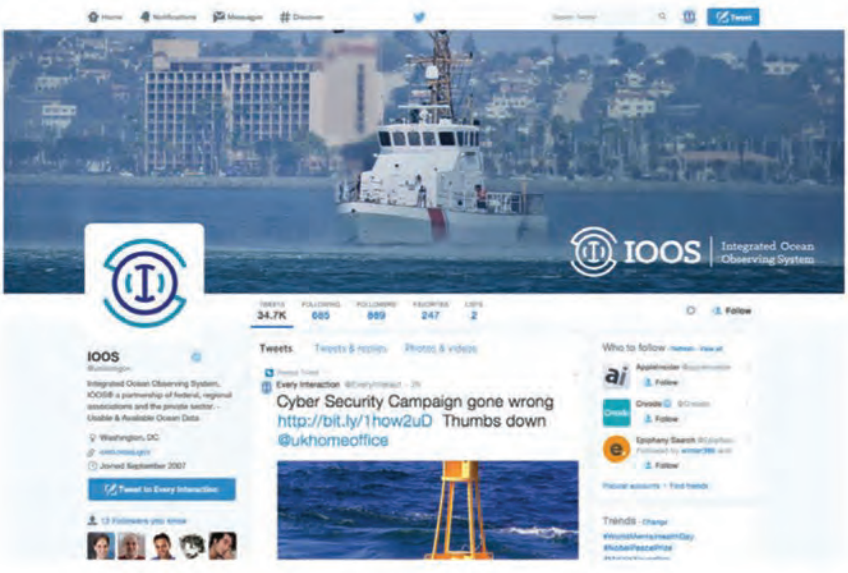
The design team had a great time learning about the industry and it opened our eyes to technologies and efforts we were unfamiliar with. The posters are a result of our team's deep dive into a strange new world. Being industry "outsiders" gave us the opportunity to present a new perspective to promote Ocean STEM to students and the freedom to not rely on past practices and standards. Michael opened our eyes to the ocean and we are pleased to know that the posters are now doing the same for others.

As you delved into the maritime world, what facets did you find most interesting or inspiring as you put together the



> **The IOOS community is excited to have worked with Brand Architecture Inc. to roll out an exciting new Logo and Brand, said Zdenka Willis, Director US IOOS Program Office. It reflects our evolution of a global enterprise and focus on the users and data, and building the best possible platform to work with our partners and peers, contributors and users, overseers and curious citizens.**





pieces that we saw last year?

We noticed that a common practice in the Maritime industry was a push strategy showcasing charts, numbers, and an overuse of messaging that would get lost with viewers. When we were strategizing ideas for the Maritime Alliance project, Michael Jones sent us books and links to images from the ocean's depths that completely astonished us. Upon first glance of the images, we were inspired. The ocean is such a mysterious place and we wanted to translate that with simple imagery to lure viewers in, as we were lured into the photos. There is so much we don't know about our ocean and it was our mission to create a series of posters to ignite the curiosity of the future STEM stars of tomorrow.

Measurable results are the hallmark of any ad campaign. Perhaps this is a question better suited for Michael Jones, but can you discuss the measurable results that your campaign helped to generate for the Maritime Alliance.

I would defer to Michael for this question. I can tell you that I've seen the posters at the NOAA offices in Silver Spring, MD and whenever I meet someone who has seen the posters, they go out of their way to compliment them.

I have often written and said that the only time anyone hears about the maritime industry in mainstream media is when there is an accident or a tragedy. Maritime and subsea matters are often subliminal, even to communities directly connected on the coast. In helping to raise awareness, to gain a foothold in the general population ... to Give "voice" to the Blue Economy and the Blue Tech Clusters around the world ... what are the most important aspects to consider, from your perspective.

You said it in your question. I believe that the mainstream has become desensitized to ocean/marine accidents or tragedies. Unless there is a direct, personal impact, it's just another "problem" for someone else to "fix" or attend to. There needs to be one voice to first and foremost deliver a singular message for ocean awareness. This voice needs to pull and not push citizens in and once we have their attention, we can introduce them to the benefits of the Blue Economy and Blue Tech Clusters that impact their lives in ways they are not directly aware of. We need to stop yelling and scaring citizens.

It's like parenting, the more you shout, the more you are ignored. We need to tell a different story to capture their attention, one that needs to be unexpected, unconventional, surprising, and alluring. We need to recruit non-maritime, high-profile, and influential mainstream partners to lead the efforts to deploy non-traditional strategies that pull in the general population, on terms and strategies they are comfortable with. It's not an easy task, but until bigger outsider voices join in the conversation, we'll be stuck relying on mainstream media to alarm us for a ratings bump.

Does your work continue today with the Maritime Alliance? If so, please provide details.

We have no current projects with TMA but we enjoy an on-going relationship of collaboration, support and mutual admiration.

Each client, each industry, adds a small chip to your collective memory and experience bank, and I would assume that this influences future work as well. Without getting to philosophical, can you explain how your work in the maritime sector has influenced your greater body of work?

Working in the maritime sector has not so much influenced our body of work as it has influenced us as individuals. I for one have gained a growing passion for the ocean and those who work to monitor and protect it. I have altered my purchasing habits. I have encouraged my staff to be more sensitive to our waste and standard workplace habits. I have sought out more work in the maritime space to contribute our expertise to help in any way we can. It has been a sort of awakening that cannot be undone. I look forward to more projects in the maritime sector and I hope to someday use our talents to make a difference in the overall awareness of the ocean, Blue Tech, Blue Economy, and all those who work diligently to make a difference.

This distinctive Coke sign is a prominent fixture in New York City's Times Square and is one of the projects of which Terral and his team are most proud.


Coca-Cola

Autonomy by (Software) Design

Over the last decade or so there have been rapid advancements in the area of maritime smart software and autonomy solutions, with developments ranging from advanced 3D graphical interfaces, operator-in-the-loop assistance all the way to un-assisted autonomous adaptive operations. Adaptive is to say that the vehicles are being equipped with the capabilities to re-plan and change their missions and behavior in response to feedback from the data they have gathered. A major focus for these developments has been on software solutions to enhance the capabilities of UUVs (Unmanned Underwater Vehicles) where, because of the low-bandwidth acoustic communication, approaches used in other domains are not applicable. For example, UUV missions are typically going to transmit 30 bytes every few minutes, in contrast to an aerial drone that may have multiple HD video streams.

Smart Software Moving Towards Full Autonomy

The concept of autonomy and smart software can cover a wide range of levels of autonomy. To start with, this advanced software processing can be as straight-forward as improving the visualization of the incoming data. This might mean, for example, using 3D graphics techniques to help an operator process large volumes of data.

The next step up in complexity, traditionally referred to as decision support, relies on the smart software to reduce the amount / complexity of data that the human operator has to view. The traditional example would be setting an alarm on temperature readings but modern software can process more complex data and identify subtler trends.

