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MARINE TECHNOLOGY REPORTER

April 2009
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Interview
Tore Halvorsen, FMC

Offshore
The push to put the Platform on the Seabed

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SAAB TECHNOLOGIES SAAB

April 2009

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Marine Technology Reporter • Volume 52 • Number 3

Pictured in the background: IHC Engineering Business recently delivered a pair of massive deepwater pipeline ploughs, designed to handle pipeline diameters up to 1.55 m in water depths to 1,000 m. For more information, turn to page 12

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on the Cover

This month's cover is an artist rendition of a subsea O&G installation, courtesy of FMC. For more on the push to put the platform on the seabed, turn to page 36.

the Authors

Dr. Ioseba Tena is SeeByte's Sales Manager. Ioseba is responsible for the development of SeeByte's overall commercial strategies and managing the marketing sales process within the company. He supervises a team with a global outreach with existing customers in the continents of America, Australia and Europe. Ioseba has been developing technical solutions for the offshore industry for more than 10 years. (**See story on page 28**)

James Jamieson, BSc, IET is an Engineering Manager in the remote technology group of Subsea 7. Based in Aberdeen, Scotland he has been actively involved in the design of control systems for Subsea 7's world wide fleet of remotely operated vehicles and tooling systems. With more than twenty years experience in this field, he has spent the last five years leading Subsea 7's AUV development work. (**See story on page 28**)

For the past six years **Adam Westwood** has been responsible for DWL's renewable energy work, completing many studies of the industry. Recent work includes: managing a due-diligence project for a 100m investment to establish a new wind turbine manufacturer, a major study on supply chain constraints and 2020 targets for the UK's Department of Business, Economics & Regulatory Reform, and due diligence for a wave energy company preparing to list on AIM. (**See story on page 18**)

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Having just returned from Southampton and the second edition of Ocean Business, I think it more than fair to say that the subsea business is navigating the current global economic storm far better than most. This is not to say that the path is clear. There are certainly interesting times ahead, and many I've spoken with in recent months tell of gathering "storm clouds on the horizon," which include the possibility of a prolonged global credit crunch and a marked slowdown in new ROV orders. Companies today seem cautiously optimistic, planning for the worst but realistically expecting stability in many sectors.

One sector that holds the attention of nearly everyone serving this market is the Offshore Oil & Gas market, of course, and while the business was brisk and spirits high in Southampton, I believe a more telling sign will be the turnout and collective 'mood' at the Offshore Technology Conference (OTC) next month in Houston. OTC, and Houston itself, have always stood as a bellwether for the offshore O&G market, and while it is certain that enthusiasm will not be as high as last year's exhibition — a time when oil prices were ramping toward the mid-summer near $150 per barrel peak — I think it will still hold a world of opportunity for companies serving the subsea sector. This month MTR had the privilege to gain insights into the history, development and future of subsea technology in the offshore O&G sector courtesy of an interview with Tore Halvorsen, Senior Vice President, Global Subsea Production Systems, FMC, a report which starts on page 36. His vision of complete production moving to the seabed, particularly in the dynamic and still unpredictable Arctic region, means that in the long-run business will be plentiful for the companies that design, develop and deliver products and systems that make subsea operations more efficient, cost-effective and reliable.

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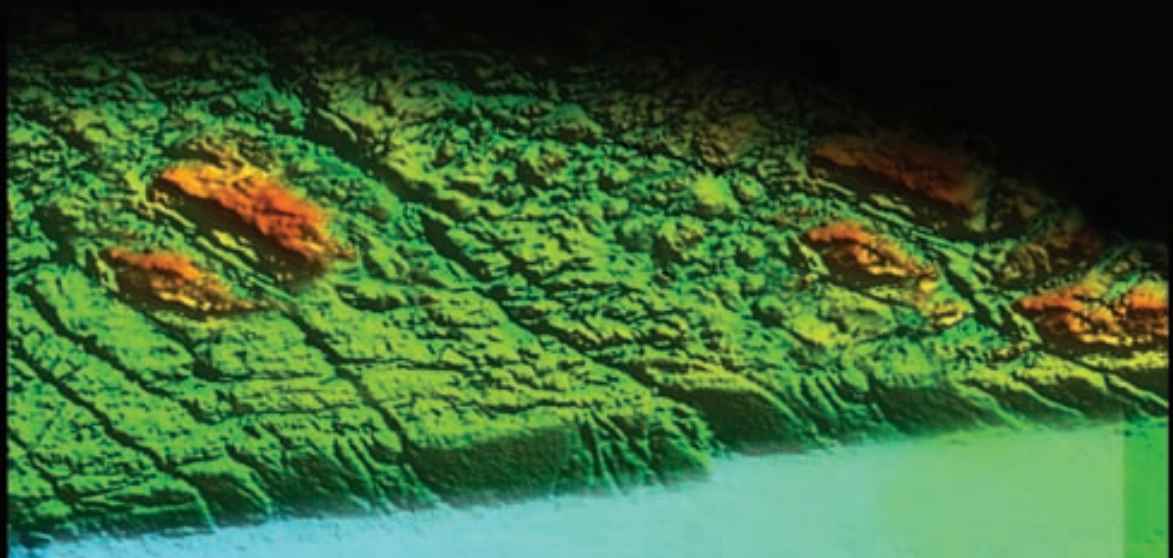

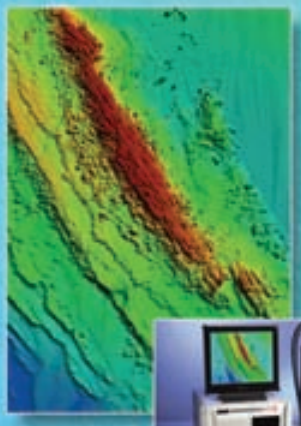

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Image courtesy of State of California Ocean Protection Council. "Mavericks" was processed by Fugro off Half Moon Bay, California.

Subsea Trees: 12.1% Growth

A recent report into global subsea tree awards, published by Quest Offshore, forecasts 12.1% compound annual growth rate (CAGR) over the next five years. This compares with a CAGR of 3.6% experienced in the previous five year period. Quest analysts said that growth prospects are sound for meaningful subsea orders during 2009/10, buoyed by notable projects offshore Brazil and Africa. The report also acknowledges that awards maybe tempered in 2009 by the potential slow down of final investment decisions (FID) on certain world class projects. This as oil companies actively look, and possibly wait, for cost reductions and concessions from all aspects of the global supply chain. West Africa is identified as a bright spot for future subsea activity, following on from ongoing projects by the major operators.

Corrections

The article written by Maggie Merrill about ocean renewable energy in New England in the November/December 2008 issue of MTR had the wrong photo. The corrections are as follows.

Congressman James McGovern expressed his desire to work with the Massachusetts Congressional Delegation early next year to promote the growth of the ocean energy industry in the Commonwealth and throughout the region.

Marine Renewable Energy Center Director, John Miller explains the potential for ocean energy in New England is untapped. There are several systems that can be deployed to test technologies and site characteristics.

Re: January 2009 Cover

With regard to the front cover of Marine Technology Reporter. The picture on the cover shows what is referred to as a ball tool in the Van Gogh Heavy lift article. The tools is actually designed and assembled by our company BALLTEC http://www.balltec.com

It was a pleasant surprise to see our tool on the cover of the magazine even if our company was not mentioned. For future reference, the tool was proof load tested to 874mT and has a SWL of 700mT Our company specializes in Ball and taper tools for the offshore industry. We also produce Subsea mooring connectors, Pipeline recovery tools, abandonment and recovery tools, and moving into the pile handling market.

