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June 2016

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# Toxic Mud

Coding the Oceans

## Fishackathon

Interview: Hege Skryseth

## Kongsberg Blazes a Digital Trail

Intelligent Flood Defense

## Saving Venice

Volume 59 – Number 5

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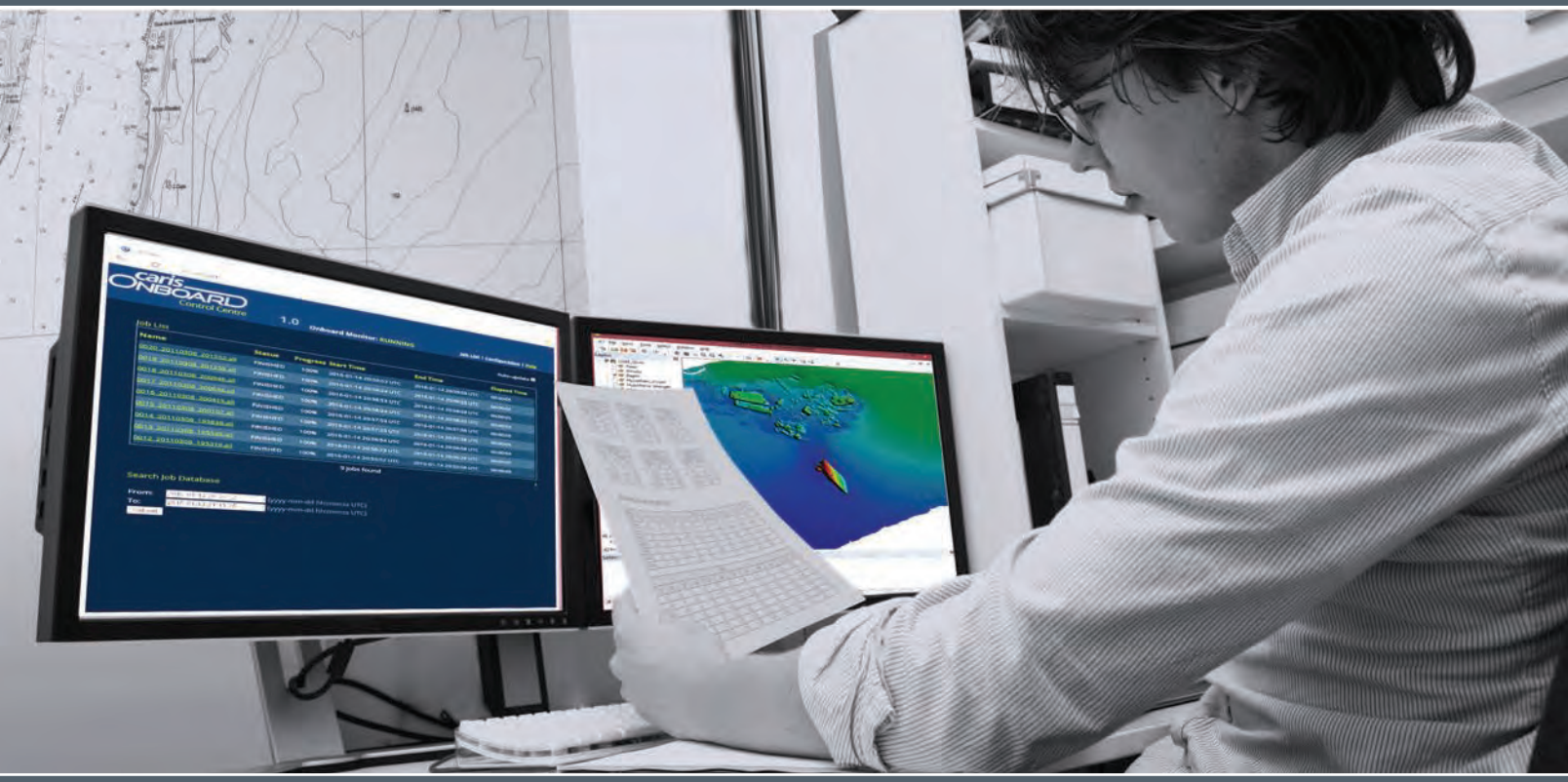

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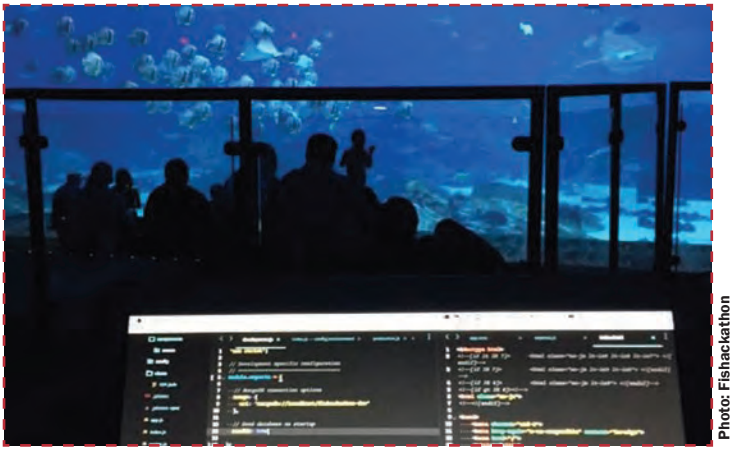


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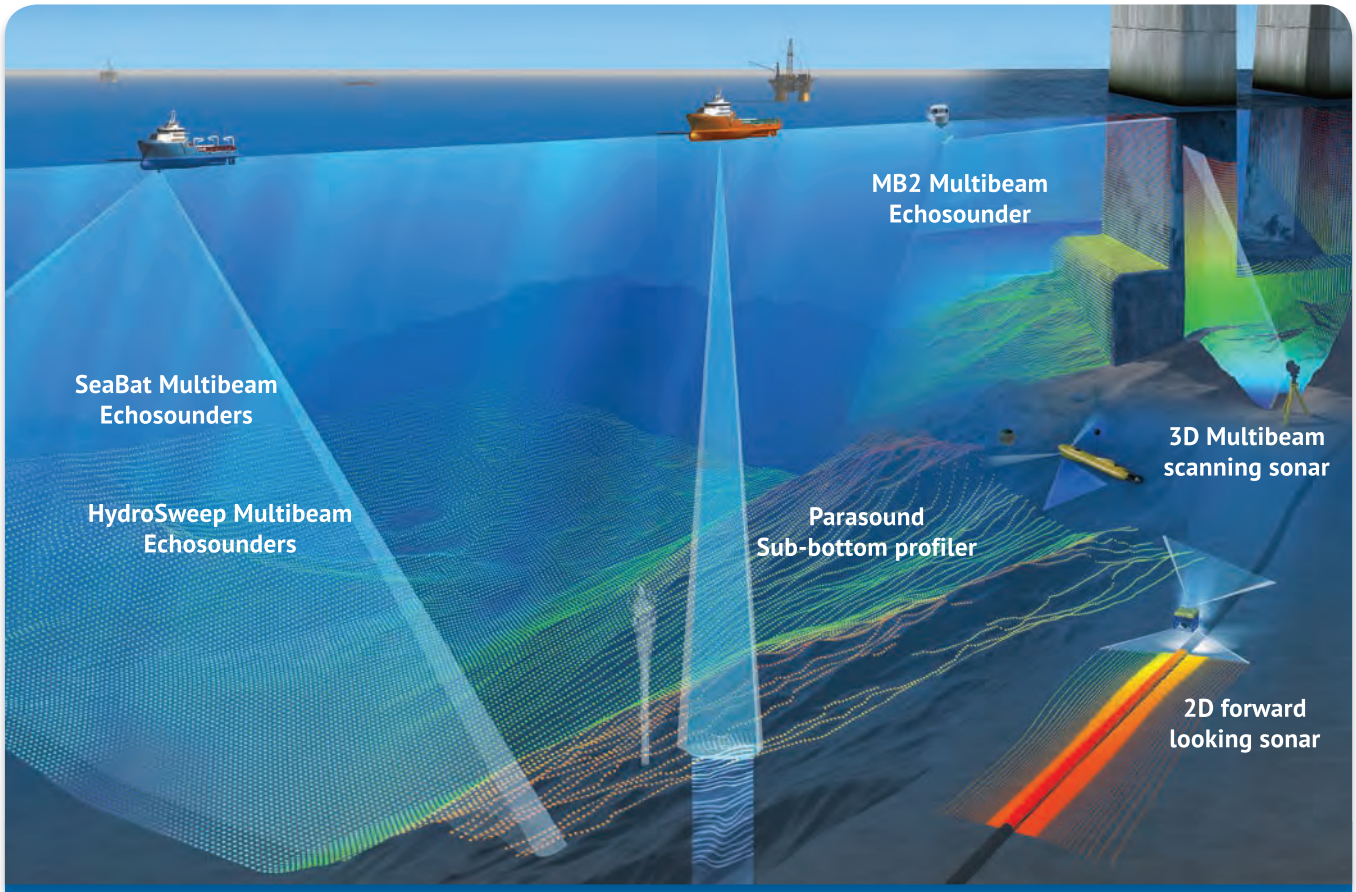


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118 E. 25th St., New York, NY 10010
*Tel: (212) 477-6700; Fax: (212) 254-6271*

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



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

Nearing the mid-point of any year I try to reflect on the course of the current year, and without a doubt 2016 is being shaped like no other by the price of oil. Though pricing has rebounded from the mid-$20s abyss of early 2016, at press time hovering in the $50 per barrel range, there is little doubt the indelible mark this pricing stumble has left on the subsea industry. While the crash has posed serious challenges, there are always opportunities to be had, as we found in our discussion with Hege Skryseth, President of the new Kongsberg Digital and also Kongsberg's Chief Digital Officer. Skryseth is a software industry veteran, and after 30 months at the helm of Kongsberg's digital empire, she sees ample opportunity across the maritime and offshore sectors. While "Big Data" is the buzzword, "Smart Data" is the practical use, and our interview with Skryseth focuses on how companies large and small can cut costs dramatically by effectively using information that they likely already possess.

Our U.K.-based contributor Kira Coley never fails to deliver interesting copy, and she fulfilled that task in this edition times two. *"Fishackathon: Coding the Oceans"* starts on page 14 and documents how the U.S. Department of State is tapping a pool of brilliant young minds of coders to help solve some of the world's most pressing ocean problems. Her encore starts on page 30, this feature providing unique insight into the engineering effort to save the city of Venice with Intelligent Flood Defense.

Finally, I would be remiss to not mention the cover story from Claudio Paschoa in Brazil. The cover picture, in my mind, says it all, as Brazil's brand new hydrographic research vessel Vital de Oliveira was called into immediate duty to study the after effects of one of the greatest environmental disasters in Brazil's history. His story on the destruction of the Doce River starts on page 20.



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Photo: ROS

## The Authors

**Kira Coley**

Kira Coley is a freelance science writer and regular contributor to MTR. She is a lecturer in science communication and a PhD researcher.

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# Kongsberg Blazing a Digital Trail

*Earlier this year ubiquitous technology company Kongsberg launched Kongsberg Digital, a new subsidiary established to foster and grow an industrial software environment, starting out with about 500 employees. We met with Hege Skryseth, the company's President and also the Chief Digital Officer of Kongsberg, for her insights on size, shape and direction of the new entity.*

**By Greg Trauthwein**

"You see some opportunities here," is how Hege Skryseth neatly summarizes the potential for the digital revolution to make maritime and offshore operations more efficient. Skryseth, who previously ran Microsoft's business in Norway, is a software industry veteran, with Kongsberg for about 2.5 years. She is determined to help lead the tide of change in this pair of conservative industries, working non-stop to outfit new ships and rigs with the latest software solutions to assist in ensuring cost efficient and safe operations.