Moving up again in sophistication, the software processing can be used to achieve "operator-in-the-loop" autonomy. This might be adaptive control of the vehicle while the operator monitors progress and intervenes where necessary.

The final stage of smart software processing is for full autonomy without the operator directly involved. In this case, vehicles are capable of carrying out full missions independently of operator input, even going so far as to adapt their behavior in response to the external environment. The main advantage to full autonomy is in situations where the vehicle has to operate for extended periods in a remote, hard-to-access or dangerous location.

SeeByte Neptune

SeeByte developed a suite of software tools to provide enhanced command and control capabilities for off-board assets. Neptune provides a payload control architecture and real time autonomy engine for unmanned systems to plan and

execute well known patterns of behavior that expedite and optimize single vehicle and multi-vehicle operations. There is a clear distinction between goal-based mission planning and straightforward pre-planned missions; goal-based mission planning places an emphasis on the outcome of the mission with the capability for the vehicles to autonomously re-plan the mission to best achieve the intended outcome. In essence, this allows the operator to focus on what the mission outcomes are, rather than how they will be achieved.

Neptune utilizes an underlying payload control architecture (PCA) that benefits from modern layered data model design and middleware messaging technology. This PCA effectively provides a level of abstraction between the system hardware and control software, sensors and planning processes. Neptune then builds an autonomy engine that provides a modular software architecture capable of integrating third-party modules.

All data processing is carried out by functions and any third-party can develop their own version for integration. This would include target recognition algorithms or seafloor swath bathymetry following algorithms. Neptune has had demonstrated on a number of occasions integration of third-party functions that extend the core capability.

Similarly all vehicle planning is performed by behaviors and third-party integrations are also possible. These could include new area survey approaches or ocean sampling patterns for oceanography. Various customers have used Neptune with third-party behaviors to provide specific capability not provided by the core product.

Benefits of Full Autonomy

The combination of PCA (abstraction layer), autonomy engine and modular software approach can provide a generic platform that consolidates all sensor, vehicle and mission data into one system. A major advantage of this is that multiple vehicles of different types can be integrated together in to the same collaborative network, effectively allowing operators to manage an entire fleet of vehicles from a single common tool.

For example, recent operations have shown that on average the autonomy-enabled mission with two UUVs can perform the specified mission in half the time normally required to carry out the same work using conventional UUV tools with two UUVs.

Autonomous capabilities can also enable the force multiplier effect where previously fleets of vehicles would be limited by labor intensive operating processes. Breaking this link between the number of vehicles and the number of operators is vital in achieving the expected benefits of operating a fleet of unmanned vehicles.

Finally the application of an autonomous UUV fleet is starting to extend across different maritime industries outside of the early-adopter MCM domain. Two mini case studies about the applications of autonomous UUVs are presented below.

Mini Case Study: Pax River

The latest Technical Cooperation Program (TTCP) event, which was held at Patuxent River, Md., in September 2015 sponsored by the Office of Naval Research (ONR), involved 150 participants and 26 different technology teams / unmanned systems to provide demonstrations of various technologies.

SeeByte demonstrated new autonomous capabilities for unmanned underwater vehicles (UUVs) in collaboration with several international partners. Autonomy architectures were used to enable multi-vehicle collaboration and inter-fleet communications, as well as autonomous solutions for Mine Counter Measures.

These include integration of SeeByte's Neptune software with SeaRobotics' family of general purpose Unmanned Surface Vehicles (USV) as part of a Defence Research and Development Canada (DRDC) contract. This integration enabled the USV to act as a relay to an Unmanned Underwater Vehicle (UUV) squad. This is an important step needed in order to enable over-the-horizon UUV operations.

The UK Royal Navy Maritime Autonomous Systems Trials Team (MASTT) also attended Pax River with their recently delivered autonomy demonstration system for MCM. This is a high level autonomous demo involving inputs from multiple nations and demonstrating SeeByte's Neptune software which is the core open autonomy architecture for the UK's Maritime Autonomy Framework, and third party, autonomous behaviours in multiple environments. Effectively, the autonomy system enables communications between international vehicles – in this case a Canadian UUV, three UK UUVs of different types and a British USV. Neptune allows end-users to develop their own autonomy behaviors, a crucial feature to allow navies to develop their own unique fleets but be able to collaborate with other nations as fleets will commonly run on Neptune. In the case of MCM, unmanned vehicles act as a layer between any danger areas and the crew. While the vehicles are able to directly survey an area and gather large quantities of data, the crew is then able to review any points of interest highlighted by the software and take appropriate measures to neutralise the threat. The systems were integrated with the UK's Maritime Autonomy Framework (MAF), developed under Dstl funding, which extends autonomy architecture to en-

Recent operations have shown that on average the autonomy-enabled mission with two UUVs can perform the specified mission in half the time normally required to carry out the same work using conventional UUV tools with two UUVs.

able further advanced capabilities.

Mini Case Study: Stokes Bay

SeeByte, ASV and the Marine Biological Association of the United Kingdom were awarded funding under Phase 1 of the Adaptive Autonomous Ocean Sampling Network (AAOSN) SBRI. The aim of the project was to reduce the complexity and frequency of operator input when supervising large fleets of autonomous systems from the shore. Phase 1 focused on Tagged Fish Tracking and culminated in a demonstration of the autonomy behavior. The core scientific question being addressed is whether the recently introduced or updated fish management zones (MCZs, SACs, and SCIs) will have a detectable effect on important fish species.

Following the successful completion of the first phase trial, SeeByte, ASV and the Marine Biological Association of the United Kingdom have now been awarded $900k of funding to carry out Phase 2. This will run until April 2016 with the trials conducted on UK National autonomous assets managed by NOC (National Oceanographic Center, U.K.) , including a long endurance autonomous surface vehicle, using a common interface and control system. The phase 2 trials will include integration of a multi-beam echo sounder, for dynamic seabed mapping.

Conclusion

The maritime sector has been at the forefront of the development of smart software solutions for unmanned vehicles. The aim of full autonomy, provided by tools like Neptune, is to allow multiple tasks to be run in parallel with the available vehicles automatically taking responsibility for tasks. The benefits of full autonomy are simpler planning, reduced error rates and improved reaction to environmental conditions. Nowhere has this been more clearly demonstrated than in recent developments in MCM UUVs. However, these proven advantages are now starting to transfer to other commercial sectors and particularly to oceanography. It would seem that the capabilities of UUVs are only as sophisticated as the software behind them.

Shipping's Stake in an Ocean Clean-Up

The Nor-Shipping 2015 Young Entrepreneur Winner shows the way forward.

By William Stoichevski

Drawn from the palace for the event, the King of Norway looks more solemn than many are used to seeing him, as he walks the catwalk to bestow honors and the Nor-Shipping Young Entrepreneur prize on a young Dutch citizen. The 21-year-old Boyan Slat and his Netherlands-based Ocean Clean-up impress not just King Harald and the Nor-Shipping awards committee, but a mixed audience of 800 from the worldwide shipping community and Norwegian officialdom.