Regards,
James Neels, Balltec Ltd, Email :Jneels@balltec.com

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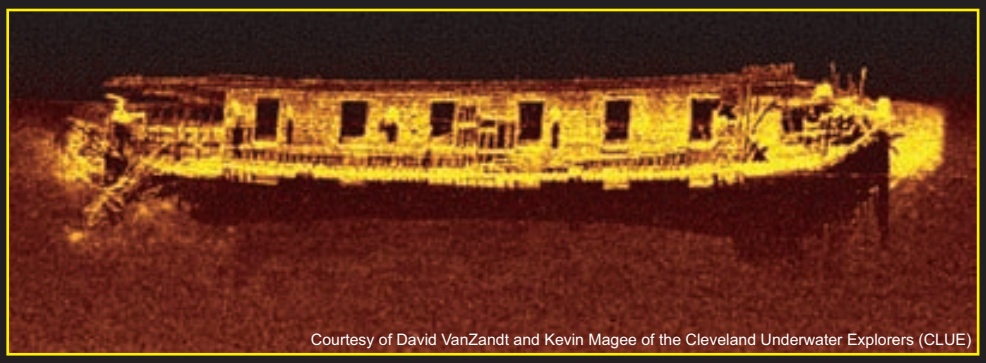

Courtesy of David VanZandt and Kevin Magee of the Cleveland Underwater Explorers (CLUE)

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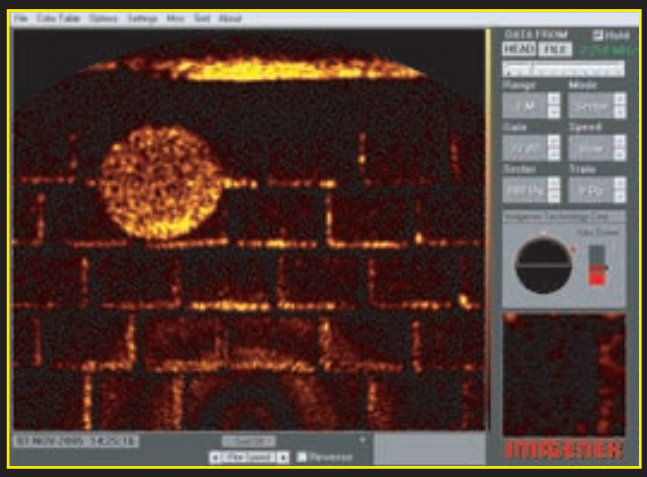

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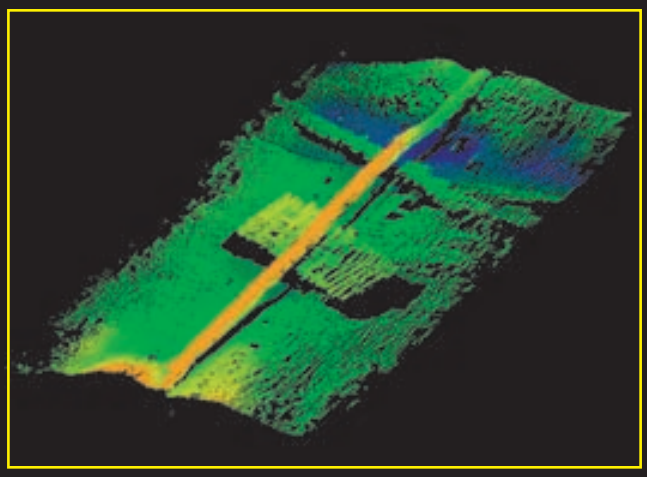

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60km into an Ice Shelf Cavity

Searching for Signs of Melting

Autosub, a robot submarine built and developed by the UK's National Oceanography Center, Southampton, has reportedly completed a high-risk campaign of six missions traveling under an Antarctic glacier. Autosub has been exploring Pine Island Glacier, a floating extension of the West Antarctic ice sheet, using sonar scanners to map the seabed and the underside of the ice as it juts into the sea. Scientists hope to learn why the glacier has been thinning and accelerating over recent decades. Pine Island Glacier is in the Amundsen Sea, part of the South Pacific bordering West Antarctica. Changes in its flow have been observed since the early 1970s, and together with neighboring glaciers it is currently contributing about 0.25 mm a year to global sea level rise.

Steve McPhail led the Autosub team during the 10-day survey. "Autosub is a completely autonomous robot: there are no connecting wires with the ship and no pilot. Autosub has to avoid collisions with the jagged ice overhead and the unknown seabed below, and return to a pre-defined rendezvous point, where we crane it back onboard the ship.

"Adding to the problems are the sub zero water temperatures and the crushing pressures at 1000 m depth. All systems on the vehicle must work perfectly while under the ice or it would be lost. There is no hope of rescue 60 km in, with 500 m of ice overhead."

An international team of scientists led by Dr. Adrian Jenkins of British Antarctic Survey and Stan Jacobs of the Lamont-Doherty Earth Observatory, Columbia University, New York on the American ship, the RVIB Nathaniel B Palmer, has been using the robot sub to investigate the underside of the ice and measure changes in salinity and temperature of the sur-

rounding water.

After a test mission in unusually ice-free seas in front of the face of the glacier, they started with three 60km forays under the floating glacier and extended the length of missions to 110km round-trip. In all, a distance of over 500km beneath the ice was studied.

Using its sonar, the Autosub picks its way through the water, while creating a 3D map that the scientists will use to determine where and how the warmth of the ocean waters drives melting of the glacier base.

"There is still much work to be done on the processing of the data," said Adrian Jenkins, "but the picture we should get of the ocean beneath the glacier will be unprecedented in its extent and detail. It should help us answer critical questions about the role played by the ocean in driving the ongoing thinning of the glacier."

The lead U.S. researcher on the project, Stan Jacobs, is studying the Pine Island Glacier with International Polar Year (IPY) funding from the National Science Foundation (NSF). One of the IPY research goals is to better understand the dynamics of the world's massive ice sheets, including the massive West Antarctic Ice Sheet. If this were to melt completely global sea levels would rise significantly. The most recent report of the Intergovernmental Panel on Climate Change (IPCC) noted that because so little is understood about ice-sheet behavior it is difficult to predict how ice sheets will contribute to sea level rise in a warming world. The behavior of ice sheets the IPCC report said is one of the major uncertainties in predicting exactly how the warming of the global will affect human populations.

EB Delivers Pair of Deepwater Pipeline Ploughs

Two deepwater pipeline ploughs designed and built by IHC Engineering Business (EB) have left EB's Hadrian Riverside workshops on Tyneside en route for extensive offshore commissioning and installation on the owner's vessels.

The new PL3 and BPL3 ploughs are the largest subsea ploughs EB has developed. Designed to handle pipeline diameters of up to 1.55 m, in water depths of 1000 m, they will be used for the burial of main pipeline trunk routes across the globe. Their design follows the theme of ploughs being specified for ever-larger pipe diameters, to match technological developments.

"We're truly passionate about ploughs," said EB's managing director, Dr. Tony Trapp. "And, we were genuinely excited to have been challenged to deliver a game changing plough system. Our design focused on increasing levels of performance, productivity, reliability and safety and will allow our client to trench the largest and longest subsea pipelines. During the whole process of design and build we took maximum advantage of the proven North East of England supply chain."

"BPL3 is unlike any previous backfill plough. Aimed at reducing the risk of damage to the trenched pipeline, its front skids run outside the trench. As a result it has been designed to fold into itself, rather like a spider, for launch and recovery. Its design ensures it is possible to launch the plough in the correct orientation to save time during deployment."

www.engb.com

U.S. Claims Chinese Harass Oceanographic Ship

Five Chinese vessels shadowed and aggressively maneuvered close to the USNS Impeccable in the South China Sea March 8, a senior Pentagon official said March 9.

The U.S. oceanographic ship was 70 miles south of Hainan Island conducting routine operations in international waters when the ships approached, Pentagon spokesman Bryan Whitman said.

"We view these as unprofessional maneuvers by the Chinese vessels and violations under international law to operate with due regard for the rights and safety of other lawful users of the ocean," Whitman said.

A civilian crew mans the ship, which operates under the auspices of the Military Sealift Command.

The incident began as the ships surrounded the Impeccable and two craft closed to within 50 feet, Whitman said. The Chinese ships included a Chinese navy intelligence collection ship, a Bureau of Maritime Fisheries patrol vessel, a State Oceanographic Administration patrol vessel and two small Chinese-flagged trawlers.

Crewmen aboard the Impeccable used fire hoses to spray one of the vessels as a protective measure. The Chinese crewmembers disrobed to their underwear and continued closing to within 25 feet.

The Chinese vessels dropped pieces of wood in the water directly in the Impeccable's path, and two of the ships stopped directly in the U.S. vessel's path, forcing it to stop.

Whitman said the Chinese used poles in an attempt to snag the Impeccable's towed acoustic array sonars. Impeccable's master used bridge-to-bridge radio circuits to inform the Chinese ships in a friendly manner that it was leaving the area and requested a safe path to navigate.

"These are dangerous close maneuvers that these vessels engaged in," Whitman said.

The incident was the culmination of earlier harassment. A Chinese patrol vessel shined a high-intensity

Two Chinese trawlers stop directly in front of the military Sealift Command ocean surveillance ship USNS Impeccable (T-AGOS-23), forcing the ship to conduct an emergency "all stop" in order to avoid collision. The incident took place in international waters in the South China Sea about 75 miles south of Hainan Island. The trawlers came within 25 feet of Impeccable, as part of an apparent coordinated effort to harass the unarmed ocean surveillance ship. (U.S. Navy photo/Released)

spotlight March 4 on the USNS Victorious operating in the Yellow Sea 125 miles from China's coast. Chinese maritime aircraft "buzzed" the ship 12 times March 5.

A Chinese frigate crossed the bow of the Impeccable at a range of about 100 yards March 5. Maritime aircraft buzzed the ship after that incident.

Another Chinese ship challenged Impeccable over bridge-to-bridge radio March 7, calling its operations illegal and directing the American ship to leave the area or "suffer the consequences," officials said.