While ambitious to get the new company up and running, Skryseth is a realist regarding current market conditions pervasive in many maritime and offshore oil and gas sectors. Not deterred, long-term (and in fact, short term) she believes companies – with the new generation of internet natives joining the workforce and the real need to cut costs now – are becoming more amenable to leveraging the data at hand.

"We currently see the market conditions impacting the oil and gas and maritime markets, and with that we see a willingness to change, and an openness to new systems," said Skryseth. "But most companies are just at the beginning of realizing exactly what digitalization can really do for their operations. So many of the discussions center on 'how can we join forces to see

*"Most companies are just at the beginning of realizing exactly what digitalization can really do for their operations. So many of the discussions center on 'how can we join forces to see what can be done' … and I think that is a good place to start."*

**Hege Skryseth**

**President Kongsberg Digital and Chief Digital Officer at Kongsberg**

what can be done' … and I think that is a good place to start."

### *Meet Kongsberg Digital*

Kongsberg Digital was established as a subsidiary of Kongsberg, a new company formed to assess and capture the world of opportunities that are available to the maritime and offshore industries as the digitalization of industrial processes starts in earnest. In announcing the new company, Walter Qvam, CEO of Kongsberg said: "Technologies such as Internet of Things, Big Data, automation and robotics will lead to significant changes for the industry as well as for the public sector. Kongsberg is already a digital group with world-leading products within sensor technology, electronics, software development and big data processing. Through the launch of Kongsberg Digital we take an important step in the group's strategy for developing the next generation of digitalized products and

*"We collect a lot of data, and it is our job to ensure that we are building the right services and applications to leverage this data"*

## Olivier Cadet

**Vice President – Information Management System, Kongsberg Maritime**

services."

With its breadth of product, service and geographic distribution, Kongsberg is many things to many people. But at its heart is software. "Kongsberg is recognized as a high tech company, and it is a significant software company," said Skryseth. "About 70% of what we do is software" across multiple markets, including maritime, oil and gas, energy, renewable energy, defense and space.

Kongsberg Digital will consist of about 500 employees from existing software and simulation environments within Kongsberg Oil & Gas Technologies and Kongsberg Maritime, and from the start it will have a significant portfolio and revenues from advanced data, software and simulation products. In addition Kongsberg Digital will have a group responsibility for developing new digital solutions and related technology alliances.

In further explaining the rationale to create the separate company, Skryseth said digitalization is one of the key focus areas in industry today, and it is changing the way we work: it's tearing down walls, changing business models … and it's happening rapidly. "We needed an organization solely focused on this."

### *The World: Digital & Connected*

"Within four years there are going to be 200 billion devices connected to the internet, and the ability to get them to talk to each other, to create value, and to create machine-to-machine communication is going to be one of our focus areas," said Skryseth. The data revolution has evoked a number of catchy names, from "Big Data" to "The In-

ternet of Things." But Skryseth and Olivier Cadet, Vice President – Information Management System, Kongsberg Maritime, contend that the key issue is less about the amount of data, and more about the proliferation of "Smart" data, meaning the ability to take vast quantities of information and put it to good use in your daily business operation.

Make no mistake, Kongsberg has its collective fingers on the pulse of vast quantities of data in this market, with more than 17,000 vessels and 10,000 oil wells today outfitted with Kongsberg equipment and software solutions onboard.

"We collect a lot of data, and it is our job to ensure that we are building the right services and applications to leverage this data," said Cadet, "bringing digitalization to the maritime and the O&G industries."

But in a way, the evolution of Kongsberg Digital transcends data, and truly is in step with the industry's move toward looking at vessels and rigs at sea more holistically, in the view of its role in the transport and energy production chain.

"The boundaries of the industry are drastically changing," said Cadet. He explained that a company such as Kongsberg used to be a provider of a single product delivered to fulfill one function. But that is changing rapidly. "That product is now becoming 'smart' with layers of functionality." For example, if you have a pipe laying vessel with a Kongberg DP system, you can have a pipe laying function; you can have a smart and connected next-gen DP system with the ability to remote in from shore. The next step really is the move toward real integrated operations, where the DP system is not simply helping its vessel keep position, but is interacting with the OSV next to it, with the ROV in the water, with the weather impacting your vessel … and the list goes on.

### *A Fast Start*

The creation of Kongsberg Digital, which officially will 'go live' in July 2016, comes in tandem with an overhaul of the corporate parent, no small feat. "We are working on the digital strategy for all of Kongsberg, while simultaneously setting up the new Kongsberg Digital," said Skryseth. As might be expected from a global electronics and software power like Kongsberg, the goals are not modest. "First and most important is to be *the* performance and efficiency partner for our customers," said Skryseth. Work ongoing is focused on bringing together the collective com-


petencies of the vast Kongsberg reach, with one eye on the present, the other scanning for future trends and competencies.

"We're all about turning data into tangible, valuable actionable information that our customers can use," said Cadet. To start the Kongsberg Digital team sees three major areas of concern, or as they term them 'Value Creation Levers,' including:

- ***Condition Based Maintenance***
- ***Performance Management (ie. fuel efficiency), and***
- ***Decision Support***

"I think there is currently a good combination between technology push and market pull," said Cadet. "The tech is at a stage where it is ready in terms of communication, data storage and data handling and analytic technique … that is the technology push. The market pull is the ever evolving needs of our customers to improve their operations. While the maritime industry is traditional, don't underestimate the younger generation entering the workforce have grown with these technologies."

As in all industries there are always pioneers, market leaders which are long-term player, not averse to invest in promising newstechnologies first. Kongsberg, with its global footprint and Norwegian pedigree which seemingly has maritime technology cooperation woven into its DNA, predictably has found willing partners in its new endeavor. "We are working now with early adopters and innovators," said Cadet. Two he could mention include:

- ***BV Gas in the LNG sector.*** ***Cadet said BV Gas is looking to reduce fuel consumption across its fleet of LNG carriers, and the company understands that leveraging technology, leveraging data and the analytics on top can help to make the correct decisions. "They have been a true innovator.***
- ***Floatel:*** ***Floatel is focused on condition monitoring, particularly on the position of the gangway, as maintaining an open and accessible gangway is central to its business proposition. Data is used to transfer information and analysis to their customers, clearly showing the percentage of time that the gangway is open.***

# Fishackathon

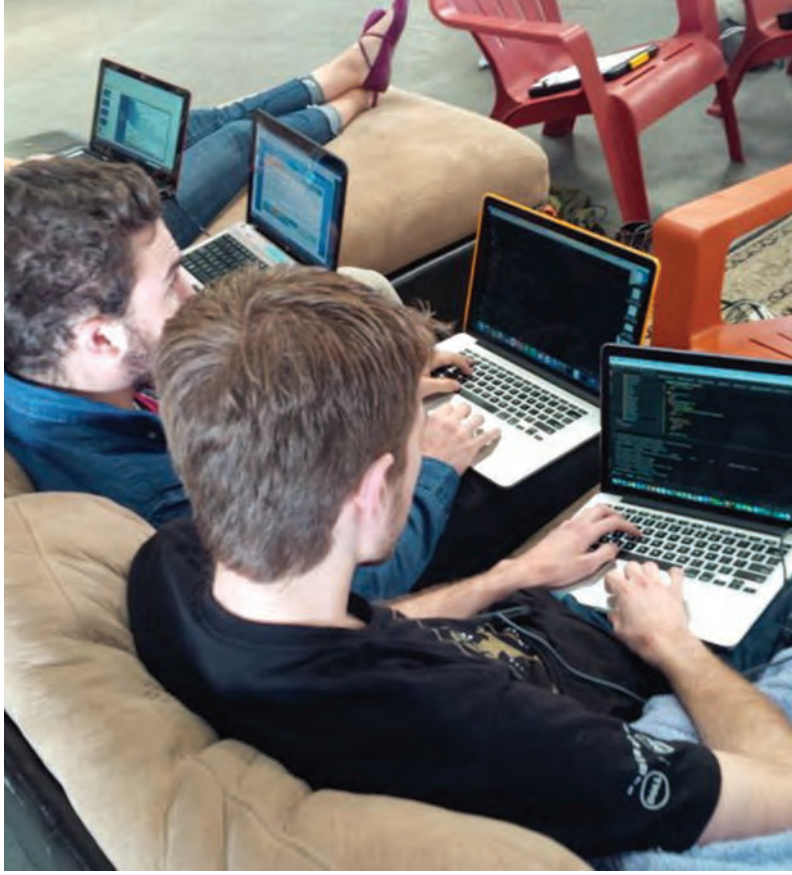
## Coding The Oceans

By Kira Coley

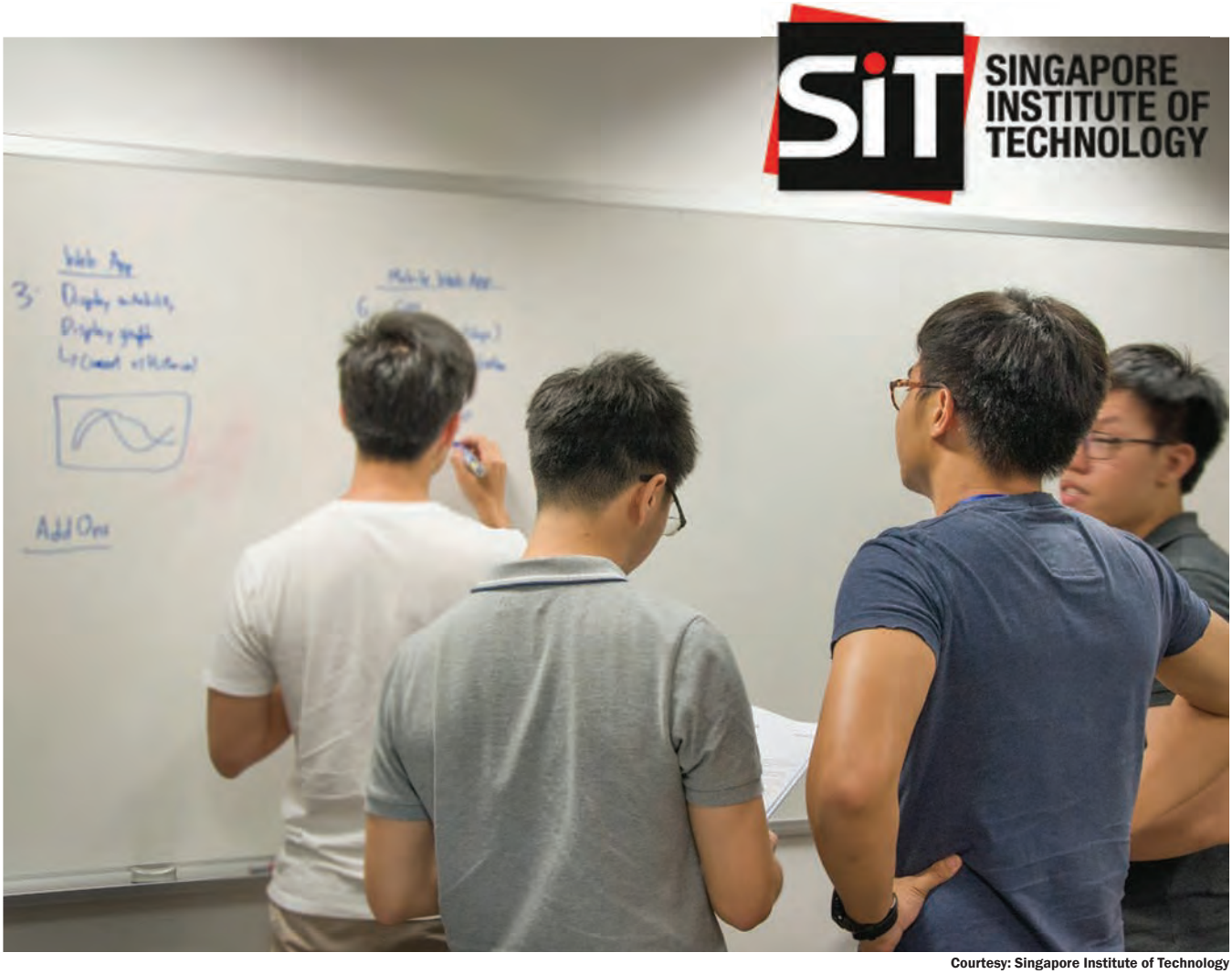
In 2014 the Food and Agriculture Organization (FOA) of the United Nations published a report documenting the state of world fisheries and aquaculture: around 90% of marine fish stocks are either fully or over exploited. Throughout supermarkets worldwide, mislabeled and laundered illegal catches make their way onto shelves and into the homes of consumers. As unsustainable fishing practices sweep through the world's oceans, unlikely collaborations bring modern technology and fresh insights to long-standing global concerns.