The Young Entrepreneur Award honors a person under the age of 40, "a professional who has founded a successful company to address maritime challenges in an innovative and new way." The prize injects a bit of youthful appeal and wildcard relevance to a Nor-Shipping conference and tradeshow that attracted 15,400 visitors in 2015. The prize was juried in part by U.S.-based, clean-shipping protagonist, Carbon War Room.

Innovation

Slat's invention is an "ocean curtain" that drapes for miles to trap plastic bags, six-pack rings and other garbage tossed by humans or carried by the wind into the sea. His technology targets "the removal of half the (trash in the so-called) great Pacific garbage patch." The "patch," by various accounts and estimations, is a continent-sized swirl of refuse circulating in perpetuity off the Western U.S.

"If you told me four years ago (during a summer school exchange) that next time I'd be back here accepting an award from the King of Norway I wouldn't have believed it," the

Credit: William Stoichevski

Big screen banner: **Ocean Clean-Up CEO Boyan Slat** above a captivated Nor-Shipping 2015 audience.

poised, slightly giddy Slat says in a modest victory address that drew laughter and applause. He says he got the idea to do something about pollution when diving in Greece as a teenager and finding "more plastic bags than fish." The idea that eventually spawned was "a very long floating barrier to passively concentrate the plastic," since a clean-up using nets and boats would take "about 79,000 years and tens of billions of dollars."

"We've been able to show that with this technology, 100-kilometer arrays deployed between Hawaii and California would clean up half the great Pacific (Ocean) garbage patch in 10-years' time," Slat asserts, adding that he'll take the award as a sign that the Ocean Clean-up project "has the support of the shipping industry, which is obviously an important stakeholder in this project."

Yet, in a note to ***Marine Technology Reporter***, recent Chamber of American Shipping chief executive Joe Cox says that while the shipping community has committed to preventing pollution it doesn't necessarily see "clean-up" as its role. "An owner would naturally question his responsibility to clean up (or pay for) another owner's pollution," Cox writes, adding that, "I also think there should be acceptance by all who have polluted. Commercial maritime has a degree of responsibility; although so do other maritime users such as fishing, some land-based industries, (boaters, etc.)."

Cox wasn't briefed on Slat's invention and couldn't comment, but he offered some caution. "An award given by an organization does not indicate universal support."

Garbage Collection

Slat dropped out of his Aerospace Engineering studies to found *The Ocean Clean-Up* and begin an entrepreneur's clamoring for funding and development. In 2014, he became the outfit's founder and chief executive after a crowd funding effort raised $2.2 million, or enough for a technology pilot to launch the platform-and-boom idea. Delft University in the Netherlands had already awarded the concept Best Technical Design, one of several honors awarded Slat in 2014, including a United Nations Champion of the Earth laurel.

The ocean clean-up installation — a two-kilometer prototype of which is due to deploy in 2016 — allows current to carry sea life beneath a boom while trapping buoyant garbage, especially plastic. It's not known how effectively it'll perform either operation over a many years, but its component materials have been researched. Part of the system envisions a trash-munching platform that lifts garbage out of concentration and into a silo for removal and destruction. No specific maintenance or support vessel is understood to have been selected to work the long stretches of oceanic garbage collection.

"The scalable array of floating barriers attached to the seabed (are) designed for large-magnitude deployment, covering millions of square kilometers without moving a centimeter," Ocean Clean-Up literature says. Its researchers — including volunteers — suggest a 100 km section swept by ocean currents for 10 years would remove 42 percent of the great Pacific garbage patch. This area of spoiled sea and Slat's idea have both received plenty of press and criticism since about 2012. Biologists have expressed the worry that the Clean-Up array could kill sea life. Blatt's adherents point to the prize: much less ocean trash.

"We conservatively estimate (the size of the mess to be) 70,320,000 kilograms," the start-up says of the Pacific garbage patch. After a 400-day engineering study that attracted 100 engineers, a clean-up cost of €4.53 per kg was arrived at. A fact sheet says the feasibility study concluded only that the

Garbage Belt:
A rendering of plastic about to be processed.

Credit: Ocean Clean-Up

concept "likely is a feasible and viable method for large-scale, passive and efficient removal of floating plastic" from the Pacific garbage patch.

Contributing scholars, including Slat, say most ocean plastic is suspended in the top three meters, where it will be trapped. Computer simulations and a 40-meter-long mockup strewn across the Atlantic showed plastic does travel along the barriers, and there's no accidental catch of "naturally buoyant" sea fauna. Slat and his engineering partners have tested the underwater performance of the concept, and found the right amount of gravitational and centrifugal force to separate zooplankton and tiny plastic particles without harming the former.

Some company literature can sound as alarmingly dismissive as the shipping industry attitudes of the 1960's that Cox described. "The environmental impact of the concept is negligible," one text relays, and "No major legal hurdles have been identified." Assurances are given that the plastic collected is recyclable and that the silos can be emptied every 45 days from a giant platform powered by 162 solar panels.

"The question I have is about the amount of garbage and types, i.e. who are the polluters? Also, where would the garbage go? Who would accept it," asks Cox.

Whatever the language of Ocean Clean-Up's concept, the worthiness meter is off the scale. As if the Pacific pile-up wasn't enough, five areas of converging currents in the world's oceans, called gyres, are fast filling with junk. That's not all: "While the debris primarily collects (in the five gyres), it doesn't just directly kill sea life, but due to the absorption of PCBs and DDTs, also poisons the food chain, a food chain that includes us," Slat says.

Ocean Experience

In his letter, Cox affirms shipping has come a long way in its attitudes. The Blatt award merely affirms 2015 is not the 1960's, a time when "deck gangs did throw things overboard." Cox admits to being one of those deck hands who thought, "It's such a large ocean and this piece of detritus I have in hand won't do much."

Slat says seafarer, offshore industry and tourist education and manual collection have fallen short, and that it's time for the ocean "to clean itself" using the Ocean Clean-Up solution. While no known net size will trap the smallest pieces of plastic, the smallest mesh size (used in Clean-Up) does and while letting microorganisms pass through. Plastic bits, large and small, are eventually eaten by the 24 platforms envisioned in Slat's first, full-scale pilot. In a presentation of his ideas, Slat refers to a maritime accident during which six cargo containers of plastic spilled into Hong Kong harbor in 2012. "The largest oceanic plastics spill ever" would be easily munched up by his Clean-Up array. The full-scale version could clean "55 containers (of spilled plastic) per day."

For the shipping industry – his new "stakeholder" – Slat

points to the "$1 billion" a year in ship damage caused by floating plastic. That junk would be recycled and sold for $500 million, the "payback" for a plan of execution Slat puts at €300 million. Sounds like a worthwhile business proposition.

Meanwhile, CEO Slat and his supporting cast of researchers and volunteers — now an ocean-experience enterprise (pay to be a part) and a mass movement organized by social media — have ploughed another barrier into the densest reaches of the great brown Pacific gyre. In tow behind their sail boats, the plastic traps have shown that design and operational costs might come down, after it was found a shallower barrier also collects garbage.