The Impeccable is one of six surveillance ships that gather underwater acoustical data, Whitman said. U.S. ships routinely operate in the area.

"We expect Chinese ships to act responsibly and refrain from provocative activities that could lead to miscalculation or a collision at sea, endangering vessels and the lives of U.S. and Chinese mariners," a Defense Department official said.

U.S. embassy officials lodged a protest against these actions with the Foreign Ministry in China, and Defense Department officials have protested with the Chinese embassy here.

(Reported by Jim Garamone, American Forces Press Service, as posted on www.navy.mil)

Right Whale Sedation Enables Rescue Effort

On Friday, March 6, 2009, for reportedly the first time ever, a North Atlantic right whale that had been severely entangled in fishing gear, was administered a sedation mixture that made it possible for rescuers to remove 90 percent of the entanglement. The rescue involved the efforts of a multi-institutional team including the Woods Hole Oceanographic Institution (WHOI), NOAA Fisheries, which manages the Atlantic Large Whale Disentanglement Network based at the Provincetown (MA) Center for Coastal Studies, the University of Florida's Aquatic Animal Health Program, Florida Fish & Wildlife Conservation Commission (FWC), Georgia Department of Natural Resources (DNR), and Coastwise Consulting Group. Team members on four boats assisted by an aerial survey plane worked for two days to free the animal. Eventually they succeeded in injecting the 40-foot, 40,000-pound whale with a mixture of sedatives that allowed them to cut away the gear that wrapped around the animal's head. The new sedation delivery system built by Trevor Austin of Paxarms New Zealand, comprises a 12-inch needle and a syringe driven by compressed air, which injects the drug into the whale's muscle.

"This tool enhances fishing gear removal from entangled whales and minimizes the added stress from repeated boat approaches to the animals," said Michael Moore, a veterinarian and research biologist at WHOI. Moore has led the investigation into chemical and physical tools to facilitate and enhance the safety of large whale restraint during efforts to remove entangling fishing gear. "It's gratifying to have successfully employed this new technique."

The animal (New England Aquarium catalog No: 3311) was first sighted entangled east of Brunswick, Ga., on Jan. 14, 2009, by the Georgia Wildlife Trust aerial survey team, which noted multiple lengths of heavy line cutting in to the whale's upper jaw and left lip and trailing behind the animal. It was tagged with a telemetry buoy by the Georgia DNR to allow it to be tracked.

Several disentanglement attempts proved unsuccessful, as the animal was unapproachable for a rescue effort. On Friday, March 6, a further increase in the dose resulted in a marked switch from the expected evasiveness. An hour after injection of sedatives, the animal no longer evaded boat approaches, but instead tolerated repeated close approaches by a disentanglement boat to allow removal of 90 percent of the remaining rope. Veterinarians on the team calculated the dosage based on experience sedating animals in captivity, starting low through the clinical range until they found a safe and effective level.

"Our prior experience with using these drugs safely in dolphins, beluga whales, killer whales and other species gave us the initial levels of sedatives to start with," said Mike Walsh a veterinarian and associate director of the University of Florida College of Veterinary Medicine's Aquatic Animal Health program.

Wave & Tidal Current Stream

Activity Set to Increase

By Adam Westwood

Both the wave power and tidal current stream energy sectors are emerging industries. While development activities run back some 30 years, commercialization of leading technologies in both sectors is only just beginning. The sectors are characterized by high numbers of prototype technologies. Over 200 are known of and tracked by Douglas-Westwood. Of these technologies, only a handful is now approaching full-scale commercial deployment. The majority fail to progress to full-scale prototyping, often due to difficulties raising the required finance in this now highly competitive market. With the first multiple-unit commercial-scale installations now occurring, such as the Aguçadoura wave farm, off Portugal, interest in the marine renewables industry is at a high. Investors are seeking the most promising technologies and individual countries are bringing in market mechanisms to help establish projects.

86 MW of wave and tidal current stream capacity will be installed worldwide in the 2009 to 2013 period. The UK is forecast to be the biggest market, and is expected to install 51 MW of the total capacity (60%).

The UK is so dominant due to three major factors. First, the excellent wave and tidal resources that exist around the coastline - many other countries do not benefit from both together. Second, the market mechanisms and funding in place, which are comparatively strong and give more confidence than in other countries. Third, the U.K. is home to a large number of wave and tidal device developers, including some of the market leaders such as Pelamis Wave Power and Marine Current Turbines.

The U.S. is expected to be the second largest market, with 11 MW (12%) of overall capacity. Portugal with 9 MW (10%) and Canada with 6 MW (7%) are the other most significant countries. Portugal is especially strong in the wave sector whereas Canada has more potential from tidal. A total of 135 units are forecast with over half of all devices being commercial scale. 74 commercial units will be installed, 55% of the total. Of the 86 MW forecast, 44 MW is from wave energy devices and 42 MW from tidal current stream.

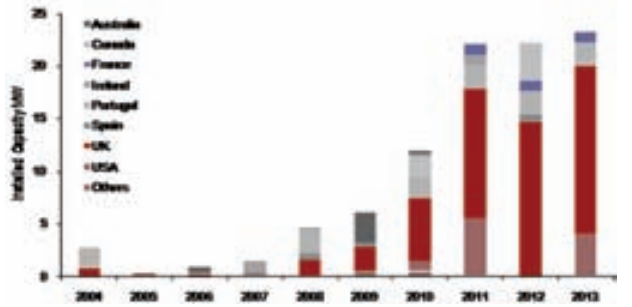


Figure 1: Wave & Tidal Current Stream - Installed Capacity 2004-2013 (Source: Douglas-Westwood)

It is our view that the 2009-2013 period will see several devices in each sector pull away and build significant market share. Over the next five years devices that are deployed successfully on a commercial basis, and can prove reliability and low maintenance requirements, will provide the knowledge for a second generation of devices, where we may see some standardisation of device design emerging.

There will be new technologies emerging, but only the most promising will progress in an increasingly competitive marketplace. Support must be forthcoming through government funding to help companies get devices into the water for thorough testing and ongoing product development.

There are, however, many challenges facing the industry:

Survivability & Reliability

There are justified concerns over the reliability of devices. With relatively little real-world operation of projects, developers must prove reliability, survivability and maintenance is adequate. There have been multiple cases of device failures but this is to be expected in the prototype stages. The growth of offshore wind has been characterised by some major reliability problems, and this sector is using decades-old technology. The marine environment is extremely challenging and for devices to operate successfully in it will require significant investment.

Supply Chain Development

While there are some elements of the supply chain already in place, the emerging industry will need a fuller range of companies to enter the sector. The high number of different technologies means that 'off-the-shelf' components do not exist. This adversely impacts costs and, potentially, production timelines.

Manufacturing

Manufacturing will prove to be a key challenge for the commercialisation of the industry. Few of the many devices being developed have yet gone through any commercial level manufacturing processes. While costs are acknowledged to be high on prototype/demonstration units, what matters ultimately to project developers and investors is costs at a commercial scale for farm-style projects (where appropriate). Without off-the-shelf components, developers must engage fully with the supply chain to accurately estimate and future-forecast costs. Location of manufacture is a key issue. Dedicated manufacturing facilities are currently a rarity. One company that has its own plant is OpenHydro which opened its European assembly facility in 2007. The 2,500 sq. m. (27,000 sq. ft.) Irish technical center is adjacent to Greenore Port, County Louth providing convenient access to sea transport. The first turbine to be built at this new facility was completed in October 2007. Pelamis Wave Power also has an assembly facility at Fife Energy Park, Methil, Scotland. In July 2007, the company secured a £260,000 ($378,000) Regional Selective Assistance grant to upgrade its production facility.

The funding made the company a permanent tenant at the Energy Park which features deep quayside access, long quaysides and large-scale covered manufacturing facilities. The production facility features upgraded production flow lines, material handling, a machine shop, test facilities and office accommodation.

Investment

Developers are usually reliant on private investment to progress their devices to a pre-commercial stage. The leading technologies have each achieved private investment of around £10 and £50 million.

Market Mechanisms

The importance of national market mechanisms for marine renewables is paramount. The U.K. is emerging as the dominant player in the industry, in large part due to the mechanisms in place. Long-term confidence in a market is essential for investors; this has been shown through both the onshore and offshore wind industry previously. While countries such as the U.S. have some strong domestic technologies, a current lack of support for projects means developers must look abroad for sites.

Cost

Thorough understandings of performance, reliability, survivability, maintenance, etc. are required to provide true costs and to ascertain the operable lifetime of a device. With full-scale prototype/demonstration plants only having been operated for relatively short periods at present it is arguable that true costs remain to be seen, certainly at the commercial level. Operational expenditure (Opex) is a variable cost and will be higher in the early years of a projects life with extended periods of commissioning, testing and refining.