Launched by the U.S Department of State, Fishackathon aims to connect coders, programmers and software designers with fisheries experts, data analysts and environmentalists. And, in a space of 48 hours, compete to develop innovative and novel solutions for the collection of key fisheries data to combat ghost gear, fish fraud, seafood traceability and illegal fishing across the world.

Since its launch in 2014, Fishackathon has quickly expanded from five cities to an international event hosted by over 40 locations across six continents. As an output of Secretary John Kerry's 'Our Ocean' conference, the annual event assembles the next generation of coders to create tools which help tackle



**Both images courtesy: Fishackathon**




Courtesy: Singapore Institute of Technology

the overfishing crisis, presented in the form of apps for smart phone devices.

"Secretary Kerry is passionate about climate change and the ocean, and therefore wanted to bring people together to talk about core problems. As part of his office, we wanted to do something innovative for the ocean and to bring in outside ideas and crowd source innovative aspects which hasn't been thought of previously: so we decided to run a hackathon," said Jim Thompson, Director of Innovation at the U.S. Department of State. "Not only is it a great cause but people also find the idea of doing something tangible, where they can actually have an impact, exciting and worthy of their time. We are bringing in younger people, Millennials and the Alpha generation, to think about doing something with their skills in coding that they maybe haven't thought of before."

Each year at the 'Our Ocean' conference, organizers issue a call for problem statements to hundreds of scientists and industry professionals. A panel of ocean experts and technologies come together to review the suggestions and select a number of codable options to put forward for the annual hackathon. When choosing what issues to address, the panel looks for original concerns that had the greatest potential of being developed, as well as the data availability that the coders could actually use to create the software. Over the last three years, organizers have seen a trend in concerns focusing around themes such as overfishing, illegal activities and prices in ports.

This April at Fishackathon 2016, the challenges coders were asked to address were around fish identification; lost fish gear; vessel data and compliance with marine applicable fishing laws; and regulations covering regions. Problem statements came from organizations such as MarViva Foundation, Fisheries and Oceans Canada, Billfish Foundation and the Global Ghost Gear Initiative.

"Trying to find solutions to ghost gear is fairly new concept for us. When a fishing net drops off of a boat, it can cause a giant environmental impact as the net sweeps across the seabed killing life along the way. If we had the information as to where

it was dropped, we could act quickly to minimize the effects," said Thompson. "So this year's coders will be working on questions such as how do we geotag or give the fisherman an opportunity to participate in sustainability by informing us quickly of the situation."

After the weekend-long event, teams of volunteer coders and technologists present their concepts in front of an expert panel of judges. A reward is given to the teams that most effectively develop usable solutions, which then advance to compete against the other winners chosen from each location. A global winner will be announced on World Oceans Day, June 8, 2016.

## #Codeforfish

The London teams, hosted by the Economist, chose to target cost effective approaches to fisheries data collection to enable fish stock assessment. Examples include the development of a smart phone app that captures data on fishing practices and catch composition with the least amount of manual data entry. The winners of the London 2016 Fishackathon, Fishazam, designed a smart phone app which tackles fish fraud by scanning fish fillets for light signatures, not visible to humans.

According to Oceana, one out of three fish are mislabeled and fish fraud is increasingly being found to be endemic in the seafood supply chain. The Fishazam team based their idea on a recent study that investigated the possibility of using infrared spectroscopy as a tool for the identification of valuable species (e.g. red mullet and plaice) that have been substituted with cheaper ones (e.g. Atlantic mullet and flounder).

The study suggests that different species of fish emit unique levels of infrared light, allowing fish to be distinguished almost instantaneously. With funding, the team hopes to increase the reliability of software by using professional spectrometers as, thanks to quantum dot technology, these tools become smaller and more portable.

## Apps for the Industry

A number of apps for smart phone and tablets are already being developed, in conjunction with and as an outcome of Fishackathon activities, which have enabled fisherman to report illegal practices.

"[Because of these new smartphone apps] fisherman are able to tell us when there is a giant trawler out there taking the fish when they shouldn't be. We find fisherman open to these opportunities as it impacts their economy and their

ability to make a living," said Thompson. "I think the fishing industry will accept and welcome these sorts of apps. We also found that these days' data is widely shared and people get excited when their data is being used. So, when it comes to the sharing of data we've had no problems. The biggest issues we might encounter are if fishing vessels are turning off the GPS locators so they aren't found where they shouldn't be – this will be a difficult issue to address at future events."

mFish is another initiative launched in partnership from the U.S Department of State using mobile services to provide real time information that allows communication between fishermen, managers, the seafood industry and families while out at sea. The program also focuses on developing mobile apps for fisherman, enabling them to report illegal fishing and to get notifications of other apps that are being developed through Fishackathon.

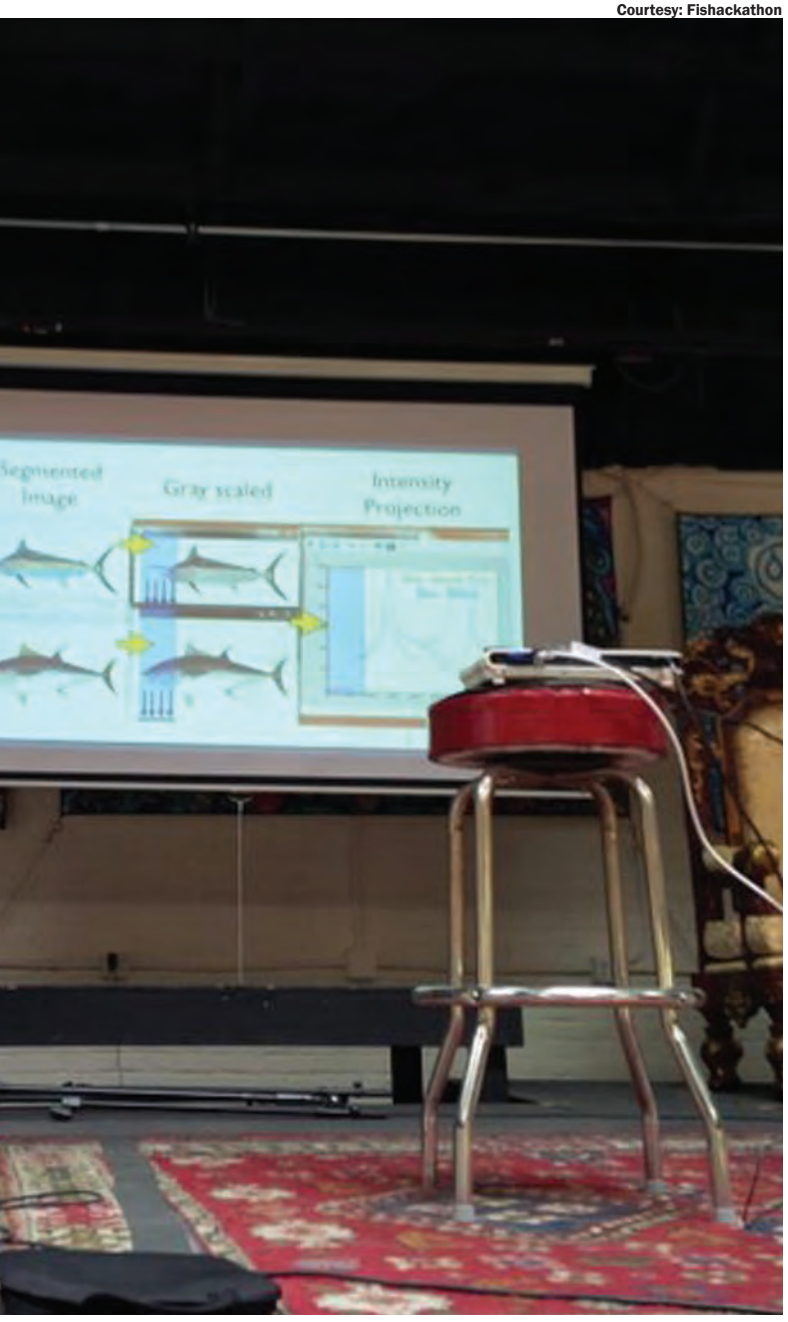
An example of one such software developed from Fishackathon last year was KnowFish – know what you're catching. The app lets the user take a picture of the fish using a mobile phone, checks the image against the database and helps to identify the species. Other examples include software which measures the size of the fish caught and identifies if the individual is undersized.

Fishackathon has an interesting series of partners on board including IBM with a focus on the data aspects and the Economist, London. Virgin is also a partner of Fishackathon 2016 and donated a $10,000 global award to be presented to the winning team.

The growing recognition to the importance of actively rebuilding overfished stocks are encouraging the formation of non-traditional collaborations. Innovation is key to finding modern solutions to addressing these global concerns. With the ever-strengthening prioritization of international governments and the industries willingness to better manage ocean resources, long-term sustainability is an increasingly realistic future.

"The mobile app development is important but equally important is informing the public that oceans are in trouble and

Courtesy: Fishackathon




individuals can make a difference. Events such as Fishackathon is a newer way to bring in the powers of the crowds. Nowadays, with tools such as social media, internet and hackathons, it's a lot easier to reach audiences." Said Thompson, "But for us, it's all about collaboration, within and outside the industries, in order to solve global issues. We are in our third year of Fishackathon and the continuation of our efforts depends on the priorities of our future governments. Therefore, we are always looking for partners to help facilitate this event going forward and help us continue driving positive change throughout the marine sectors."

# Monitoring Brazil's Greatest Environmental Disaster

Brazilian Navy

By Claudio Paschoa

Only four months after the Brazilian Navy launched its newest and most advanced hydrographic research vessel, Vital de Oliveira (H39), in July 2015, arguably the greatest environmental disaster in Brazilian history struck. On November 5, 2015, a huge mining refuse and ore tailings storage dam, known as "Fundão," burst in the state of Minas Gerais. Situated in a mountainous region hundreds of kilometers inshore, this released an estimated 55 million cubic meters of toxic mud, which caused a massive flood wave of toxic slush and mud, destroying villages in its path and killing at least 19 people on its destructive path downriver to the mouth of the Doce River (Sweet River) in the state of Espírito Santo.