This summer, another Slat-led expedition heads for Bermuda, the Azores and the North Atlantic Garbage Patch. For aspiring engineers with sea legs, Slat says he's hiring: two design and structural engineers; a hydrodynamic engineer and a finance intern. He's also looking for volunteers with specialist training, including communications.

Whatever one thinks about Slat, his "solution" or the high-profile support and coverage he's received, no better ideas have appeared to clean things up. The shipping industry might be partly on board, but other coastal industries — offshore energy or aquaculture — might want to pitch in with an award of their own. As Cox said, who are the polluters?

DOE's Bergman, Sabo & Takeda

Deep Ocean Engineering

*Last month MTR sat with Deep Ocean Engineering – **Robert Sabo**, President & Corporate Secretary; **John Bergman**, Vice President of Engineering; and **Mike Takeda**, Director of Operations – to discuss recent advances in the field of ROV outfit and operation.*

By Greg Trauthwein

For our readers not familiar with Deep Ocean Engineering, please provide a brief company history as well as information that give them the size, scope and depth of your current product line and operations.

Takeda

Deep Ocean Engineering, Inc. is a privately owned small business founded in 1982 and is incorporated in California. Deep Ocean Engineering is a technology-based engineering and manufacturing company that provides integrated robotic solutions for various underwater applications in harsh and diverse operating environments. Deep Ocean designs, builds and tests its remotely operated vehicles (ROVs) from its plant in California. Deep Ocean has been in operation for over 30 years and has sold more than 600 ROV systems in over 30 countries worldwide. Deep Ocean's ROV systems have been used in a broad range of industry applications - military, security, salvage, long tunnel and pipeline inspection, customs, nuclear and hydroelectric power plants, dams and lakes, offshore oil and gas servicing, scientific research and education, fisheries and broadcast filming. Customers include the military organizations of twenty-five (25) countries (including the U.S. Navy, Naval Surface Warfare Center, Explosive Ordinance Disposal, Naval Facilities Engineering and Service Center and Army Corps of Engineers), the FBI, Canadian Defense, UK Customs, various utility power companies, science, law enforce-

Case Study

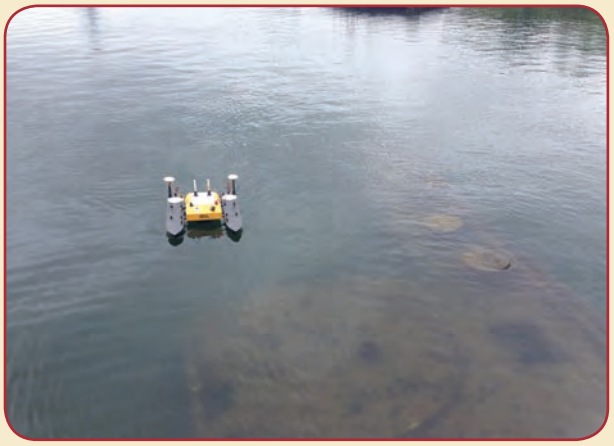
H-1750 USV Mission:
Survey USS Arizona and USS Utah

Deep Ocean Engineering Inc.'s Unmanned Surface Vehicle, H-1750, was selected to survey the historic USS Arizona and the USS Utah at Pearl Harbor, Hawaii

Deep Ocean Engineering participated in the first comprehensive multibeam survey of the USS Arizona and the USS Utah at the World War II Valor in the Pacific National Monument in Pearl Harbor, Hawaii. During a week in October 2014, team members from Deep Ocean Engineering, Inc, R2Sonic, Autodesk, and eTrac traveled to Oahu to conduct these surveys as a gift to the National Park Service.

In the months leading up to this survey, R2Sonic contacted Deep Ocean to use its their H-1750 USV as an unmanned platform to operate their SONIC 2020 multibeam. Typically, these surveys are completed using a 2-3 manned vessel with an affixed multibeam but the survey site above the USS Arizona has a height restriction where a manned vessel cannot navigate. The memorial building that straddles the USS Arizona makes for a low ceiling above the water at various tides. Couple that with the shallow depth of water above the sunken ship and there is a very tight set of survey vehicle characteristics that must be met.

The survey's goals were reached and 100% high resolution sonar coverage was obtained of both sunken warships to replace the artists' rendition surveys from some 30 years prior. This will yield high quality measurements of the ship that can be repeated over time and from there, changes such as shifting, settling, and coral growth can be evaluated, something that was absent from the surveys from 30 years ago. Not only will it provide a long term monitoring baseline, but a 3D scale model of the USS Arizona will be created and used for display purposes at the memorial site.



Pictured, from top to bottom:

The H-1750 USV's shallow drafting and maneuverability made it a suitable fit for the shallow waters above the sunken warship USS Arizona. (Photo: AJ Cecchettini)

The H-1750 USV was able to be easily transported to Ford Island in the back of a small truck to continue running surveys at the partially submerged USS Utah. (Photo: Shaan Hurley)

The low ceiling of the USS Arizona Memorial building made the H-1750 a well-suited for this survey. (Photo: TJ Kneale)

ment and security groups.
As part of Deep Ocean's efforts to bring the latest technology to the market, Deep Ocean has recently diversified its product line with the introduction of unmanned surface vehicles (USVs). Leveraging the knowledge and experience of the ROV world, the new USV product line continues that same tradition of an integrated robotic solution for various marine applications.
In addition to offering a complete range of standard ROV and USV systems, Deep Ocean provides customized solutions for clients with specific requirements. Tailor-made solutions are engineered from component technologies, which have been proven in various industry applications. The engineering and manufacture of appropriately configured submersible delivery systems also include the integration of a wide variety of sensors, tools, electronic navigational controls and tracking systems, instrumentation packages and accessories.

Please give specifics on each of your individual product lines / families, with specifics regarding the number of vehicles in operation and their primary use. Please be descriptive of the family/line traits and characteristics

Bergman
Deep Ocean Engineering (DOE) has diversified its product offering to include both ROVs and USVs. Our USVs can be controlled either manually or autonomously for many survey scenarios. Bathymetry, ADCP, multibeam sonars, HD video, LIDAR, etc. From the small I-980 (0.98 meters) to the I-1650 (1.65m) and the H-1750 Catamaran (1.75m) which was used for the multibeam survey of the USS Arizona and USS Utah in Pearl Harbor. Three standard ROV product lines/ classes. Additionally, special projects like Hydro Quebec's hydroelectric survey system, etc.

1) Nuclear inspection ROV: Our line of nuclear inspection systems (the Firefly, Dragonfly, and Phantom 150 to name a few) survive and thrive in the extreme environments of heat and radiation inside a reactor where reliability is paramount.

2) Observation ROV: The T series,

Set to deploy L4 in Russia.