The major cost variables are as follows:

- Distance to shore - this creates an immediate increase in cabling costs and will also affect the cost of both installation and O&M due to the distance vessels and personnel will have to travel. With greater distances to the site, weather windows are shorter due to travelling times. This

(Photo courtesy of Pelamis Wave Power)

can impact upon uptime and overall production.

- Installation - major factors here are fabrication, transportation, foundations or moorings, time required for installation and network integration. Minimising the amount of time and work required to install and commission is a major cost (and risk) benefit.
- O&M access - some devices have functionality to raise the unit out of the water entirely and hold it fixed in place. This greatly eases O&M activity and could reduce O&M time and therefore downtime. Other devices are operable in location but others will have to be relocated onshore for major work. This is costly but provides a safer working environment. It also may enable a fuller inspection of the device whilst out of the water than would be possible during routine offshore maintenance.
- Modularization - devices with easily 'swappable' components can offer quicker and safer O&M, lowering costs offshore, potentially with overall cost savings.
- Redundancy - Providing redundancy in the device may be costly but can prevent expensive intervention and the associated loss of production. However, this may not be possible/desirable and performing remedial work on site or onshore may be preferable. Whilst this is usually considered on a device level, looking at it on a project level, it is possible to see some projects deploying 'extra' devices to bring online in case of the failure of one of the array's devices. This is more likely with smaller units.
- O&M strategy - the scheduling of O&M activities is of key importance. Unscheduled downtime must be avoided by ensuring the upkeep of the device, but this must be balanced against the cost and risk of offshore O&M activity. Remote monitoring is particularly significant here.

The World Wave and Tidal Market Report 2009-2013 forms part of a series of reports that are used by companies in over 50 countries globally. These include leading corporations, investment banks and agencies of governments. The report considers the prospects for this growing market and forecasts activity through to 2013. The report also reviews technologies and drivers and details prospects. Further information is available at www.dw-1.com. The authors can be contacted via publications@dw-1.com or +44 1227 780999.

Offshore Floating Wind Turbines

Call of the Sea

In the wake of the wind-energy boom on land, more turbines are now to be built offshore. Worldwide, the potential in terms of available area is enormous.

The bad news was received just before the start of the conference: installation of the offshore wind farm "alpha ventus", which is to lead German wind energy out onto the oceans at long last, will be delayed. But this message did not dampen the general interest in the wind sector. Some 200 experts met at the end of September for the Hamburg Offshore Wind Conference. "Offshore wind is big business," declared Frank Zimmermann of Siemens Wind Power in kicking off. "20 to 25 per cent of the Siemens installations are to be erected offshore." Siemens is one of the trailblazers for ocean-based wind energy. As early as 1991, the company, then still operating under the name Bonus Energy A/S, installed its fi rst ocean units at the Vindeby site.

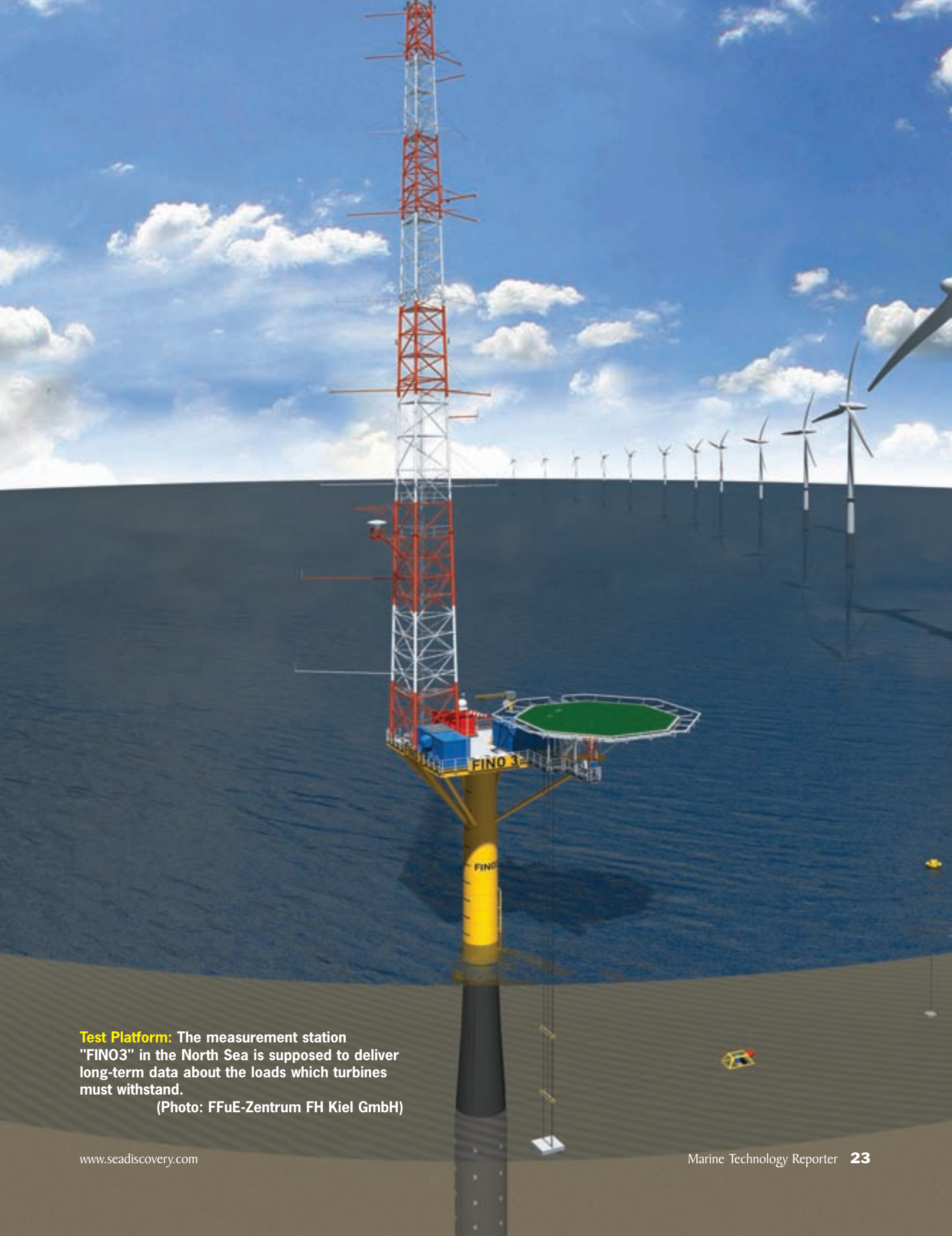
Influence of Water Level and Wind Speed

Before Zimmermann's promise can be put into practice, however, a lot of homework still has to be done. Building a wind turbine in the water differs completely from erecting one on dry land. The ocean makes its own rules. Waves, ice, seabed, currents and wind speeds vary greatly from time to time and place to place. Apropos waves: how the waves build up and what height and force they can develop was explained by Elimar Precht of DHI-WASY GmbH. "Water level and wind speed exert a significant influence on the wave height," said the project manager for wind energy and offshore technology. With the aid of impressive videos, he showed how waves slam against off-

(Photo: FFuE-Zentrum FH Kiel GmbH)

Mitigating Risk

Wind turbines are exposed to multiple loads. Snow, ice, rain, high winds and the possibility of earthquakes all challenge land-based wind power plants. In addition, lightning strokes and short circuits can cause fi re. Offshore turbines are frequently exposed to even tougher conditions, such as rough seas or potential ship collisions. Capturing solid data. Wind turbines are generally designed for a service life of 20 years. Nevertheless, they must be capable of withstanding natural forces that occur at much greater statistical intervals. The new offshore measuring platform FINO3 will continuously collect meteorological and oceanographic data and measure a number of additional technical parameters such as wind turbulences, lightning strokes and the interaction between the foundation and the sea floor.



Test Platform: The measurement station "FINO3" in the North Sea is supposed to deliver long-term data about the loads which turbines must withstand.
(Photo: FFuE-Zentrum FH Kiel GmbH)

shore wind turbines and may lead to damage. His advice is to save money and avoid unpleasant surprises through good planning. Building the foundation too solidly means you waste money, but making the structure too flimsy means you could lose it. In a nutshell: You have to be aware of the conditions prevailing at sea. Tests and model trials in test basins are simply indispensable. Florian Biehl of Germanischer Lloyd put forward a similar view. He listed the relevant parameters to be observed: Where should the installation be erected? What type of turbine do we need? Where should it be assembled? What loads must it withstand? To answer all these questions, the so-called "metocean conditions" have to be considered.

These include the primary factors (wind, waves, ice, etc.), but subsoil conditions and events such as earthquakes, lightning or ship collisions must also be included. The scientists can obtain the corresponding data in various ways, for instance by using wave radar, measurement buoys and satellite imagery. Computational methods can also yield the required figures. In all cases, it is essential to conduct long-term measurement research, sometimes extending over many years. To harvest such data, the measurement platform FINO3 is being erected in the North Sea, with participation by Germanischer Lloyd.