The mud covered pastures, plantations and patches of forest, along with cattle and wildlife, while turning the river water yellowish orange and killing nearly all forms of fauna and flora in the river, contaminating the riverbed and adjacent areas along with a considerable length of coastline and coastal waters. A task force from the Federal Prosecutors office (MPF) has charged Samarco mining company, along with its owners, mining giants Vale do Rio Doce and BHP Billiton, demanding R$155 billion ($44.28b) in reparation for the damages caused by the Fundão dam collapse.

Weeks after the disaster, H39 was sent to the river mouth to sample and analyze the contaminated water, which was so dense offshore that the H39 was forced to motor just beyond the limit of the mud in order to preserve its engines, using zodiacs and an ROV in order to sample within the mud plume. According to Vice-Admiral Antonio Reginaldo Pontes Lima Junior, the Brazilian Navy's Director of Hydrography and Navigation, "It is worth highlighting that the Brazilian Navy took a very important step in hydrography and oceanography in 2015, incorporating the Hydro-oceanographic research ship Vital de Oliveira, whose name is a tribute to the patron of Brazilian hydrography. The new ship equipped with modern equipment and laboratories, will act in strategic areas, increasing the country's presence in the South Atlantic and Equatorial seas, contributing to the enhancement of Brazilian research at sea," he said when the Navy received the new ship. Up to the end of 2014, the Brazilian Directorate of Hydrography and Navigation (DHN) had six research ships over 1,000 tons and nine ships between 100 and 1,000 tons. Most of these vessels were built at a time when the ships were conceived for an exclusive purpose, either hydrography or oceanography and were normally used by only one institution, instead of being multipurpose and working with different universities and research institutes.

*Image above: Scientific Workstations aboard the H39*

## H39

First launched at sea at the Guangzhou Hangtong shipyard, in Xinjui, China in September 2014, the multipurpose vessel is now Brazil's most advanced hydrographic vessel. Northern Research Shipping of Norway, responsible for the ship's design and construction, officially delivered the vessel to the Brazilian Navy in Singapore on March 24, 2015. The acquisition of the R$162 million ($46.3m) H39 was made possible by a cooperation agreement between the Brazilian Navy, the Ministry of Science, Technology and Innovation (MCTI), Petrobras and mining giant Vale do Rio Doce. Petrobras made the largest investment with R$70 million ($20m), followed by Vale R$38 million ($10.85m), with the MCTI and the Brazilian Navy investing R$27 million ($7.71m). It is ironic to remember that Vale is also one of the owners, along with BHP Billiton of the Samarco mining company, responsible for the mining area where dam burst. The 4,200-ton H39 measures 78 x 20 m, with a maximum draft of 6.3 meters. Its maximum speed is 12 knots, and it can store 500 tons of fuel and 125 tons of water and stay offshore for 30 days. It is also DP2 capable and can accommodate a crew of 90 naval personnel and 40 researchers.

***The U39 is equipped with a variety of research equipment, including:***

- Kongsberg Maritime EM 122 (12Khz) - Multibeam echo sounder
- Kongsberg Maritime EM 710 (70-100Khz) Multibeam echosounder
- Kongsberg Maritime SBP 120/300 (2.5-7Khz) Sub bottom profiler
- Klein Associates AUV/UUV System 5000 V2 (455Khz) Multi-Beam Side Scan Sonar
- Sperre SUB-fighter 15K ROV, OBS Class ROV with TV-Grab-20 HP, 2000 meter depth
- Acoustic Doppler Current Profilers (ADCPs) – 75-100-300-600 and 1200Khz
- Kongsberg Maritime HiPAP 501 - High precision acoustic positioning (HPR)
- Piston Core, Box Core and Van-Veen Grab bottom samplers
- Vaisala WAMS-410 Weather Station
- Expendable Bathythermograph (XBT) probe
- ODIM Brooke Ocean MVP300 – Moving Vessel Profiler
- U-CTD and CTD/Rosette
- pCO2 analyzer

## Hydrographic Research at the Doce River Mouth

The H39's sampling program was divided into two phases. During the first phase, from November 26-30, 2015, more than 390 samples of water and sediments in 21 oceanographic stations distributed over an area of 500 square km were collected. In total 350 liters of water and 65kg of sediments were collected. During the second phase, between December 1-5, 2015, researchers collected water and sediments in three new sectors, totaling 24 oceanographic stations. Altogether 80 samples were taken, totaling 80 liters of water and 100 kg of sediments. In February 2016, researchers from the Federal University of Espírito Santo (Ufes) reported the results of the first analysis of the environmental impacts from the dam collapse. The results showed a high concentration of metals in the water, an increase the number of nutrients and reduction the number of species of algae and micro-algae. The research group was formed on November 13, 2015, and, since then, 2,785 analysis were performed. The samples were collected


*Box Corer from OSIL-UK with sediments from the Doce River mouth on the H39*

UFES


*The H39 is the newest research vessel in Brazil*

Brazilian Navy

*Images of the Doce River Mouth before and after the toxic mud arrived*

G1 and Google Earth

along the coast, from the mouth of the Doce River to a depth of 30 meters. Water and sediment were sampled in order to analyze the presence of metals, turbidity, temperature, salinity and oxygen levels, among others.

The interdisciplinary research team was composed of more than 70 people. Among the data presented, The Ufes Department of Oceanography Professor, Alex Bastos, highlighted the high concentration of particulate matter in the sea. "We have never recorded such turbidity levels in seawater at more than 20 meters deep. Moreover we identify a very high percentage of colloid, about 2% of the sample. The colloid is a kind of very fine powder which is not deposited on the sea bottom and can be very harmful to the environment. It can be ingested or even serve as transport vehicle for a virus, for example," he said, also pointing out that the considerable increase in the amount of nutrients in the water was mainly composed of nitrates, ammoniacal nitrogen and silicon. "The first analysis of the sediments in the water showed high values for four metals: iron, chromium, manganese and aluminum. These values were also observed in the river. "We also had a very large increase of nutrients in both the river and the sea, which is a very big impact, because it can lead to an imbalance of the environment," said Bastos. There was a significant decline in the biodiversity of phytoplankton, which are the basis of the marine food chain. According to Bastos, Ufes studies before the arrival of the contaminated mud had identified around 50-70 marine species in the area. After the accident, there were only between 12 and 39 species recorded. Fishing is still suspended in the region with no prognosis of this suspention being lifted in the near future. Ufes is conducting continuous river and coastal monitoring of the affected regions with research teams on land and using small boats in shallow waters. "Ufes's results demonstrate the characteristics of the environmental impact. There was an acute impact when the mud arrived, and a tendency of decrease in the ensuing volume of the toxic plume in time. However there is much worry about the accumulation on the seabed and how the base of trophic chain will be affected," said Bastos.

*Contrast between ocean water and the toxic mud off the Doce River mouth.*

UFES

## Sampling Results at the Mouth of the Doce River

*Summary of results from sampling at the Doce River mouth and in shallow coastal waters in front of the river mouth. The main negative effects to the river and ocean environments are the high concentrations of particulate matter in suspension and the toxic potential of the metals found in waters.*

- **Particulate material in suspension inside the river mouth, on November 22 showed a concentration of 300mg/l on the surface and shallow coastal water concentrations on the surface of 200 mg/l reaching 8,700 mg/l on the seabed. All sampling stations showed high concentrations on the seabed, decreasing in concentration towards deeper waters.**

- **Nutrient concentrations were also determined along the river and sea sampling stations. In the river high concentrations of nitrate (50.69 µM), ammonia nitrogen (9.07µM) and silicon (175.47 µM) were observed. The analysis of ocean samples also points to high concentrations of nitrate (26.48µM), silicon (65.58µM) e ammonia nitrogen (2.32µM) near to the River mouth, and usually on the surface.**

- **Quality and quantity analysis of the phytoplankton showed high chlorophyll values near the river mouth, with the highest values at 5.3 µg/l, which are considered very high for coastal regions even when near estuaries.**

- **Although no results have been attained about the benthic community, the high rates of sedimentation and high concentration of metal on the seabed, have the potential to significantly impact these communities.**

- **Before the arrival of the toxic mud to the river mouth, between 50 and 70 phytoplankton species were present in samples. After the arrival of the mud, only between 12 and 39 species were present in the samples.**

- **Concentration of metals found at the Doce River mouth and in shallow ocean waters:**
  - *Aluminum: River-surface (10mg/l); Ocean-seabed (30mg/l)*
  - *Iron: River-surface (20 mg/l); Ocean-seabed (50mg/l)*
  - *Chrome: River-surface (5mg/l); Ocean-seabed (2mg/l)*
  - *Manganese: River-surface (5mg/l); Ocean-seabed (0.5mg/l)*

# Integrated Geospatial Hardware & Software Solutions

# Facilitate Gorgon Jetty Marine Construction Project

By Ron Bisio, Vice President, Trimble Geospatial

The soon-to-be-complete Gorgon Project is Australia's largest ever single-resource development. A local survey firm was responsible for surveying the Gorgon Jetty, an undertaking that demanded ambitious surveying techniques and a full toolbox of marine survey technology solutions.

The Gorgon Project is a natural gas project developing the Gorgon and Jansz-Io gas fields located between 81 to 137 miles off the northwest coast of Western Australia. The project includes a three-train, 15.6 million tons per annum liquefied natural gas (LNG) facility on nearby Barrow Island, and a domestic gas plant with the capacity to supply 300 terajoules of gas per day to Western Australia.

Subsea infrastructure will transport natural gas from the gas fields to the LNG plant on Barrow Island. From there, LNG destined for domestic use will be piped to the mainland; LNG for international markets will be offloaded from the Gorgon Jetty.

Western Australian firm CADS Survey was contracted to survey the 1.3-mile Gorgon Jetty, including structural, mechanical and hydrographic surveys. The company also developed and managed the necessary automated module guidance systems.

With 40 surveyors performing conventional, laser scanning, UAS, and hydrographic surveys, CADS Survey was well equipped to meet the tasks and challenges of the project. Simon Bush, co-owner of CADS Survey, was the Survey Manager of the Gorgon Jetty project.

## Blended Geospatial Technology

Marine construction presents unique challenges for surveyors due to variables such as tidal changes, erosion, shifting seabed foundations and weather, but the growth in sophistication and availability of blended geospatial technology that aligns cutting-edge data collection hardware with hydrographic software now provides streamlined solutions for complex marine construction projects.

Previously, construction projects of any scope required a number of tools for the surveying and modeling facets of the project. Today, however, several different hardware and software combinations are used – allowing surveyors to gather geospatial

data quickly and then turn that data into usable models. GNSS modular receivers now have the capability of monitoring tidal and other water level changes in real-time, providing a more precise and cost-effective solution than conventional methods, meaning, tide gauges and associated radio links are no longer essential. Additionally, GNSS receivers with more rugged designs have made them well suited for temporary and permanent installations in extreme environments. Improvements in marine GNSS hardware have also dovetailed with stronger, more efficient software that can be integrated across multiple platforms, allowing project crews to share data and create the necessary models based on the data collected. By connecting this software to receivers and other sources of sensor data (like an echosounder, for instance), project engineers can determine real-time position, heading and the precise elevation of the target surface.

The combination of marine geospatial hardware and software can be deployed in a wide range of applications, including the placement of marine structures like breakwaters, bridges, caissons, piles, piers and coastal defenses. For the Gorgon Project, a large component of the work depended on caisson placement, and the use of integrated geospatial solutions allowed the surveying team to easily gather data and improve its real-time decision making.