L5 with BlueView 3D sonar

300m depth – Really, the "observation class" ROV has been redefined here at DOE. This class has morphed past having just an SD video channel as its primary sensor. Now it includes multiple HD video channels, multibeam imaging sonars, DVL, INS, USBL, along with a manipulator for light intervention, etc. In fact, our T5 outfitted with the Homeland Defense skid has all of these sensors and still has available expansion ports as standard. It should be noted that even though these small, man-portable, systems can be heavily loaded with all these work-enabling gizmonics, they are stable platforms. The T5 has what I would call a ridiculous amount of thrust, significantly more than the ROV's dry weight. I have yet to hear anyone complain about having too much power.

3) Light work class ROV: The L and S series, 500 and 1000m depth respectively – larger, heavier, systems that are capable of carrying larger sensors, providing even more power, and, all the while, doing it deeper. These larger systems are often outfitted with electro-hydraulic manipulator(s)/tools.

From previous conversations, I realize the importance of fiber optics to the concept of your vehicles. For the benefit of our readers, kindly explain how fiber optics has enhanced the DOE line of vehicles.

Bergman
Fiber Optics are nothing new at DOE. We have been using them for at least the last 20 years. Now it actually reduces the price of the umbilical since it allows the umbilical design to use much less copper. The umbilical can be thinner, reducing drag and improving performance. And, of course, delivering the bandwidth that today's sensors demand. Also, terminating modern FO umbilicals is a simple task that can be done quickly in the field by technicians without any special skills, all at a very low cost.

Obviously there are still some that have not bought into the Fiber Optic solution. Can you explain some of the perceived drawbacks to fiber optic use, and provide insight why you believe that those objections are not valid.

Bergman
Deep Ocean Engineering has been around for many decades now, making ROVs since pioneering this market in the early 1980s and, as such, still has relationships with of "old school" customers that only feel comfortable with a wire that they can solder. Also, they may remember horror stories about fiber terminations. Terminating a fiber tether is a breeze now. Also, the world of digital telemetry may seem daunting to those that have spent most of their career in the analog world. I'm sure that they often had to be magicians, finding a way to multiplex one more signal or find an extra wire or two. Now, all the copper in the tether can be used for what it does best, transmit power with plentiful signal paths up the fiber.

Aside from fiber optics, what do you see as the characteristics of your vehicles that make them unique in this space?

Bergman

Durability, these systems last for decades. Stability, users get the best video and exceptional data quality. Expandability, standard spare ports provide power and telemetry for whatever needs present themselves to a customer in the future. Simplicity, these systems are easy to use and interface to. And, lots of power - can't have too much of that. Also, it's the support of the factory. DOE really goes the extra mile to support our customers for the decades of use we expect to see from our systems.

Please discuss how the recent downturn in the offshore oil and gas markets have affected your business?

Bergman
The downturn in the offshore oil and gas markets has not made an impact to our overall sales. Fortunately, Deep Ocean Engineering is well diversified in the markets it serves besides oil and gas. These markets include port and harbor security, military, homeland defense, nuclear and hydroelectric power plants, inshore dams and lakes, scientific research, fisheries, salvage, search and recovery, broadcast filming, hydrographic surveys and pipeline inspections, to name a few.

When you look at the markets you serve today, where do you see bright spots, and why?

Bergman
By niche and back to our roots. The "T" series ROV provides affordable and formidable capability to many users that would otherwise either have to use survey boats and put divers at risk. These systems are easy to transport and can deploy quickly from a vessel of opportunity. This has, and will continue to be, DOE's primary market.

By world region, Asia, with its seemingly boundless infrastructure growth, presents oportunities

What ONE technology has had the greatest impact on DOE's ability to provided engineered solutions to the subsea market?

Bergman
If I had to pick one technology, it would be computers, both embedded and PCs. Legacy Phantom ROVs were "hard-wired," and, at the time, this was a strength. They had the majority of electronics located on the surface so even if the system was flooded, I could be hosed out, dried, and back in business in a couple hours. This architecture isn't practical with longer tether lengths and the bandwidth requirements of modern sensors. Now, with our open frame designs, we can mount new hardware and sensors anywhere. Going digital has made our tethers small in size yet dripping fat with telemetry space. In short, computer technology allows for a standardized footprint that can accommodate nonstandard applications, things we can't anticipate but can certainly be prepared for. DOE's ROV systems are ready for anything the market demands now and in the future.

S5 in the shop.

Fishing for

With more than 50 offshore service vessels (OSVs) laid-up in the North Sea due to less drilling, fleet owners with fisheries roots are showing signs of "going back" to the past for "new" ideas on how to adapt in lean times. Fitting and testing novel equipment and new ways to work was one way. Super charterer Statoil has looked to the fishery for cost-cutting salvation and, along with other oil companies, has chartered a purse seiner fitted for ROV and AUV work, seismic shoots, subsea lifts and seabed surveys. In these times, it's about value increments.

By William Stoichevski

Ervik & Saevik's ROV Haul

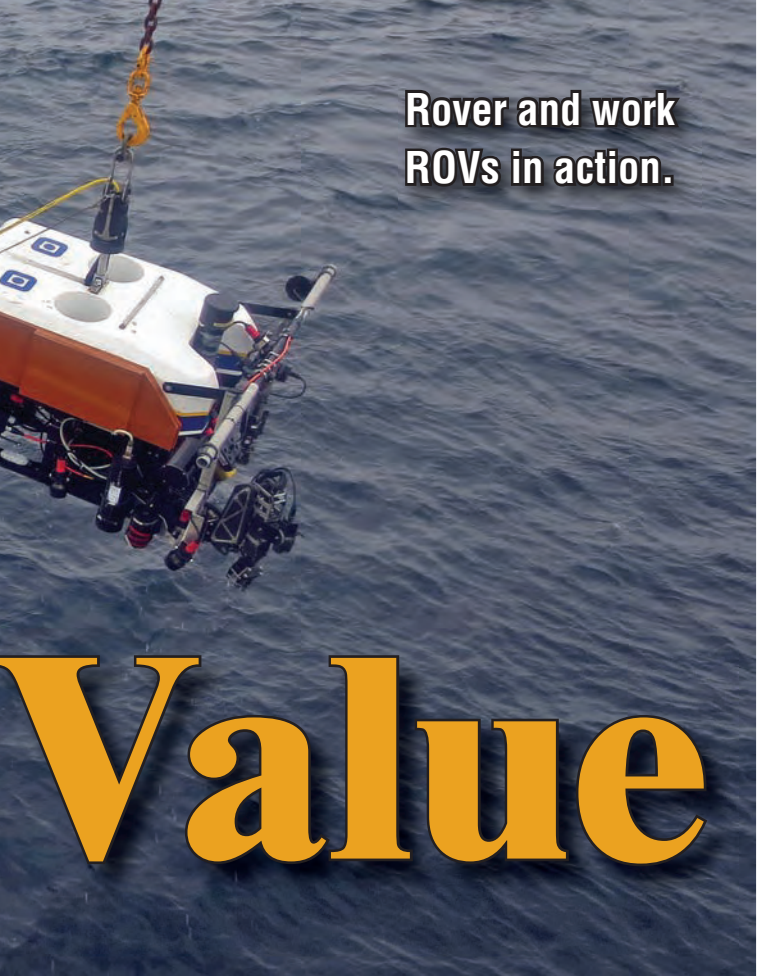
"Here's the other owner of the ship," says Rita Saevik of her partner, Espen Ervik, the ship's captain, in the gentle, slightly breezy English common in these parts. Saevik is manager of Ervik & Saevik's 80-meter purse seiner and multipurpose vessel, the Christina E. She introduces herself by recalling the dreamy day on the wide-open Barents Sea when she decided to own her own vessel. She was 11 and fishing with her father.