KISS - Keep It Simple, Stupid!

While one may get the impression that the wind only blows in European waters, wind farms are flourishing far beyond the North and Baltic Sea - on paper, at least. "The potential in North America is huge," said Richard Legault of Hélimax Energy. No less than 1,000 gigawatts are possible in the USA alone. His forecast was that 50 gigawatts will be installed by 2030. Above all, the East Coast, West Coast and the Great Lakes areas appear to be very promising. The electricity grid is generally in good condition; as recently as 2007, the USA invested eight billion US dollars in the system. According to a study, however, an additional 20,000 line-miles still have to be laid. But here Legault issued a word of caution: the weather conditions prevailing in America's northern regions are gruelling, with ice being the main challenge. In the Gulf of Mexico, where turbines are also to be erected, hurricanes could make things difficult. Besides, there is still considerable capacity available onshore. The first sea-based projects will be implemented in 2011 at the earliest, Legault predicted. Interesting plans have also been reported in Canada.

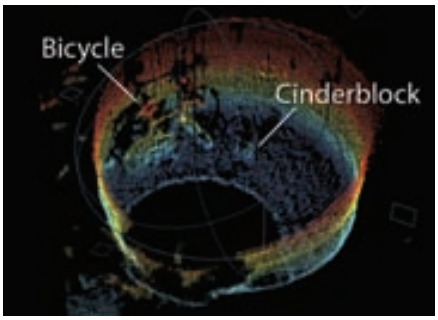
Things are taking shape on the West Coast of British Columbia, where there are more bears than people, as Peter Hunter of NaiKun Wind Development noted. The NaiKun Wind Project will be Canada's first offshore wind farm and also one of the world's most ambitious, with a capacity of 1.75 to 2 gigawatts. Although Canada is able to cover 94 per cent of its electricity requirements with hydroelectric power, Hunter said that the demand is rising. British Columbia already has to import electricity. The grid is well established and very few additional lines need to be installed for wind turbines. Moreover, wind and water power fits well together: "When the water flow drops in autumn, the wind starts up." However, the conditions are even tougher than in the North Sea. Not only is the weather extreme, the subsoil on which the wind turbines are to be erected is also unfavourable. The region is very active from a geological viewpoint. To make matters worse, only five months a year are available for setting up the plants. Hunter intends to counter these negative factors with special methods. KISS (keep it simple, stupid!) is his magic formula. In contrast to usual practice, the wind turbines will not be arranged in a regular pattern, but just as the foundation soil allows. "A good layout is asymmetrical," says Hunter.

(Reprinted with permission from the January 2009 edition of NonStop, a Germanisher Lloyd-produced publication)

Traffic: Ferry near the offshore wind park "Lillgund" in Öresund. Each of the 48 plants produces 2.3 MW. (Photo: Siemens AG)

MicroBathymetric (MB) Systems for Offshore

In the fall of 2007, BlueView formed a strategic business unit focused on supporting offshore Oil and Gas operations. By delivering next-generation underwater vision solutions, BlueView believes it has a unique opportunity to succeed in an industry where saving hours can result in substantial dollar savings. These savings show up both on-site through increased operational efficiency and off-site by providing a new level of 2D and 3D data quality during decision making processes. Recently, BlueView has brought to market a new line of underwater acoustic line scanners referred to as MicroBathymetric (MB) systems. These systems are designed to create detailed 3D renderings of complex underwater structures and sea bottomThese high-resolution renderings save significant time by accelerating reliable project decisions and reducing planning errors that can arise from incomplete data and models. Laser line scanners are commonly used for generating 3D renderings of land based structures, but due to optical attenuation, have limited range in murky water conditions. BlueView's acoustic line scanners can produce similar high-resolution data underwater without the range and turbidity limitations associated with optical systems. These systems also operate much like traditional bathymetric sonar except at much higher frequencies (MHz region) and much higher resolutions. These acoustic line scanners, which can be deployed from ROV, surface vessels, tripods, and even the smallest UUV, are poised to revolutionize the underwater 3D mapping and rendering market. BlueView's MB products interface with most of the leading bathymetry software packages used today, making them a drop in replacement or augment for traditional bathymetry systems.



Ultra-high resolution 3D rendering of a bicycle in test tank. This new level of detail saves significant time during project planning.

www.blueviewtech.com

Autonomous Vehicle Meets New Challenges Offshore

"PAIV"-ing the Way

by
James Jamieson, Subsea 7 Ltd.
Dr Ioseba Tena, SeeByte Ltd.

The Offshore industry has had to foster innovation in order to face the world's most challenging environments. But, innovation has not always been synonymous with industry wide acceptance. The introduction of the Remotely Operated Vehicle (ROV) only came about as the industry understood the possibilities that the new technology delivered. Through the years the spectrum of ROV tasks has steadily grown and today it is the workhorse of Subsea operations. But, the industry must now face new challenges as its rapid expansion into deeper water and harsher environments pushes resources and current technology to the limit. To meet this challenge new concepts of operations and novel solutions are required. Taking a leaf from the history of the ROV this article will present a new Autonomous Vehicle concept that will lead the way to new services and opportunities. This concept is the result of a program of work that has been partly sponsored to date by BP and Chevron. These oil majors have understood the possibilities and are working in collaboration with SeeByte and Subsea 7 to deliver a new service to the offshore industry.

Subsea 7 a major engineering and construction company supplying a range of services and technologies primarily into the offshore oil and gas industries has its Remote Technology Group centred in Aberdeen (UK). The company operates a worldwide fleet of high specification subsea construction and survey vessels together with over 100 ROVs. Over the past 10 years Subsea 7 have been actively involved in the development of autonomous underwater technologies.

SeeByte, Subsea 7's collaborative partner is a software company with a track record in delivering solutions to both military and industry customers helping them automate and de-risk their processes. Through its involvement in key programs of work, SeeByte has been at the forefront of Autonomous Underwater Vehicle (AUV) development. In 2005 SeeByte demonstrated a prototype autonomous riser tracking system for AUVs. The system used a sonar to identify and track the riser and guide the AUV. In 2006 SeeByte's Autotracker [1] software and Subsea 7's Geosub AUV were used in conjunction to carry out the world longest un-interrupted AUV inspection run of a pipeline, a total of 22.2 km running at four knots. SeeByte also supplies the U.S. Navy with SeeTrack COIN (Common Operator Interface for the Navy) a software solution that allows the US Navy to plan missions, analyse and display data from underwater and airborne sensors, and to integrate VSW MCM (Very Shallow Water Mine Counter Measures) with global command and control systems. This article presents a joint initiative by Subsea 7 and SeeByte to develop the next generation AUV for the offshore O&G industry, to see the development of the first truly autonomous vehicle capable of both inspection and light intervention in an offshore environment. SeeByte will provide the autonomous behaviour and control software to match the vehicle engineering, intervention systems and operational experience of Subsea 7.

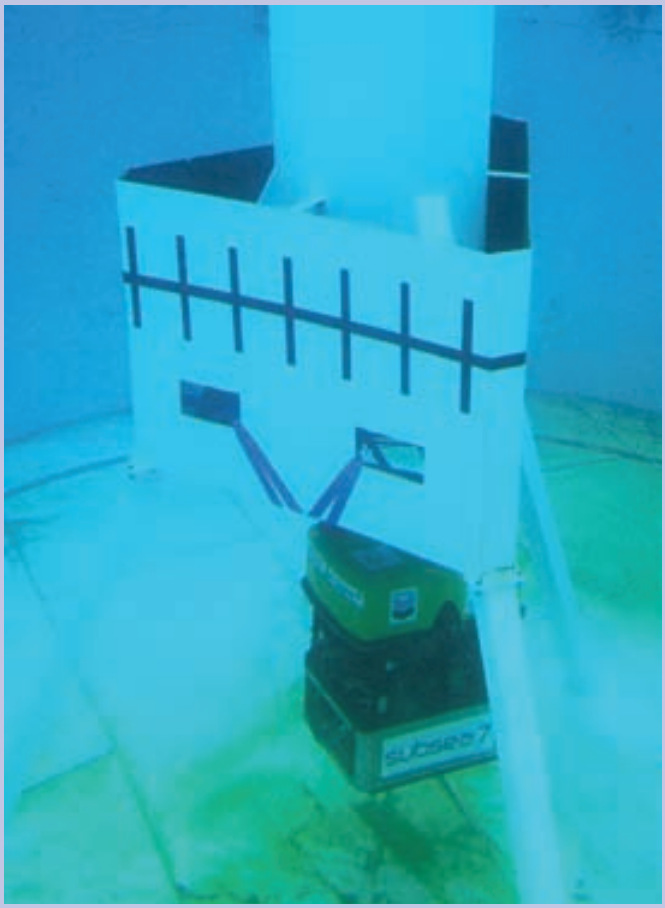
Vision

As offshore O&G exploration and production has evolved over the last decades more and more infrastructure is being installed on the seabed, of increasing com-

Industry representatives observing Prototype Autonomous Underwater Vehicle during structural inspection tank trials.

plexity, in deeper water and of increased criticality to successful operations. Installation, support & maintenance of this equipment is currently carried out using specialized vessel based Remotely Operated Vehicle's (ROV's) and/or diving operations. The vision of Subsea 7 & SeeByte is to use our know-how in offshore operations and autonomous technology to provide this type of service using a hover-capable inspection AUV operating from a host facility. The ability to operate directly from the host facility as apposed to an infield support vessel provides significant advantages as routine or unplanned inspections can be easily and frequently carried out without a dedicated support vessel.