## Caisson Placement and Stabilizing

For the Gorgon Jetty, blended geospatial technology proved to be a decisive factor in the ultimate success of the project. Surveying work began with the placement of caissons on the sea floor, which were then filled with heavy gravel. Screed formed a level base for the caissons. During the screeding process, the GNSS modular receivers were attached to the crane hook, barge and screed frame to provide guidance. The crew used specialized hydrographic surveying software designed for marine construction to visualize the accurate positioning and leveling of screed frames. Dips and ridges in the seabed

detected by the survey vessel used by CADS Survey were post-processed and the results were reported back before the screed frame's positioning was signed off.

The survey vessel also helped verify that gravel bed extents and elevations were satisfactory after the survey.

For accurate caisson placement, the upper beam of each caisson was mounted with three or four GNSS receivers, which wirelessly transmitted position data to the hydrographic surveying software. In the control room on the caisson floating barge, an operator viewed the position and tilt of the caisson in relation to the design location. A team that included engineers to determine how much water to pump into the caisson to keep it level, a hydrographic surveyor and a winch operator watched the visualization on three large screens. The hydrographic software displayed winch lines to help the operator determine which one to use to move the caisson, plus information such as vertical-distance-to-touchdown and caisson center location. The latter screen was used when the caisson was close to design location.

### Static GNSS Enhances Total Station Traverse

To solve the problem of poor network geometry for total station observations, CADS Survey observed primary control points with static GNSS—these tied back to the high-order network on Barrow Island. The baselines were observed for 12 hours or more to negate any subtle movements caused by environmental factors.

"Caissons sway, so you can wander off with your traverses," Bush said. "The static GNSS tied everything back to the Barrow island network. It was an insurance against angular drift in the total station traverse."

Caissons were placed 260 feet apart. At approximately every 1,600 feet survey pillars were installed on a caisson. Further static GNSS baselines were observed to each one.

### How to Meet in the Middle?

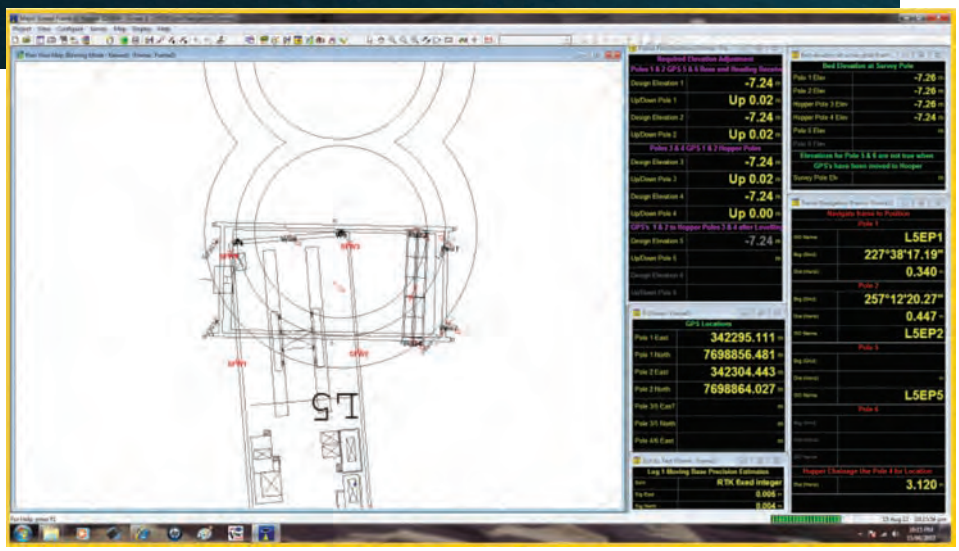
To ensure both ends of the jetty met in the middle, CADS Survey employed long-range reciprocal trigonometric heightening using geospatial total stations and interference-averse measuring technology. These instruments can detect targets without interference from surrounding prisms to 8,200 feet, achieving one-centimeter level accuracy.

The team set up the total stations to face each other from neighboring caissons and observed from both ends of the line. They measured at exactly the same time to derive mean elevation differences while minimizing the effects of refractive turbulence. CADS Survey was able to do this due to the reliability of the total stations and will be able to repeat their results even for the longest observations.

### Solving Access Problems with 3D Scanning

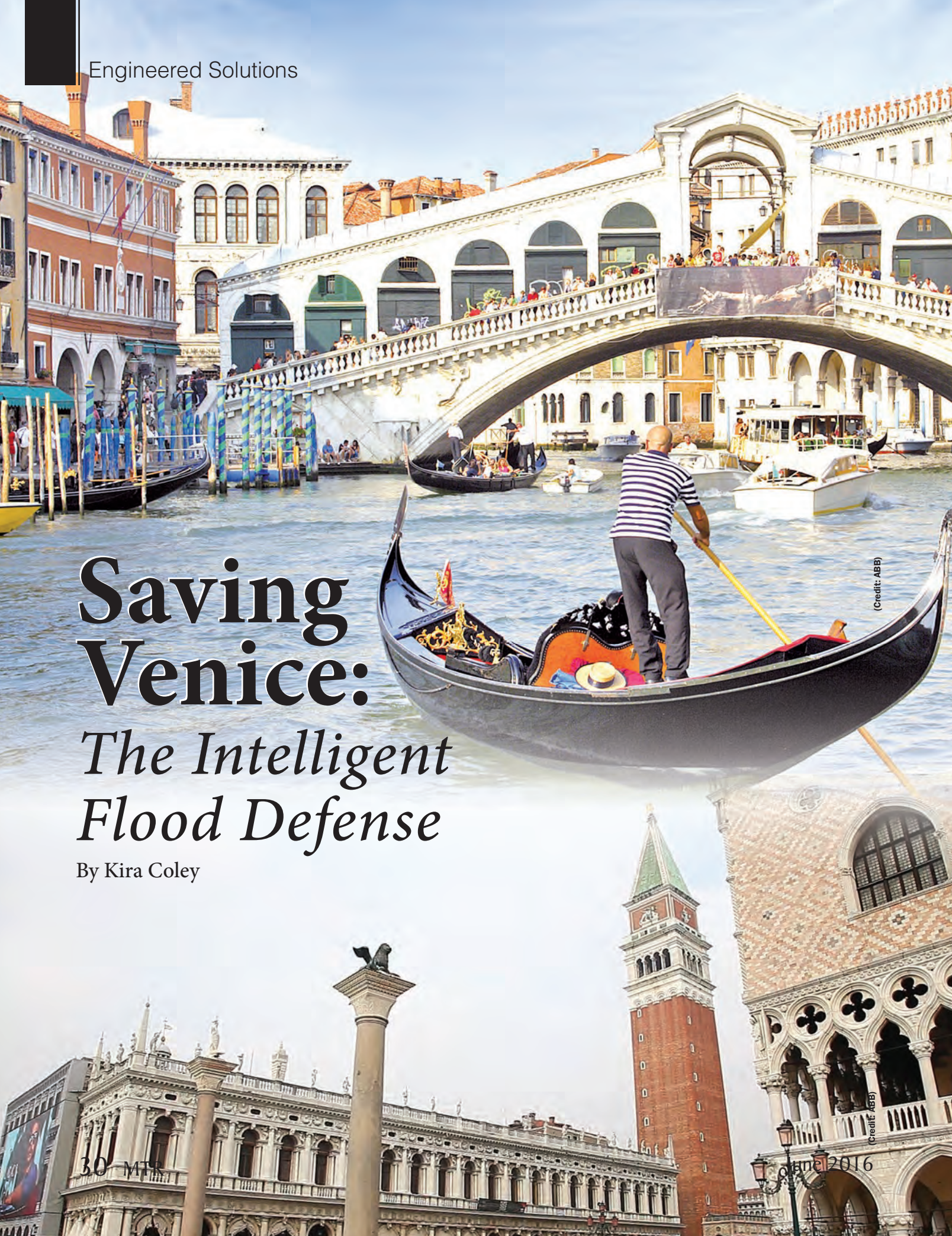
When pipe modules were installed, they came with straight lengths of pipes already installed. CADS Survey's next task was to deliver accurate pipe end measurements. After careful testing, CADS Survey deployed 3D scanners to aid in data collection. Rope access climbers, with the sea beneath them, bolted the scanners in place close to pipe racks. The survey team positioned themselves nearby with the scanning PC – used to operate 3D software – and were able to provide a clean representation of pipe ends that they could model with certainty.

*All images courtesy: Trimble Geospatial



## Gorgon Jetty Project Completion

On the Gorgon Jetty, the CADS Survey team greatly enlarged its swag of surveying capabilities. Integrated geospatial hardware and software solutions broadened the scope of data collection and modeling, allowing the team to complete the project efficiently and accurately. "The construction sequence was not a traditional land-to-jetty-end build, so it provided a great surveying challenge," Bush said. "To maintain the highest accuracy, we really had to use the latest surveying technology available."



(Credit: ABB)

# Saving Venice:

## *The Intelligent Flood Defense*

By Kira Coley

(Credit: ABB)

As one of the most important civil engineering projects in recent history, the story of the Venetian Mo.S.E flood barrier has been one of innovation and modernization. Now, in the final stages of the $6 billion venture which seeks to save the historic floating city, the 'nervous system' of the project is due to be installed linking the architecture to an intelligent control network. This $38 million order will provide automation and power, connecting 78 independently operated steel gates with signals from more than 50,000 devices. The ABB Symphony Plus automation platform will be the 'brain' of the entire Mo.S.E system, navigating the safe operation of the project's barrier gates and providing the anti-intruder and cyber security systems required in this era of digitalized flood protection.

### *EUROPE'S MOST ENDANGERED CITY*

Venice is an amazing engineering endeavor: it has been built on a group of more than 100 little islands as part of a lagoon. This large, enclosed bay is protected by 50 km of sandbank and connected to the sea by three inlets giving passage to the city's maritime traffic, as well as the normal 1-meter tides that flush the city's canals.

Earlier this year, the heritage NGO alliance Europa Nostra and the European Investment Bank Institute (EIBI) declared Venice as the most endangered heritage site in Europe. While the lagoon is subject to variations in water levels, extreme spring tides are more regularly surging through the city flooding homes, businesses and buildings. Unesco will present a report on the status of Venice to the World Heritage Committee, which will follow with recommendations in July this year.

"A range of factors have made the lagoon vulnerable to high water surging through the inlets from the Adriatic Sea. This includes erosion caused by port development, subsiding land and rising sea levels, periodic wind conditions that push waves into the lagoon, as well as the surrounding drainage basin that empties rain and water into the lagoon," said Stefania Mascheroni, ABB. "As a result of global warming, sea levels are expected to rise about 20 cm by 2050. This puts the city of Venice at huge risk to be inundated nearly once a week with tides starting from 80 cm above normal."

### *SOLUTION: MO.S.E.*

The Mo.S.E. (Italian acronym for Modulo Sperimentale Elettromeccanico) flood barrier system is designed to block the annual high tides and storm surges that enter the Venetian region. Led by the construction consortium Consorzio Venezia Nuova, the installation of 78 independently operated steel gates across the three inlets should shield the lagoon from both major and minor floods.

"The Mo.S.E. concept is unique: nowhere else in the world, where the same issue of high waters occurs, a system of barriers like the one in Venice has been implemented. Usually, barriers remain visible as infrastructures above the sea surface. The Mo.S.E. option instead is hidden on the seabed surface and their movement is managed by the injection of compressed air or salt-water," said Mascheroni.