Although the first of four pelagic fishing seasons is about to begin, Saevik talks contracts, including the recent 180-day charter extension with Statoil for subsea inspection work by ROV. There's the growing list of jobs won in the "off-season" for doing environmental research; for towing a single seismic streamer; hiring her own ROV crew and then getting ready for future work with arguably more suitable AUVs.

The two trained captains compete with the township of Heroey's 150 OSVs and 3,500 sailors in the cutting-edge fleets of Olympic, Island, Havyard and others, including the seismic survey crews of Sanco. Tech-savvy Captain Ervik confirms the vessel has been modified to offer ROV teams three deck power supplies: 3-phase, 440V of 400 amps, 300A and 6300A and 305 kilovolts, 230 kVa and 50 kVa. We avoid day rate discussions — she's obviously cheaper than a large OSV — and we learn of the Christina E's other advantages of speed to mobilization, deck space, Karmoy cranes and winches. There's "roll-reduction" to operate WROVs in rough weather and a retractable keel on which subsea equipment can attach.

Argus ROVs

While Statoil, the locals say, "thinks mostly about fuel con-



sumption." Saevik says she would prefer they and other oil companies brought their own ROV's aboard. Statoil and other oil companies have chartered the Christina E. for five assignments.

"I hired the personnel and the two ROVs," she says, adding that the resulting earnings are "just not comparable" to profitable fishing. She confirms, though, that the local fishing vessels in the fleets of offshore vessel owners are growing despite shrinking fish quotas.

To serve crews, the ROV pilot room is has the feel of an high-end OSV. The Danish cook is more chef than cook. Saevik says she spent $700,000 on art.

We remove our shoes to follow a first officer tiptoeing to the engine room in her socks. ABB has tweaked the electrical and propulsion system so the 2.5MW and 4.5MW engines can handle a seismic operation's heavy tow. "It's EM seismic," says Saevik.

"You're towing a cable that pulses the ocean bottom."

Several days later, we called Argus ROVs, who Saevik had hired for the Statoil gigs. A voice on the line told us their ROV operation aboard the Christina E "Went much quicker and smoother that on some other jobs. The crew were very efficient." Class's DNV GL has helped her get machinery and equipment ICE-C compliant for ROV surveys. It's not known whether her HIPAP 500 hydro acoustic sonar was put to work for offshore work (it surveyed the bottom for the environmental surveys). There's deck space for three 20-ft. ROV containers.

(Photo: William Stoichevski)

Flexible Partnership: Captains Rita Saevik and Espen Ervik of Ervik & Saevik.

Multi-Purpose: The Christina E tows an EM seismic cable.

ORG Geophysical

SINTEF brought its own ROV when doing ocean research. Two other research institutes and the oil companies have also made use of the comfortable cabins for 34, the conference room, the three bridge work areas and separate Inmarsat data network. Summer 2015 saw the Christina E perform a 90-day seismic survey for ORG Geophysical in the Barents Sea. It followed a similar one in 2014. Environmental survey work on the British and Norwegian sides of the North Sea in 2013 rounded out a season that also saw an ROV LoVe installation and separate seabed survey. Two more ROV environmental surveys were won in 2012.

"The ship has been used for WROV, survey, installation of subsea equipment and seismic," Saevik says, adding that "offshore support" and AUV operations are also suitable work (as is pipe and cable-lay inspection). In summer 2014, a 10-week AUV tender was won, but it was decided instead to follow the promise in a six-month seismic contract that came with options.

The Broker

The break from purse seining in order to do Statoil subsea work in September suggests Ervik & Saevik see the oil company as vital for their future. "The mackerel season can't be interrupted," says Saevik, so it was cut short, instead, for that 180-day contract and its options.

The cranes, space and crew are clearly adept at removing and adding equipment to match the job and season. Yet, while ROV and AUV crews have a willing, able and compliant charter vessel in the Christina E (she's won an environmental award for her NOx), Saevik clearly sees the need to grow. The Christina E., it turns out, has "one competitor in southern Norway."

"We dared to go offshore," but then "The learning curve was through the roof," Saevik says. It was fitting acknowledgment of Statoil's rigorous supply chain qualification program. Meanwhile, Ervik and ABB's reworking of the vessel to make the most of her DP 1 and CAT engines; her bottom-scanning sonar and winches has created a multipurpose vessel, or MPV, and capable OSV for cost-conscious project managers.

"I want more vessels," Saevik says. Yet, like the other OSV owners all she can do is "tell the brokers she'll be free (for offshore assignments) soon."

All charters go through them.

Sanco looks to GoM

Pulling a single streamer, long-line style, might soon be the work of many, judging by the dire seismic market sized up by Sanco chief operating officer, Rudy Amundsen.

A market economist, now, and a former Ramform captain, Amundsen remembers Sanco entered the seismic market on a fishing vessel converted to refuel OSVs and carry their equipment and parts. Today, like the original Sanko Chaser,

(Photo: William Stoichevski)

Survey Savvy: Sanco COO Rudy Amundsen.

the ice-class tanker Sanko Sky chases vessels that pull long nine-kilometer, 15-cable streamers. All seven Sanco vessels are built here in Sunnmore, including the 4D-capable Sanco Star (now with OceanGeo) and the Sanco Swift and Sanco Sword with Dolphin Geophysical offshore Australia.

Sanco is fresh from the record-setting 125--sq.-km. shoot offshore Myanmar for Shell Myanmar, where the Sanco Sword spread its 12 streamers to a "record" (per-kilometer) day rate and spread of 12 sq. km.

Now, with a 50 percent cut in seismic budgets being felt the world over, Sanco is looking to the past fisherman's strategy of retooling. At Las Palmas in the Canary Islands — a base being revitalized by others, including Rolls-Royce — Sanco is fitting seabed seismic equipment but faces delays ahead of a planned shoot in January 2016 with Houston-based OceanGeo.

The Bad News

Exacerbating today's dearth of surveys, there's a persistent oversupply of vessels and fierce competition for the few going tenders. About 40 high-end, 3D seismic vessels will be out of work by year-end 2016, says Amundsen.