The introduction of hover-capable AUV's has some striking similarities with the path taken by ROV based tooling systems starting in the early 1980's on projects such as Chevron Montenazo, leading on to the ISO13628-8 intervention standards and the deep water operations carried out all over the world today. The hover-capable AUV concept now evolving will, like the ROV based systems, provide a unique capability that in time will change the way life of field projects are carried out.



Prototype Autonomous Underwater Vehicle passing through a structure during tank trials, without tether.

The improvements that free flying AUVs brought to the seabed survey market is a positive indicator to the potential gains that autonomous systems can bring. In little over 10 years AUVs developed for oceanographic and military applications have entered the commercial market and are now the tool of choice for deep water seabed surveys. A recent paper by Thomas S. Chance of C&C Technologies charts this development path [2]. The starting point for Subsea 7's involvement in AUV technology was a 10-year license agreement with Southampton Oceanographic Centre (SOC), commencing in 2001, for total access to current Autosub technology. Subsea 7 engineers used the Autosub template to develop a significantly modified vehicle designed and implemented to operate in the demanding oil, gas and subsea cable markets with the specification of minimum 30 hour missions in water depths to 3000m.

From the initial development phase the Subsea 7 vehicle, Geosub, has been used to help develop intelligent payload systems such as SeeByte's Autotracker [1]. This payload is used to analyse the side-scan and multibeam data in real time to detect and track pipelines. The output from the tracker is fused with the legacy data and it is used to plan an optimal route for the AUV to survey the pipe. Subsea 7's engineering know-how was also of service to SeeByte when developing the SpiNav [3] program: a payload for AUV riser inspection. Through these programs it became evident that the technology was ready for transition to a hover-capable AUV capable of carrying out inspection and eventually light intervention work.

PAIV

To get from the development environment to a point where a hover-capable AUV will be routinely used in a Life of Field project, Subsea 7 and SeeByte have jointly developed a structured three-phase plan to de-risk the technologies, develop operating methods and qualify the technology for use. To achieve this a Prototype Autonomous Inspection Vehicle (PAIV) is being developed as a test bed vehicle. PAIV has been assembled in its basic form and used for the first set of in-water tests. PAIV is based on a converted inspection class ROV and does not have the hydrodynamic form that might be expected for a self powered vehicle. It is a prototype and as such its primary function is to provide a stable and robust platform to carry the smart sensors and systems required by the SeeByte software during the de-risking phase of the development. The vehicle that will eventually be deployed to provide a service will take all the smart technology from

Life-of-Field Concept of Operations

When deployed into a field development, there are some basic tasks that the hover-capable AUV will have to carry out during every mission and some that will be mission specific. Some typical mission elements are described below. It is important to note that, unlike the seabed survey AUV where its task is to find out what is on the seabed, the hover-capable AUV will be deployed into a field development where the seabed infrastructure is relatively well understood.

Launch and Recovery
The vehicle is deployed using a deck winch or vessel crane. As the launch and recovery of AUV systems is currently recognized as being one of the major difficulties in operations, the solution to be used is both simple and robust and it taps into the techniques developed during many years of ROV operations.

Navigation
Once the vehicle is on the seabed, as part of the launch and recovery method, it will have a position error limited to a few tens of meters. This accuracy is sufficient to seed the initial frame of reference for the vehicle to start navigating by. As it moves off to locate the start point of its first task it uses real time data from the vehicle sensors to identify known features and uses this to refine its position estimate. Although the intelligence in the onboard software to achieve this is very advanced, the process adopted is well understood. We all do this when driving to a new address. Generally we find the district then look for the street and once found look for the house number. This method of navigating is different from the prescriptive script based navigation of survey AUVs, they have no real knowledge of the outside world, except that provided by absolute coordinate sensors, such as GPS or acoustic sensors. The survey AUV must therefore dead reckon using way points achieved by precisely measuring distance, heading and speed and they must fix their navigation using depth sensors and the aforementioned acoustic or GPS updates.

Inspection
As the vehicle navigates closer to the start point of the first task, the position estimate and sensor data interpolation reaches a confidence level that positively identifies the start point of the task. When this occurs the vehicle will navigate relative to the structure using the sensor data as a relative position input to the control system. In the case of a riser inspection for example, the riser will be tracked by the vehicle in three dimensions. For flexible riser inspection this active tracking is very important as any movement of the riser caused by environmental conditions will be taken into account as the vehicle maintains the optimum inspection position. The SpiNav [3] program de-risked this technology using an ROV platform in tank experiments in 2005 and offshore work in 2006.
As the vehicle moves along the riser image, condition information is gathered and stored digitally onboard the vehicle. This technique of sensor enhanced navigation, positive identification of the task start point and relative sensor based positioning of the vehicle while on-task, provides a very accurate navigation system. A high level of accuracy is achieved using relatively simple sensors that do not require the level of complexity and investment seen on the seabed survey AUVs.

Intervention
It is expected that the development path of hover-capable AUVs will follow the same path that the ROV evolution has followed, from observation tasks to simple manipulation then to intervention (look, touch, act). With the vehicle positioned relative to a structure the vehicle based senor package will be used to positively identify the intervention point and initiate the maneuver. Development of docking techniques is already well advanced. Details of this are covered in the paper entitled "Autonomous Docking for Intervention-AUVs using Sonar and Video-based Real-Time 3D Pose Estimation" [5]. Tooling required for intervention will have to be tailored to operate from an AUV. At this point in the development tooling has not been looked at in great detail as a solution is considered to be an engineering exercise rather than a technology challenge.

Communications
When the vehicle is subsurface, communication are limited to acoustic or short range electromagnetic modems. The acoustic systems will generally be used for long range communication in support of specific tasks. It might well be the case that some operations require the vehicle to report a finding or change of state. One such task could be the detection of hydrocarbons during an observation task or the change of state of a valve indicator. For this type of communication the amount of data to be sent has to be minimized to achieve robust communications. An option to install an acoustic array to provide communications and positioning information to the vehicle would be suitable for areas that require more immediate information updates.
To retrieve large volumes of data from a remote sensor in areas where direct communications is not possible requires the vehicle to be close enough to the user's receiver to use high data rate acoustic or electromagnetic modems. This type of mission to pick up data from a sensor or monitor for changes in a seabed asset over a long period of time is ideally suited to the hover-capable AUV.

PAIV and have a form factor that is tailored to the project specific seabed infrastructure. Outwardly, PAIV may appear unsophisticated but at it's center is some of the most sophisticated autonomous vehicle intelligence currently under development.

PAIV Physical Layout

PAIV — as currently configured — is relatively small. The initial design concept of a vehicle that can be easily deployed to perform trials in test tanks, inshore areas and offshore sites has been achieved. Although the vehicle is small, a legacy from the donor ROV is that most of the components are depth rated to operate at 2000m water depth, with all the components being easily upgraded when required. The key parameters of the final test vehicle are detailed below.

These figures include both the core vehicle and the battery skid:

Length 990mm
Width 750mm
Height 955mm
Weight (in air) 330kg
Depth Rating . . . . . .1000 msw (option to upgrade to 2000 msw)

Prototype Autonomous Underwater Vehicle performing a structural inspection during tank trials.

The vehicle is propelled by 6 proportionally controlled DC electric thrusters. The thrusters have industry standard high reliability brushless DC motors:

Thruster configuration . . . . . .4 vectored axial, 2 vertical
Forward Thrust (vectored) 36kgf
Vertical Thrust 24kgf
Lateral Thrust (vectored) 36kgf
Maximum Vehicle Speed . .1.8 Knots (forwards), 1.3 Knots (vertically)
Maximum Hovering Current . . . . . .1.6 Knots (horizontal current)

Battery System

An under slung skid is capable of accommodating up to 12 kWh of batteries for offshore use. Pressure tolerant Lithium ion batteries have been chosen for the vehicle as these units are now commercially available. Other options are available but are not yet mature enough to be considered for this project. Some of these options are described and discussed in the paper entitled "Energy Storage for Long Endurance AUVs" [4]. Currently a simple test battery is fitted to PAIV to provide enough power for tank testing.