The 20-m-wide gates are between 18.5 – 29.5 m in length and consist of hollow, hinged metal boxes that are fixed to large prefabricated 23,000-ton concrete bases embedded into the sea floor. When the control room is alerted to high tides or storm surges, the water inside the barriers is pumped out with compressed air, and the gates lift into position aided by their own buoyancy. In just 30 minutes, the entire barrier system can be risen, isolating the lagoon and protecting Venice from tides as high as 3 meters.

The flexible design allows operators to completely close all inlets simultaneously, or vary the level of closure at each site independently depending on winds, atmospheric pressure and tide level.

There are a variety of critical requirements which will be compulsory for the success of the entire defense. From a structural point of view, the barriers should not interfere with normal maritime traffic flow and host infrastructure to safeguard the area, which demands also vigorous safety from a system point of view through a sophisticated anti-intruder and

# ABB's Symphony® Plus advanced automation software platform

## The brain behind Mo.S.E.– the innovative flood barrier system in Venice

To protect the city from flooding, Venice is building a system of navigation locks, breakwaters and **78** retractable, air-filled steel flood gates to protect Venice from rising sea levels, winter storms and spring tides.

**Mo.S.E.**
Italian acronym for Experimental Electromechanic Module


The barrier's complete system is automated and controlled by ABB's Symphony® Plus distributed control system.

The system takes about **30** minutes to deploy, creating a steel barrier that can withstand a three-meter tide.

Utilizing ABB's Internet of Things, Services and People, Symphony® Plus manages data signals from more than **50,000** devices monitoring the subsea and surface hardware and coordinating electrical automation and control of the Mo.S.E. project.

Power and productivity for a better world™


(Credit: ABB)

protection systems to keep out unauthorized entries.

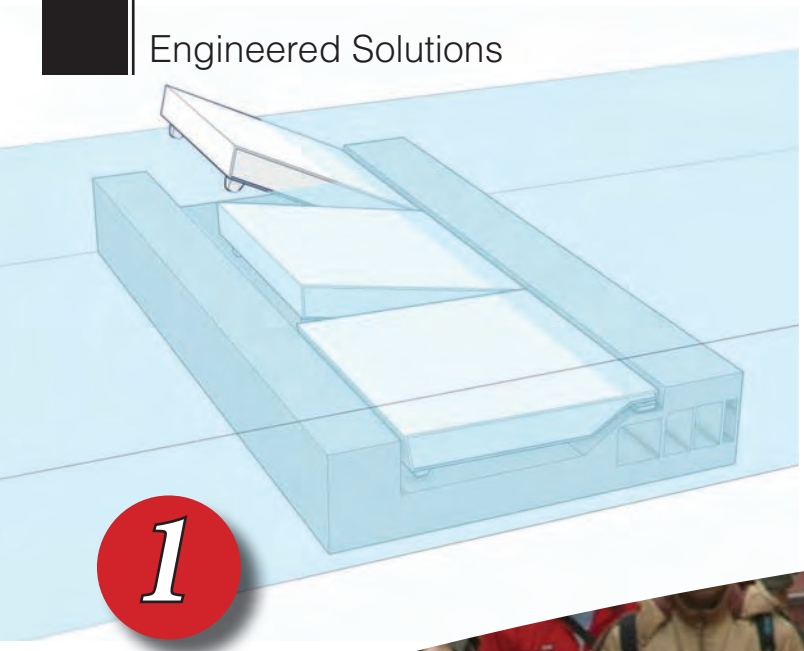
There are also environmental considerations, such as the possibility of natural gas leakage penetrating the subsea structures at the inlets, saturating the environment and rendering it potentially explosive.

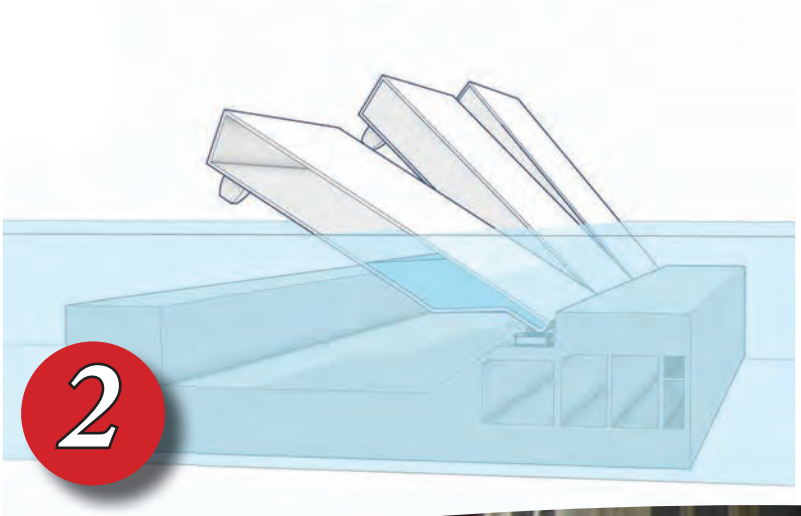
***DIGITAL FLOOD DEFENSE***

ABB provides field instrumentation and control and I/O devices that will coordinate operation of the entire flood defense system. This consists of managing the different operational, architectural and safety functionalities for flood barriers, navigation locks and breakwaters, while integrating with ABB's safety system in addition to the Mo.S.E external security system.

The signals gathered from more than 50,000 devices provide the data to position and maintain the barrier at the 45-degree angle, with a variance of 1 degree – an amazing endeavor when taking into account the pressure of water on the barrier and the continuous tidal movement.

"For what concerns ABB's scope of supply, the integrated electrical and automation solution is one of our strong suits: our competence in both automation and electrical products and systems is renowned and testified by thousands of references in power and water. The system provided to Mo.S.E. features Symphony Plus latest technology, the control system managing the automation and electrical system enabling the barrier movement. ABB is not new to such peculiar project: they count in fact a number of references in automating many flood barrier projects in The Netherlands," said Mascheroni. "Essential for the reliability of the Mo.S.E. project, to make sure it works when it is





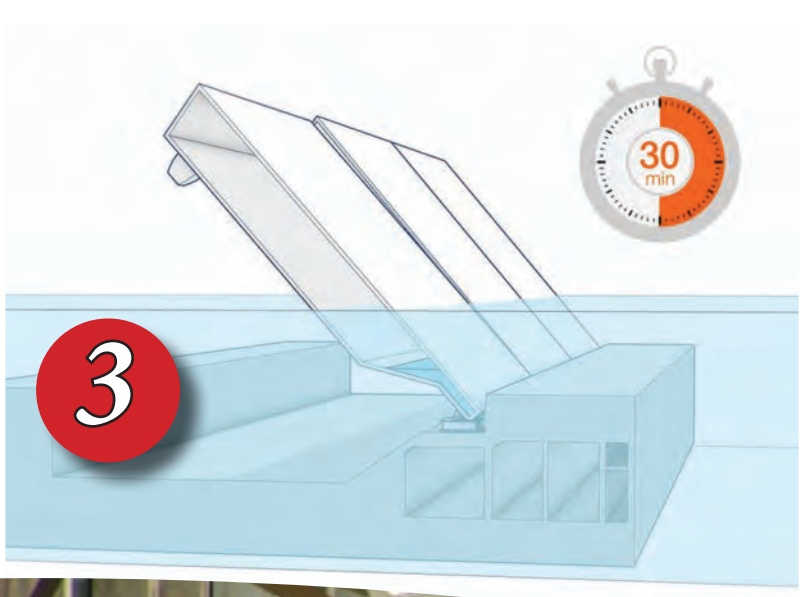
most needed, is the availability of the system: an exceptionally redundant design, further reinforced by the geographic separation of redundant components, brings the availability of this system to unprecedented levels."

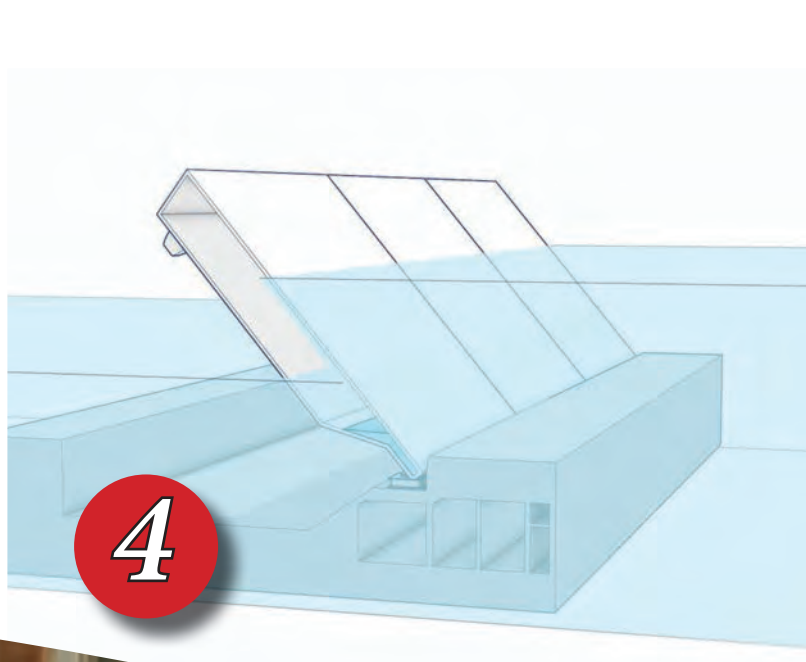
The capacity of ABB's Symphony Plus control system to easily integrate electrical and field equipment is an important differentiator, as is the platform's unique ability to be easily scaled and customized for different sizes and complexities of application. ABB's control system is also easy to maintain, as the main components are redundant (controllers, switches, servers) and most can be quickly replaced.

"The biggest challenge will be to ensure the position of the barriers is always the one needed independently from the varying pressure of water and air into and outside the barriers. The variance of 1 degree might seem nearly indiscernible, but it may affect the system efficiency. With reference to the installation activity, difficulties are mainly related to the actual position of the equipment, underwater in harsh environments," said Mascheroni.

***NEW WAVE OF INNOVATION***

The Mo.S.E. barriers are expected to provide a financial return within 50 years due to the hopeful reduction in costs from damage to the cities structure and contents. But despite the pure return on investment, Venice is a priceless treasure whose




*All images courtesy: ABB

safeguard cannot be enumerated.

"Digitalization and Internet of Things (IoT) are the new wave to bring innovation and value added services to a technology portfolio. Although in automation we were already providing 'intranet of things' throughout our DCS systems, the opportunity generated by the digitalization and big data is tremendous in terms of both new services and solutions," said Mascheroni. "ABB is taking an additional step ahead with our concept of the Internet of Things, Services and People (IoTSP), namely by connecting inextricably Services and People to technology. Data collected from super-intelligent devices will drive advanced services that make use of actionable information derived from them, while people will be the ultimate recipient of the advanced analytics for conscious and accurate decision-making."

This Mo.S.E. project with the ABB intelligent systems, showcases a wealth of cutting-edge innovation and technology. As sea levels rise across the world, flood barriers may become more digitalized. Intelligent automated and electrical systems will be required to help control these defenses efficiently, protect from cyber intervention and to maintain consistent reliable defenses for decades to come. Adaptability and modernization of future flood defenses will likely be key in vulnerable areas where the looming impacts of climate change and the variability of extreme weather events, remains uncertain.