"The good-times contracts are expiring, and within the year for most," he warns. In that time, there'll be two massive PGS vessels delivered from Japan. "It's just not a good market now," and not helped, he says, by elections in formerly active Nigeria, where contract delays are now the norm, or sanctions that have hurt Russian exploration. Worse, a project of WesternGeco's is understsood to have sailed from new-build quay to cold-stack. Polarcus, once a market darling, runs its own vessels but owes nearly USD800 million, although new September geophysics sales ought to help.

The Good News

Dolphin, now equipping its new-builds, plies Russia's Kara Sea with Sanco, although U.S. companies are still active there, so sanctions have yet to fully disrupt global marine deal-making. The good news comes from Sanco client PGS and the chance several of its vessels will soon find employment off Newfoundland, Canada — toward which the Sanco Spirit was last known to be steaming — and on the Mexican side of the Gulf of Mexico. The final stages of pre-funding for multi-client promises an opportunity to sell results for a company with three cold-stacked Ramform survey vessels. "Fifty-percent prefunding is good enough for most," says Amundsen on when a multi-client survey operations begin to look profitable.

In a note to shareholders PGS says things ought to start looking better for seismic in 2016.

DOF, Statoil ID ROV Value

As DOF Subsea — with its 71 OSVs and 11 ROV types — announces $350 million in Canadian, Australasian and Gulf of Mexico contracts for inspection, maintenance and repair, or IMR, it's clear, here, that the mini submersibles from rival Bergen were key.

The IMR work is unavoidable for oil companies, and the

The good news comes from Sanco client PGS and the chance several of its vessels will soon find employment off Newfoundland, Canada — toward which the Sanco Spirit was last known to be steaming — and on the Mexican side of the Gulf of Mexico.

DOF awards show the value of having several ROV and AUV types in your purpose-built fleet of subsea construction vessels. ROVs can keep you competitive when times are tough. Further up the littoral, in quietly busy Ulsteinvik, people remember when the ROVs of Island Offshore earned work inspecting moorings for a billion-kroner newbuild still waiting for its first major Statoil offshore construction mission.

Unlike DOF's success, the news here is modest at best — two more laid up vessels, this time for Havyard, but Statoil has just signed a deal with the simulator centers at Aalesund and Faasnavaag to train all future subsea crane operators and ROV pilots in integrated, "augmented" subsea operations. The simulator award may seem like mere necessity, but it belies another hidden market for ROVs: supporting subsea lifts and inadvertently jacking up the quality of subsea simulation training by feeding mission experience to designers of the SIM projector technology.

U.K. expat Joel Mills, the Aalesund-based technological design director behind the simulators of Faasnavaag Academy and the Centre of Excellence in Aalesund, says that both the electronic tags on the subsea equipment being installed and the new equipment aboard today's ROVs "feed each" in a spatial, information loop.

The Aalesund facility's dome crane simulator will train all involved in an entire subsea operation, while Faasnavaag will do individual training, including ROV SIM training from Q4 2015. It's understood that half of all NOV and all TTS cranes have been SIM'ed for training. Now training for complex operations with low-speed ROVs will be possible to augment the survey work of faster ROVs.

Aasgard Catalyst

It was Statoil's training gear-up for the launch to the sea bottom of a giant gas compression manifold for the Aasgard oilfield that started the "augmented subsea" training here. Two WROVs have been in the SIM for over a year, but putting cranes and ROVs together in the SIM is new.

"In subsea crane lift you need a subsea view, and this is a fed view from an ROV," says Mills.

He says about 85 percent of offshore accidents are down to humans, so "this type of training presents a savings in risk".

ROV views have helped with the giant screen SIMs of "virtual prototyping" (a la Aker Solutions), but they're still new to integrated operations training, even for Statoil. "The survey screen (looped from or to an ROV) is no longer 2D," explains Mills, adding, "When you turn on your (navigating) screen you're able to get a full 3D view. It's like turning the lights on underwater."

In the augmented subsea SIM reality, all the information gathered by ROVs is put back into the SIM for third-person viewing or for the crane operator to see directly into a structure for added visual security or just an excellent image of the seabed.

Via transponders on the ROVs, mission info is run through the real SIM "so there isn't just a SIM scenario". ROV tech increasingly also allows feedback for better future ROV designs.

"They're more instinctive than a crane and better with regard to humans in the (info) loop. Joysticks point the ROV to where you want to go," says Mills

Mills, meanwhile, is just back from demoing a SIM of divers integrated with ROVs and cranes. "It's still in the demo stage," he says.

Oceans 2015

The MTS/IEEE Oceans '15 conference and exhibition is set to take place October 19-22, 2015 in Washington, D.C.

Sponsored by the Marine Technology Society and the IEEE Oceanic Engineering Society, the annual event focuses on advances in marine technology, science, education and policy, drawing on an international audience of more than 2,000 attendees; up to 200 exhibitors showcasing the latest innovations in products and services; more than 500 professionally reviewed technical papers; plenary sessions with leaders from industry, academia, the military and government; tutorials, workshops, demonstrations, government listening sessions, social/networking opportunities, professional field trips and more. This year's theme, "Sea Change: Dive into Opportunity," aims to shine a light on some of the most critical issues the world faces today and how our community can help society develop solutions to address their impacts and benefit from new opportunities. Following is the exhibitor list at press time, with highlights on select companies.

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www.alseamar-alcen.com

AML Oceanographic
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www.amloceanographic.com

Aquabotix
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ASL Environmental Sciences, Inc.
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BIRNS, Inc.

Booth 602, 604

Founded in 1954, BIRNS, Inc. is an ISO 9001:2008 certified global leader in the design and manufacturing of high performance lighting and connector systems for deep ocean, marine, military and nuclear power applications.
www.birns.com

Canal Geomatics
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CARIS USA

Booth 533

Established in 1979, CARIS designs and build software solutions to meet the geospatial requirements of a broad base of clients operating in the marine, land and aviation sectors. CARIS products are continually selected by hydrographic offices, military agencies, survey contractors, ports and harbors, municipalities, land administrators and academia among others.
www.caris.us

Cathx Ocean
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www.cathxocean.com

CeramTec GmbH
Booth 435
www.ceramtec.com

Channel Technology Group
Booth 240
www.channeltech.com

CLS America, Inc.
Booth 205
www.clsamerica.com

Compusult Limited
Booth 535
www.compusult.net

Deep Ocean Engineering

Booth 622, 624

Starting as a small engineering company in 1982, Deep Ocean Engineering builds, designs and manufactures ROVs, with more than 600 sophisticated ROV systems currently in use worldwide. Based in San Jose, Calif., the company's ROV and USV services include sales, repair, maintenance, production, instruction and installation.
www.deepocean.com

Consortium for Ocean Leadership
Booth 339
www.oceanleadership.org

DeepSea Power & Light
Booth 508
www.deepsea.com

EA Engineering, Science, and Technology, Inc.,
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www.eaest.com

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www.energy-sales.com

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linkoe.org

Focal, a Moog Inc. Company
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www.moog.com/markets/marine/

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www.f-e-t.com

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www.geodynamicsgroup.com

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Kongsberg Underwater Technology