Offshore Battery System
Capacity . . . . . .8 X batteries, Total Capacity 12kWh
Typical Endurance . . . . . .7.5 to 29 hours (dependant on conditions)
Charge Time . . . . . .2.5 hours

Video System & Lighting

A color camera (auto focus, auto iris, fixed focal length) is controlled by the vehicle software and images are recorded in a digital format specific to the control system. Lighting is provided by high efficiency lights. As one of the primary tasks is inspection a power budget of 150W for lights has been allocated.

Sensors

The sensors listed below are fitted. These provide the control system with enough information to navigate accurately and successfully:

- Doppler Velocity Log (DVL) provides and XYZ speed across the seabed.
- Acoustic positioning sensor to take advantage of any existing seabed navigation infrastructure.
- Digital compass, Single axis laser gyroscope.
- Depth sensor (2000msw ±0.01% FS)
- 2D, 3D Sonar systems.
- GPS receiver for coarse surface alignment.

Communications

The ability to move information on and off the vehicle in a development environment is key to efficient and rapid progress when developing new systems and procedures. Because of this the vehicle has already been interfaced to an acoustic comms system and high data rate

WiFi surface system. The final communications system will include:

- WiFi Transceiver; for high data rate surface communications over short ranges.
- Iridium satellite transceiver; for long range (global) communications with a vehicle on the surface. In case that the rendezvous plan is altered this system will act as part of the emergency tracking system.
- Acoustic modem transceiver; for underwater communications and positioning.
- On-deck USB 2 cable link.

Emergency Systems

To date the testing of the vehicle has been restricted to test tanks and there has been little need for an emergency recovery system. The next phase of the work takes the vehicle into open water and some or all of the emergency recovery systems listed below will be fitted.

- Iridium satellite transceiver
- Drop weight
- Emergency Xenon strobe light

PAIV Software Architecture

The PAIV control system is built using a modular software architecture. The modules interact with an Abstract Layer Interface ensuring ease of use and compatibility when prototyping. The design allows for real modules to be replaced by simulation modules ensuring that de-risking and testing can be done in a controlled manner.

At the core of the PAIV lies the SeeTrack DP Core. This is made up of the Mission Executive, World Model, AutoPos and Navigation modules. The Navigation module is responsible for fusing the sensor information and providing a real-time optimal estimate of the position, velocity and orientation vectors. The Autopos module is responsible for guiding the vehicle. It can interpret waypoint requests and, by using the output from the Navigation module as a reference, place demands on the different thrusters to meet those requests. The World Model keeps a representation of the world. The Mission Executive module interprets the mission, goals and assigns new waypoints to the AutoPos module.

The PAIV will be used as a de-risking platform for new modules and capabilities, for example 3D tracking of structures and navigating in the mid-water column without Doppler lock. These new capabilities can be easily interfaced as new payload modules or be made to replace existing core modules.

De-Risking Program

The program developed by Subsea 7 and SeeByte is a structured three-phase plan to de-risk the technologies required to provide the services necessary to support Life of Field operations. The stages are:-

- Prototype Vehicle Development: This includes building the vehicle, developing the control software and testing to provide a stable vehicle platform capable of operating in test tanks, inshore and offshore locations.
- De-Risk Applications: This is the development, in-water testing and qualification of the operational systems.
- Detailed Project Application Qualification: This phase concentrates on tailoring the technology to provide a specific service to a defined field development. This could involve producing a vehicle designed specifically to match the requirements of the particular work area. This development will use all the proven and qualified software models and operational procedures.

In general the de-risking process follows a simple and structured approach. This can best be described by considering the de-risking of the software components, which follows a carefully structured plan consisting of:

- Simulation: Each module can be simulated to ensure the interfaces are operational.
- Hardware-in-the-loop: Real modules can be integrated to the simulated modules and tested as part of the system.
- Tank Tests: In water tank tests can be carried out for each component in isolation, as part of a more realistic hardware-in-the-loop exercise, and for the whole system. It is important to ensure that the AUV can react to failures of components in a predictable and safe manner.
- Inshore Tests: These include in water tests in lakes and harbours. Inshore tests are an economic and safe way to test the whole system.
- Infield Testing: In the form of a demonstration this test will show the procedures and systems qualified operating in a real work environment.

Current Status

The PAIV has been built in order to test the initial software modules in a series of experiments carried out in a water tank. The tests also serve to demonstrate the systems capability. As previously described the physical form of PAIV is relatively unimportant and the status of the software development is more critical. To date the PAIV vehicle software has integrated the 3D sonar tracking payload module and an enhanced mid-water navigation module. The 3D sonar tracking module can be used to build a 3D picture of the environment by detecting and tracking targets in sonar data. PAIV can then hover and maneuver

This technology can be used to carry out complex inspection procedures: such as orbiting around a riser or a rectangular inspection of a ship hull or seabed structure.

The mid-water navigation module has been developed to ensure that the system can operate in the mid-water column when the Doppler velocity log must track the sea currents as it can offer no bottom-lock. The mid-water navigation module fuses the navigation data observations from other sensors in order to estimate the direction and strength of the water current. This information can be used to provide a better estimate of velocity with respect to the sea bottom. The aim is for the AUV to be able to transit from surface to seabed and from seabed to surface as well as transiting from one target to another in mid-water and maintain an accurate world reference. These modules have been tested in simulation and in a water tank tests.

The program has also been able to interface the existing PAIV modules to a Synthetic Environment that can be used to test each module in laboratory conditions. Tests were carried out for the 3D sonar tracking module using this environment. These tests confirmed that the system was ready for deployment.

Demonstration Results

With the support of BP and Chevron, the initial phase of this development has been successfully completed, culminating in a water tank demonstration that showcased the potential of the technology. The showcase demonstration took place at Subsea 7 test tank facility in Aberdeen, Scotland and was attended by an invited audience of key individuals form the O&G industry. The specific tasks demonstrated are described below and were all carried out as a single autonomous mission where the vehicle was sent off to carry out a number of defined tasks.

Basic Manuevers In the first part of the demonstration PAIV moved to a position in front of the tank viewing portholes and performed some basic maneuvers to show off the precision and stability in the vehicle control.

Hull Inspection On completion of the basic maneuvers PAIV moved to a start point of the hull inspection task. The location data from the forward looking sonar was used to positively identify the tank wall and lock on. PAIV then tracked the wall in a lawnmower pattern to ensure 100% coverage, gathering image data as it went. A feature of this survey is the ability of the tracking algorithm to use image and position data to ensure 100% coverage of the area. This data can then be use to create a single image mosaic of the hull. This is valuable if the real-time video data is unsteady due to environmental conditions as a clear representation of the hull can still be achieved.

Observation Task On completion of the hull inspection, the vehicle moved to a point opposite the test tank cameras to demonstrate an observation task. PAIV maintained its position in three dimensions while recording image information for some time before moving away to another inspection site for several minutes then returning to the first observation point. This demonstration was designed to show the ability of the system to carry routine observation tasks that would usually require an ROV system to be on site for long periods of time, tasks such as valve cycling and checking for control fluid leaks.

Riser and Structural Inspection The next task for PAIV was to survey a five meter high structure previously installed in the test tank. The structure consisted of a vertical cylindrical section mounted on a tripod. Flat side section fitted at the lower end of the cylinder provided an additional three surfaces to inspect. PAIV moved to the start point offset from the upper cylinder of the structure. When in location, data from the forward looking sonar was used to positively identify the cylinder and lock on. PAIV then conducted a 360 degree circular clockwise inspection of the cylinder, keeping the cylinder in the field of view of the onboard video camera by continually adjusting the vehicle heading. On completion of the circular section inspection the vehicle dropped down a couple of metres to the flat sections and inspected these by moving around the structure in an anticlockwise direction. In this inspection the tracking kept the vehicle parallel with the flat face until it reached the corner at which point it moved round the 120 deg corner changing its heading as it went to continue the inspection on the next flat face.

Confined Areas Access When PAIV completed the survey of the structure it descended a couple of metres and transited under the structure. This demonstrated the amazing flexibility that an Autonomous Vehicle with no tether has when accessing difficult-to-reach areas. On completion of this task the vehicle transited back under the structure and surfaced to upload gathered data via the

high speed WiFi link. This successful demonstration of technology to an industry audience has shown we now have the capability and development program required to offer a new solution currently unavailable to the market in the Life of Field sector.

Summary

Subsea 7 and SeeByte have a worldwide reputation for the development and implementation of remote technology systems for the subsea oil and gas industry. This was demonstrated by the execution of the world's first use of an Autonomous Vehicle on a pipeline inspection project for BP in the West of Shetlands region of the UK. This success has been followed by the development of a hovering Autonomous Vehicle concept, targeted to perform numerous activities from a host facility throughout the life of a subsea offshore development.