# Cables & Connectors

## *Innovations in Keeping Connected*

**Hydro Group plc**

Subsea cable and connector specialist **Hydro Group plc** announced multiple Asia Pacific Business Partner agreements as the firm continues strategic growth in the region. As part of international expansion plans in 2013 the firm formed its Singapore based division, Hydro Group Asia, which has shown an annual increase of sales in the region of over $2.2m. The five new Business Partner agreements with Uni-One in Taiwan, ISL in China, Oceanpixel in the Philippines, PT Indonesia in Indonesia and DKHG in Vietnam will aid Hydro Group's cabling interconnect solutions presence in these important markets.

"Asia currently represents Hydro Group's second largest export market, with significant growth in demand for our range of subsea optical cables, electrical cables and connectors from defense markets and increasingly energy customers, due to the expansion of exploration activities in the region," said Doug Whyte, Hydro Group MD. From its manufacturing facilities in Scotland, Hydro Group develops the complete subsea electrical and optical interconnect package, built to withstand harsh environmental conditions.

**South Bay Cables: 50 Years Strong**

South Bay Cable celebrates its golden anniversary this year, owned and operated by the same management since 1957. The company boasts more than 80,000 square-feet of production space in the Idyllwild and Temecula facilities, in Southern California, and to date it has designed and produced more than 60,000 different cable constructions. Each cable is designed around the customer's needs and contains a combination of electrical, optical and mechanical elements.

From the drawing of the copper rod to the jacketing of the finished cable South Bay Cable has a wide variety of cable manufacturing equipment to perform many unique operations.

Specialty equipment includes; stranders, insulating and jacketing extruders, taping lines, striping machines, small and large planetary cablers, armoring machines for steel, serving lines for aramid fibers as well as considerable additional equipment required for the manufacture of specialized cable products.

**Falmat**

Cable manufacturer Falmat debuted its new Xtreme-Marine HD line of video cables engineered to provide HD and SD high quality video transmission down to depths of 7 kilometers. Designed for harsh environments, the rugged cables are available as single coax design with polyurethane jacket or in a composite construction with additional power conductors, strength layers or other features. A key feature of the cable is its impressive long range capabilities, said Falmat president Brian Falk. Applications include ROV, diver umbilical, overboard drop camera, topside and subsea monitoring, ocean observatory, pipe and well inspection, robotics, fisheries, water theme entertainment and even marine movie production.

**Hydro Group's Doug Whyte & Steve Ang**

Hydro Group

**Falmat president Brian Falk**


Eric Haun

**Silicon Sensing**

The DMU30 program is moving into the qualification phase, ready to ramp up to full volume production in July 2016. DMU30 is a new high performance 12-DOF MEMS IMU using high-precision Multi-MEMS inertial sensors with a novel 'sensor blending' filter to achieve near-FOG grade bias and angle random walk characteristics. The qualification phase puts in place a fully specified and controlled production process and verifies that the process will deliver the product specification throughout its production lifetime. This process is compliant with the manufacturer's AS9100 quality assurance accreditation and culminates in a 'PPAP' production release process in accordance with automotive production control standards. Low volume initial production for testing, customer evaluation and integration has been in place for several months. The performance of these parts has been highly encouraging both in the **Silicon Sensing** design proving tests and in customer evaluations. Interest in the product is very strong so the company is preparing to run additional low-volume production batches. This will allow it to expand the number of customers participating in early evaluation, and to allow customers to start integrating DMU30 into their applications ahead of full volume production.

DMU30 SOP (Start of Production) coincides with the 'tape cutting' on a brand new, dedicated, high-volume Silicon Sensing test and calibration facility. This facility will be solely used for high precision test and calibration of SSSL IMUs. The first machine was installed in February 2016 – a state-of-the-art 2-axis rate table with thermally controlled chamber supplied by Acutronic of Switzerland.

**SBG Systems**

SBG Systems has added two new inertial sensors to its MEMS technology based Apogee product line: a Motion Reference Unit (MRU) Apogee-M and an Inertial Navigation System Apogee-U – both made of titanium with a depth rating of 200 meters. According to its developer, Apogee integrates the latest generation of MEMS sensors to reach a high degree of precision - 0.008° in roll and pitch in real-time – while delivering a robust and accurate heading thanks to the continuous fusion of GNSS and IMU data. Made of titanium, Apogee-M and Apogee-U are suited to mount close to the sonar head for hydrographic tasks from shallow to deep water.

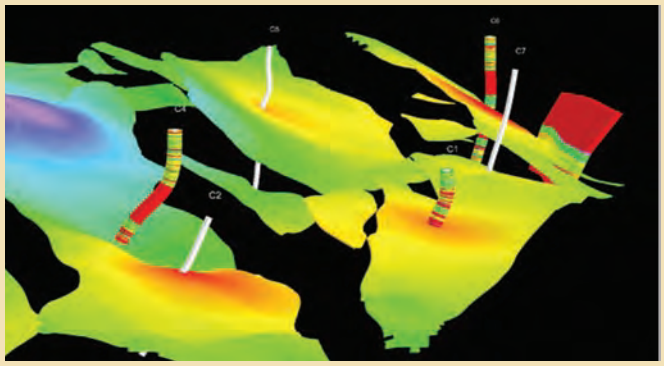
The Apogee provides a real-time heave accurate to 5 centimeters, which automatically detects the wave frequency and constantly adjusts to it, SBG Systems said. When wave frequency is erratic or in case of long period swell, the delayed heave feature can save the day by allowing survey in rough conditions. This algorithm allows a more extensive calculation, resulting in a heave accurate to 2 centimeters displayed in real-time with a little delay. Apogee sensors can be paired with any type of survey-grade GNSS receiver or by the one offered by SBG Systems. The SplitBox GNSS integrates the latest tri-frequency GNSS receiver to offer several positioning features such as RTK, Marinestar, OmniSTAR, Veripos and TerraStar corrections. Configuration is made easy throughout the intuitive embedded web interface where all parameters can be quickly displayed and adjusted.

**SBG Systems**


Eric Haun

# CGG GeoSoftware Releases EarthModel FT 9.5

CGG GeoSoftware has launched EarthModel FT 9.5, the latest version of its geological modeling software that combines well and seismic data for a better understanding of the reservoir. Users can determine reservoir properties such as lithofacies, porosity and permeability, for more accurate modeling results. EarthModel FT combines surface mapping, integrated structural modeling, reservoir property modeling and upscaling all in one package, with direct output to most flow simulators. EarthModel FT 9.5 offers sandboxes where users can independently explore alternative interpretation scenarios and store them separately from the main project. Changes can be incorporated collaboratively into the central database in real time, allowing for information sharing.



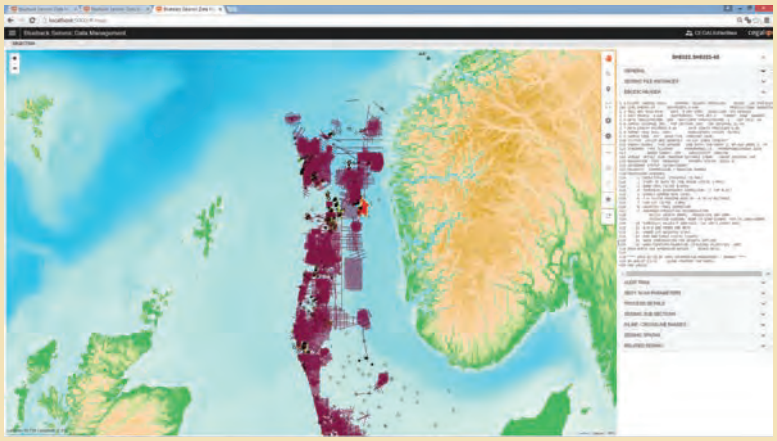

CGG

**www.cgg.com**

## Seismic Data Info Management

Cegal released Blueback Seismic Data Management, a software solution that provides full life cycle management of seismic data for a range of geoscience applications. Built on a modern architecture and a web based user interface, Blueback Seismic Data Management scans, catalogs, quality controls and prepares seismic data, aiming to solve the increasing complexity of seismic data sets. The solution is cost and time efficient, and helps improve the quality of application ready seismic by managing large volumes of data with efficient workflows, where geoscientists achieves easy access to available seismic data with self-service tools.
The solution integrates with geographical information systems (GIS) and provides map and table based views. The spatial information can be accessed directly from ESRI ArcGIS for integration into GIS workflows and external maps.

**www.cegal.com**




ROS

## Monochrome Camera

The new ROS C460 Low Light Camera offers exceptional sensitivity in ultra low-light conditions, according to the manufacturer. The ROS Monochrome C460 Camera offers outstanding performance in low light conditions as well as bright sunlight. Features include 570 TVL resolution and a low light sensitivity of 0.000005 lux. The C460 also features a titanium housing, a 77° field of view and is depth rated to 6,000 meters.

**www.rosys.com**

# RoweTech Launches SeaSEVEN ADCP

In 2010, Fran Rowe founded RoweTech and leads the company that is developing the next generation of Doppler measurement tools. RoweTech has now designed a new ADCP that contains the features of RoweTech's dual frequency ADCP and its wave measurement ADCP SeaWAVE. Additionally, this new product named SeaSEVEN has all the features of RoweTech's standard ADCP's, which include 24-bit front end A/D converter, multi-mode and multi-missions, high ping rates, high capacity data storage and high speed serial and Ethernet data comms interface. These standard ADCP features allow total control over each beam, beam pair, Janus beams and 3-D profiling. RoweTech's new product has two pairs of three beams splayed around the vertical beam. It has 60º azimuths between the beams and a 20º elevation, which allows the SeaSEVEN to make measurements never before available from a traditional three, four or five beam current profiler. SeaSEVEN is also able to make the basic measurements of Doppler shift, echo intensity, correlation, depth and temperature at a high speed [10+ Hz] and store it on up to 64 GByte of memory. Researchers now have the ability to achieve applications which have been difficult or impossible with standard ADCPs.

**www.rowetechinc.com**


RoweTech

## CoPilot Retrofitted onto Falcon ROV

SeeByte announced that Heriot-Watt University has integrated CoPilot with its Seaeye Falcon 1256, an observation-class ROV. With assistance from Heriot-Watt University's Ocean Systems Laboratory personnel, the SeeByte team integrated and tuned the system to operate with a Teledyne RDI Workhorse Navigator 600 KHz DVL. The work was conducted over a two day period including testing in Heriot-Watt University's wave tank. This configuration can be used with other Seaeye Falcon systems. CoPilot is an advanced, easy-to-use, plug-and play software that makes piloting any ROV a much simpler task. CoPilot permits pilot controlled auto-transit and stop-and-hover, while providing automated sonar tracking and movement relative to a target. CoPilot is easily retrofitted to any ROV system, but is also available from the factory with VideoRay, Seatronics and SMD.

**www.seebyte.com**

SeeByte

Aquabotix

## Aquabotix Debuts New Inspection Class Mini ROV

Aquabotix is making a push further into the commercial sector courtesy of its new ROV dubbed Endura, with pricing starting at $17,000. The Endura was engineered for dependability and functionality across a wide range of underwater applications, designed for ease of use. According to the manufacturer it is ready for the water in three minutes, basic driver competency is developed in about three hours with professional proficiency achieved in three days.