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Kongsberg Underwater Technology, a U.S. subsidiary of the Norway-based Kongsberg Group, specializes in sales and support of underwater products and equipment, including AUVs, camera systems, echo sounders, sonar systems, hydrographic systems underwater security equipment, subsea navigation and more.
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Knudsen Engineering Limited
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Kraken Sonar Systems

Booth 527

Kraken Sonar Inc. is a marine technology company engaged in the design, development and marketing of sonar and acoustic velocity sensors for Unmanned Underwater Vehicles used in military and commercial applications. Kraken ranks among the leading innovators of Synthetic Aperture Sonar (SAS) – an underwater imaging technology that improves seabed surveys by providing ultra-high resolution imagery at superior coverage rates.
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Metocean Data Systems
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www.metocean.com

National Oceanographic Partnership Program (NOPP)
Booth 408
www.nopp.org

Nautilus Marine Service
Booth 601
www.nautilus-gmbh.com

Naval Research Laboratory
Booth 400, 402, 404, 406
www.nrl.navy.mil

Naval Undersea Warfare Center
Booth 504
www.navsea.navy.mil/nuwc/newport/pages/techpartner.aspx

NOAA
Booth 505, 507
www.noaa.gov

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www.nortekusa.com

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www.oceanaero.us

Ocean Business
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Ocean Networks Canada
Booth 733
www.oceannetworks.ca

Ocean Sonics Ltd.

Booth 526

Ocean Sonics is an ocean technology company that designs and manufacturers digital hydrophones, a product that measures ocean sounds and helps provide greater insight into those sounds, introducing a better way to listen in the ocean. Its icListen Smart Hydrophones are used by scientists, environmental assessment specialists, engineers and field operations personnel.
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Oceanology International - Reed Exhibitions
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OceanServer Technology

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OceanServer provides OEMs with power solutions, sensors and robotics for a variety of applications. OceanServer's products are designed to be cost effective and easy to integrate into customer equipment. Fully engineered and well-documented subsystems can reduce time-to-market and enable new solutions for real-world application challenges.
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www.rosys.com

Rowe Technologies

Booth 234, 236

Rowe Technologies designs, develops and manufactures acoustic Doppler current profilers for applications in oceans, lakes and rivers. Its products blend the most established and modern acoustic Doppler sonar technologies into a broad and versatile product line of high performance sonars, for current profile and vehicle bottom velocity measurements.
www.rowetechinc.com

Saab Seaeye

Booth 429

Saab Seaeye manufactures electric powered Remotely Operated Vehicle (ROV) systems for a wide range of professional applications. Its range now includes Saab's underwater vehicle range of tethered, autonomous and hybrid underwater vehicle systems for the defense industry. The range extends from the portable Seaeye Falcon to the revolutionary electric work class Seaeye Jaguar.
www.seaeye.com

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www.teledynemis.com

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Booth 321B

The Teledyne Marine Systems group includes Teledyne Benthos, Teledyne Gavia, Teledyne SeaBotix and Teledyne Webb Research. The oceanographic equipment it designs and develops allows researchers, commercial companies and the military to gain valuable information from the world's oceans. Its product lines draw upon shared leadership in engineering and manufacturing and a coordinated sales team that connects modems to gliders and more.
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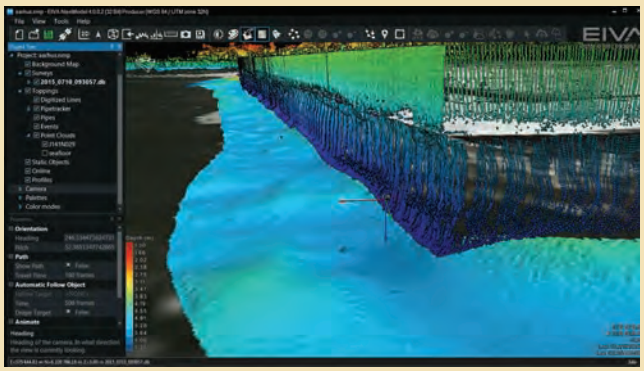

EIVA Software for Shallow Water Surveys

The EIVA NaviSuite software suite includes single-user sensor data acquisition and processing bundle for shallow water surveys, NaviSuite Kuda. The products include the new software solution NaviSuite Kuda, developed by the offshore survey and engineering specialist EIVA a/s and launched on September 10. NaviSuite Kuda is a single-user bundle dedicated to shallow water surveys. Its price matches the budget of small companies, while allowing them to benefit from the advanced features of the NaviSuite software solutions relevant to this type of operation by offering all the necessary tools to carry out time-efficient surveys that result in extensive end reports with high-quality data.

www.eiva.com

Compact Guide Wire Cutting Tool for ROVs

Allspeeds launched Webtool ROV cutting tools designed to cut steel guide wires used during subsea installation. Suitable for wire up to 30mm diameter, the WCO30 tools are a compact and reliable alternative. The heavy duty WCO30D and WCO30DLP (high pressure and low pressure versions) wire cutters are suitable for steel wire ropes up to Ø30mm (1.181 in.) with a maximum tensile strength of 1960N/mm and high grade wire up to Ø28mm (1.102 in.) with tensile strength 2160n/mm. With its corrosion resistant stainless steel body with Nitrotec coated alloy steel cylinder, the hydraulically operated WCO30 tool is designed for use in severe working conditions. The WCO30 cutting tool can be used at any water depth, with pressure compensation on the hydraulic supply. Weighing 13kg in water, the high pressure WCO30D uses 700bar maximum input pressure.

www.allspeeds.co.uk

Brazilian Order for Tritech's Gemini

Tritech International Ltd. sold its multibeam sonar Gemini, to remotely operated vehicle (ROV) providers Sistac Sistemas de Acesso S.A. Sistac initially hired a deep-rate Gemini to evaluate its performance during sea trials and after the company observed its capabilities, subsequently purchased the sonar. The Gemini 720id multibeam sonar is now the primary sonar onboard Sistac's Soil Machine Dynamics (SMD) Atom work-class remotely operated vehicle (WROV). Tritech's Gemini multibeam imaging range offers users a real-time, 120 degree field of view and operates at 720 kHz with a range of up to 120m, making it ideal for obstacle avoidance and target detection.

www.tritech.co.uk

(Image courtesy of SISTAC)

Teledyne RD Instruments Updates ADCPs

Teledyne RD Instruments announced two updates to its Sentinel V ADCP. The enhancements include a complete update to the firmware and the user software interface program, ReadyV, and an update to the post-processing Velocity software package. These two releases provide for added flexibility in the setup of the instrument, including two completely independent ping profiles, an improved web interface and new post-processing software package for its Sentinel V and Workhorse acoustic Doppler current profilers (ADCP). The firmware upgrades allow users to now use any web browser on their computer, laptop, tablet or phone. The software upgrades include a fully integrated version of waves processing from the company's WavesMon software program.

www.rdinstruments.com

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55	Subsalve USA Corporation	www.subsalve.com	(401) 884-8801
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