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**www.Aquabotix.com**

(Image: Saab)

# Sea Wasp

## *Saab Develops Underwater Anti-IED Robot*

Designed to combat below-the-surface terrorism, Sea Wasp is the latest generation remotely operated vehicle (ROV) from Saab. Sea Wasp was engineered to relocate, identify and neutralize underwater improvised explosive devices (IEDs). While most underwater IED threats are disposed of manually by trained explosive ordnance disposal (EOD) divers, Sea Wasp is operated remotely by two-person teams from the surface, allowing operators to keep a safe distance. To produce Sea Wasp, Saab leveraged technology from its Saab Seaeye line of commercial ROVs, added capabilities previously developed for its military systems portfolio and worked with the U.S. Underwater Hazardous Device Response Community to adopt the ROV for EOD purposes and procedures.

"Sea Wasp is a hybrid of preexisting Saab technologies that can now be applied to an urgent worldwide need," said Bert Johansson, Sales Director Underwater Systems within Saab business area Dynamics. "Underwater EOD is a rapidly growing niche around the world, and Sea Wasp's capabilities correspond to that niche."

Sea Wasp is a portable system that includes a vehicle, generator, pilot station, hand winch and power supply unit. The modular system carries a sensor suite including wideband sonar, LED lights and video cameras for operation and identification capabilities in areas with limited visibility; however additional sensors can be fitted. Sea Wasp's basic configuration can be altered during the mission planning stage to suit each specific mission with the integration of relevant payloads to create a tailored system. This interchange of parts ensures easy configuration upgrades. Modularity is at the very heart of the Sea Wasp concept, and Saab is working with its partners to build additional capabilities into the system as the underwater terrorist threat evolves.

Sea Wasp's onboard Doppler Velocity Log (DVL) and Internal Measurement Unit (IMU) deliver navigational capability, allowing it to maneuver between specific waypoints. The vehicle incorporates Saab Seaeye's iCON intelligent control system, and is modeled on Saab's Double Eagle family of MCM vehicles, to give six degrees of freedom for ultimate maneuverability. Its six thrusters deliver enough power to be effective in up to 2.5 knots of current, allowing the Sea Wasp to hover when processing a target or to secure itself to structures such as a ship's hull or harbor walls.

Although designed to operate in the difficult shallow conditions and tidal currents of harbors, the ROV has a maximum operating depth of 60 meters, as IEDs vary significantly in form and design, and consequently, tools to counter the threat need to be diverse.

Sea Wasp is fitted with an electrical five-function manipulator arm, giving the operator the flexibility to deploy a range of tools and techniques for Improvised Explosive Device Disposal (IEDD) and EOD, depending on the scenario.

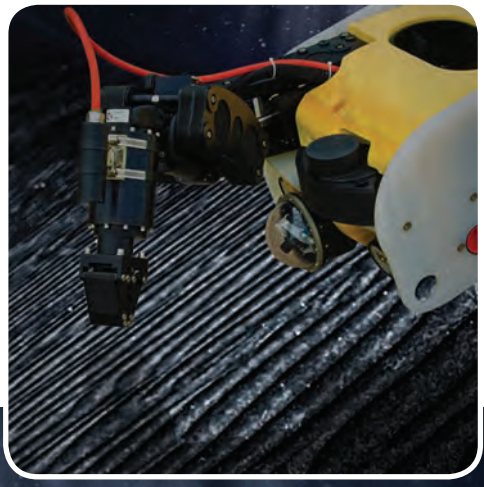
The ROV is used to locate targets, identify the nature of the threat and determine the best method for disposal. When the vehicle is ready, the operator uses Sea Wasp's thrusters to lock into position on a ship's hull or harbor wall. With the aid of the five-function manipulator arm, a disruptor can be positioned beside the target, ready for detonation. The Sea Wasp is then piloted back to the surface for recovery, after which the disruptor is fired from the surface and the target neutralized.

Sea Wasp testing and evaluation is now being carried out over the next 10 to 12 months, for which Saab has partnered with the Combating Terrorism Technical Support Office (CTTSO) in to provide prototypes to three EOD agencies: the U.S. Navy EOD Group 2, the FBI Counter-IED Unit, and the South Carolina Law Enforcement Division's Counter-Terrorist Operations Maritime Response Unit, all three of which have received Sea Wasp training.

## System Specifications

Length: .....1.7 m
Width: ..... 0.5 m
Height: ..... 0.4 m
Weight in air: ..... <90 kg
Weight in water:..... Slightly buoyant, adjustable
Operational depth: ..... 60 m
Operational current: ..... 2.5 knots
Vehicle control: .....6 degrees of freedom, Saab iCON 2, auto depth, altitude, station keeping, obstacle avoidance, way point navigation

Navigation sensors: .....IMU, DVL with integrated compass
Sonar: Multibeam forward looking sonar, other types of sonar available on request
Cameras: ..... 1 x color pan tilt on ROV with ..... 2 x optical zoom, 1 x color on manipulator arm
Tether: .....160 m power and fiber optic
Power supply: ..... 180–260 VAC Single phase 47–63 Hz, primary power demands max 32 A, auxiliary power demands max 16 A
Manipulator arm: .....ECA electrical five-function



(Image: Saab)

**Pferdehirt**

FMC

**Aadland**

Innova

**James**

N-Sea

## Pferdehirt New CEO of FMC

The FMC Technologies Board of Directors appointed Douglas J. Pferdehirt President and Chief Executive Officer of FMC Technologies, effective September 1, 2016. Pferdehirt will succeed John T. Gremp, who will continue to serve as Chairman of the Board of Directors while the company completes its transition to the new CEO. He started with a 26-year career with Schlumberger.

## Aadland Named MD at Innova

Innova AS appointed Alf-Kristian Aadland as its new Managing Director. Aadland has been Innova's Technical Director since January 2014, prior to which he served in leading roles at Oceaneering since 1993. His area of responsibility included offshore operation to department manager for different development and engineering groups. Aadland's last position in Oceaneering was Manager for Subsea All Electric department.

## N-Sea, DOF Offering Integrated Dive Service

Subsea IMR provider N-Sea and Subsea Projects and engineering provider DOF Subsea have entered into a two-year cooperation agreement to provide an integrated saturation (SAT) dive service.
The principles of the agreement are set out with DOF Subsea providing the dive support vessel Skandi Achiever, while N-Sea will provide saturation diving resources. N-Sea chief operating officer, Roddy James, said, "This cooperation agreement with DOF Subsea reinforces N-Sea's key objective to fully appreciate our clients' requirements and provide them with the safe, sound and swift service they have come to expect."

## Theobald Joins WFS

WFS Technology appointed Mike Theobald as Project Director for Australia and SouthEast Asia. Having worked in the subsea industry for over 25 years, Theobald will bring considerable subsea control systems knowledge and understanding to the role, as well as an insight into how best to use Seatooth products and technology.

## Deheer New OceanLED Marketing Director

OceanLED has appointed Jim Deheer to the role of Director of Marketing with global responsibility for all of OceanLED's marketing and communication activities. Deheer has over 20 years of experience in the marine industry, previously working for Navico as Global Brand Director and EMEA Marketing Director managing a number of high profile brands including B&G, Simrad and Lowrance.

## Hemisphere GNSS Names Guo Interim President, CEO

Hemisphere GNSS, Inc. said that Xinping Guo has been named interim president and chief executive officer, effective immediately.

## RoweTech Names RTA Mid-Atlantic Agent

Rowe Technologies appointed Ransone Technology Associates (RTA) as an exclusive agent for distribution in the following states of the Mid-Atlantic region – Maryland, Delaware, Virginia, North and South Carolina, Washington DC, and GSA contracting.

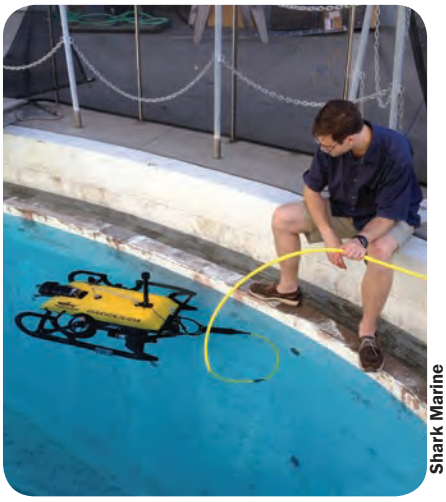
## SCRIPPS Procures ROV from Shark Marine

SCRIPPS institution of Oceanography acquired a Shark Marine Barracuda ROV. The Barracuda will be used in conjunction with the Shark Marine Navigator, procured by the institute a couple years back. The Barracuda ROV can operate at multiple power levels, from 2,000 to 6,000 watts, allowing for a small or large generator depending on the thrust required for the job. Barracuda boasts a constant forward bollard thrust of up to 85 pounds, allowing the vehicle to be deployed from vessels of opportunity, whether that's a small RHIB or a full ocean going vessel.

**Theobald**

WFS Technologies

**Shark Marine**



Shark Marine

**JFSE: T4000**


James Fisher Subsea Excavation

## JFSE to Aid FSO Replacement

James Fisher Subsea Excavation (JFSE), will support its client, EMAS-AMC, at the Bouri oilfield with post-lay trenching and backfilling services. EMAS-AMC is responsible for the engineering, procurement, installation and commissioning of new offshore facility, FSO Gaza, at the Bouri oilfield. Bouri, considered to be the Mediterranean's largest producing oilfield 120 km from the Libyan shore, is operated by Italian oil company Eni with the National Corporation of Libya as a partner.

## Proteus Delivers Satellite Derived Bathymetry Service

Proteus has delivered satellite derived bathymetry to Royal Haskoning DHV in April 2016. Proteus was commissioned by Royal Haskoning to deliver the data as part of a port design project in Saudi Arabia and to identify suitable and cost effective approaches to the port. The 8,000 sq km area of interest was surveyed and delivered within six weeks and depths up to 20m were successfully reached. The work was completed in just under six weeks from receipt of order, proving the time and financial benefits of using satellite derived bathymetry for mapping large areas.

Proteus

## Small Field Buoy on Global Dredge Projects

Ocean Scientific International Ltd (OSIL) are reporting extensive use of its 0.7m Small Field Buoy on international dredging projects. The lightweight, easily repositionable buoys can be repeatedly deployed to follow in the path of dredgers in order to monitor plume activity, and are often complimented by the OSIL 1.2m Tern buoys, which provide more permanent monitoring stations for long term projects. The robust buoys are constructed from rotationally molded polyethylene hulls that are foam filled for added security. Instrumentation is securely protected from damage and interference by the integral stainless steel deployment frame/cage without interrupting the flow of water around instruments such as water quality sensors or turbidity meters.

## FET Delivers to North Africa

Forum Energy Technologies Inc. delivered a number of its largest subsea Pig Launchers and Receivers (PLRs) and laydown heads to a project in North Africa. The nine PLRs have been deployed as part of a development of nine subsea wells, which vary from four to 24 inches in size, with water depths ranging from 300 to 800m.

## Forum Subsea Rentals Invests in MultiMillion Rental Order

Forum Subsea placed a multimillion dollar equipment order with subsea technology provider, Sonardyne International Ltd. Included in the order are multiple Ranger 2 GyroUSBL acoustic positioning systems which combine Sonardyne's 6G acoustic positioning transceiver technology and a Lodestar AHRS sensor in the same mechanical assembly.

## Gardline, Neptune Launch Integrated Vessel/ROV Solution

Gardline Geosurvey Ltd. and Neptune entered into a strategic partnership which will see Gardline's DP2 multi-role survey vessel, the MV Kommandor, enhanced with the permanent installation of Neptune's Explorer 06 100HP ROV.

Manned by staff from both companies, the vessel has also seen a dedicated ROV control area created on-board and benefits from mid-ship moon pool capabilities.

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