The ability to operate directly from the host facility provides significant advantages as routine inspections can be easily and frequently carried out without having to call in a dedicated support vessel. The Prototype Autonomous Inspection Vehicle is used to qualify and demonstrate the technologies to be embedded in the final vehicle design. With the support of BP and Chevron, the initial phase of this development has been successfully completed, culminating in a water tank demonstration that showcased the potential of the technology. This paper has described concepts, the approach to de-risking and current status of the project. It is intended to provide a clear insight into the viability of this game changing technology which our collaborative efforts will deliver to the global subsea market.

(This paper was originally presented at the Deep Offshore Technology Conference 2009)

About the Authors

James Jamieson, BSc, IET

Jamieson is an Engineering Manager in the remote technology group of Subsea 7. Based in Aberdeen, Scotland he has been actively involved in the design of control systems for Subsea 7's world wide fleet of remotely operated vehicles and tooling systems. With more than twenty years experience in this field, he has spent the last five years leading Subsea 7's AUV development work.

Dr. Ioseba Tena

Tena is SeeByte's Sales Manager. Ioseba is SeeByte's Sales Manager, and is responsible for the development of SeeByte's overall commercial strategies and managing the marketing sales process within the company. He supervises a team with a global outreach with existing customers in the continents of America, Australia and Europe. Ioseba has been developing technical solutions for the offshore industry for more than 10 years.

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Tore Halvorsen, FMC's head of Global Subsea Production Systems, provides a

View from the Top

FMC has led the charge towards complete subsea production systems. Tore Halvorsen, the company's global leader in this regard, discusses with MTR the great strides this subsea technology has made - and needs to make - in the coming years.

Please discuss with MTR your background.

TH I was born and raised in the northern part of Norway, an island called Senja, which is not far from the city of Tromsø. In 1980 I graduated from the Technical University of Trondheim (Norway), MSc in Mechanical Engineering; and I started in 1980 in the oil business; the Oil Division at Kongsberg Vapenfabrikk — the business unit later became Kongsberg Offshore — and in 1993 acquired by FMC, renamed FMC Kongsberg Subsea.

What are two or three of the most significant changes that have advanced the business of subsea technology?

TH There are obviously many significant technological breakthroughs that over the years have led to what subsea is today. There are many that I believe are the most important, including:

- Diverless installation including diverless tie-in systems: The first system was developed in 1984 and it was the enabler for moving into deeper waters. You should remember that at the time, the industry was working on programs to qualify diver operations in 400 m of water.
- Development of a reliable ROV technology: This is a clear enabler for trusting diverless systems
- Development of Multiplex Electrohydraulic Control Systems: This enabled communication and control of multiple wells (i.e. Xmas Trees) through one umbilical — which again enabled the use of subsea manifolding. This was a major breakthrough.
- Development of Flow Assurance capabilities: This was also an enabler for Subsea fields — particularly deepwater fields to understand and avoid Hydrate/Wax deposit problems. It is interesting to remember that the first Subsea well in the north sea — in the late 60's — clogged up by hydrates after a few months of operation.
- I would also comment that the development of flexible riser technology was also a breakthrough for Subsea, as it helped to avoid large top tensioned steel riser systems to bring fluid from the seabed to the FPSO.
- Ultradeep water technology was developed partly in the Gulf of Mexico, and partly in Brazil — following the speed of deepwater drilling, and today we can install systems down to 3000 m (10,000 ft).
- Also worth mentioning all the advances in drilling technology — deepwater, horizontal, directional etc which has enabled development of some of the more difficult reservoirs

A Lot of historic milestones here which were part of the Subsea development history — adding more and more confidence to the use of Subsea production systems as the primary method of developing offshore fields today.

Some of the more recent advances and technology enablers are linked to the fact that the easy oil and gas fields have been found and developed. More and more difficult fields are left to be developed, and operators want higher and higher yield from the reservoirs:

- Subsea Boosting and Subsea separation: This is a key enabler for long distance tie-back of Subsea fields - including Subsea-to-beach systems. Also a prime enabler for increased oil production as boosting will reduce the back-pressure on the reservoir allowing it to yield more production.
- Low cost Well Intervention technologies for wireline and coil tubing operations have been developed over the last several years — from 2005 — and is another enabler for increasing the recovery factor from Subsea wells.

What do you see on the horizon as having the biggest impact on the efficiency of subsea operations?

In a Subsea field, flow from different reservoir zones/wells are commingled via a manifold into larger flowlines, and this commingled fluid is transported to the platform/FPSO. It is always difficult to fully understand

how the individual wells and reservoir zones are performing. Getting physical access to a Subsea installation requires mobilization of a vessel — including a rig if a hot intervention is needed. This is expensive and operators try to avoid this as long as they can. The development and implementation of reliable instrumentation for flow monitoring, including multiphase metering of individual wells prior to commingling into the manifold. This will be a major enabler for optimal production from a multiwell field. Other areas of interest include:

- Development of condition monitoring systems for Subsea installations will enable the operators to fully understand wear and tear, remaining life of components, etc, so that an efficient intervention campaign can be planned and executed.
- Use of low cost vessels (read… *not* Drilling Rigs) for installation of Subsea fields typ Tree on wire installation technologies
- Subsea boosting to extend the life of a Subsea field
- Use of Light Well Intervention techniques from Monohull Vessels can reduce the cost of well interventions and enable higher recovery rate from Subsea wells; and
- Future development of more subsea separation and processing technologies — typ secondary separation — can eventually lead to production from a Subsea field directly to the market — i.e. the "platform" is now put on the seabed. If you think about that - no offshore personnel, no helicopter service, no offshore hotels, no offshore cantinas, no offshore gas fired power plants; the list goes on. This will be a step-chance in cost efficient operation.

FMC's reach in the subsea arena is vast. Can you boil down FMC's core competencies in a sentence or two?

Our core competences are: Strong systems/solutions knowledge (Skilled architects of Subsea fields if you like); Best-in-class base products for Subsea fields; and we are a technology leader in next generation subsea.

From a technical aspect, what does FMC do that sets itself apart from the competition?

First of all, we have a complete range of "standard" building blocks for Subsea fields. In addition we can offer the complete range of Subsea processing products, and we have the most advanced Increased Oil Recovery product range. Our strategy has always been to be the preferred partner to an operator — from the architect stage (Front End Engineering Stage) — through the development stage — and through the life of the field.

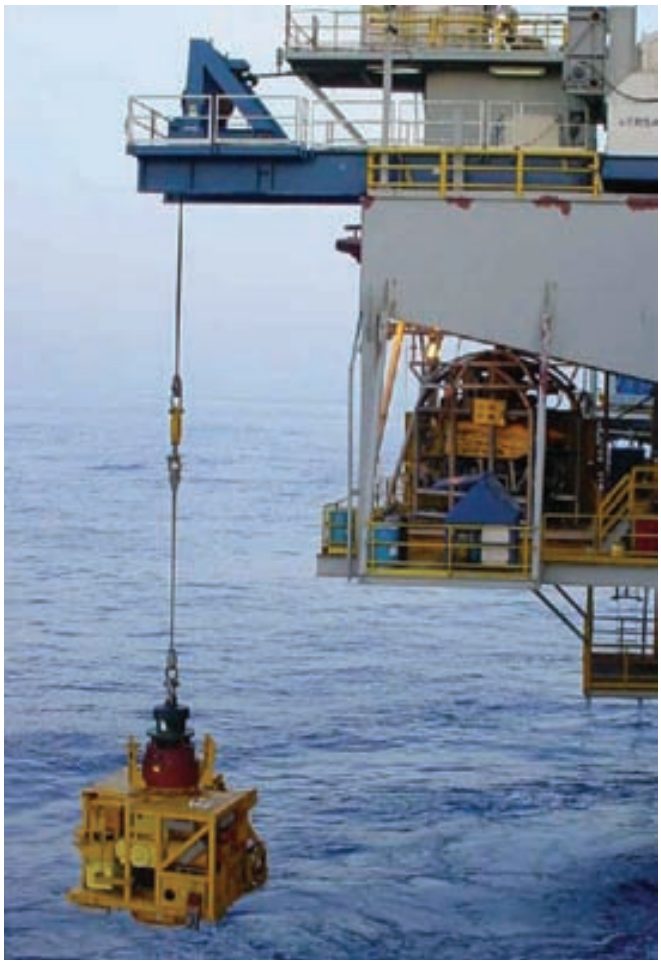
Can you provide a case study or two which clearly illustrates how a client has benefited from the use of your products/services?

Where do I start? I am particularly proud and impressed by the award of the Total Pazflor project outside Angola in late 2007. The field could not be developed without the use of a Subsea processing system. We identified Subsea processing as future technology in 1998, and we built competence for seven years, won our first Subsea processing system in 2005 (Statoil Tordis) — and used this opportunity to convince Total that Subsea Processing was a reliable technology, which led to the winning of the worlds largest contract — Pazflor — in 2007

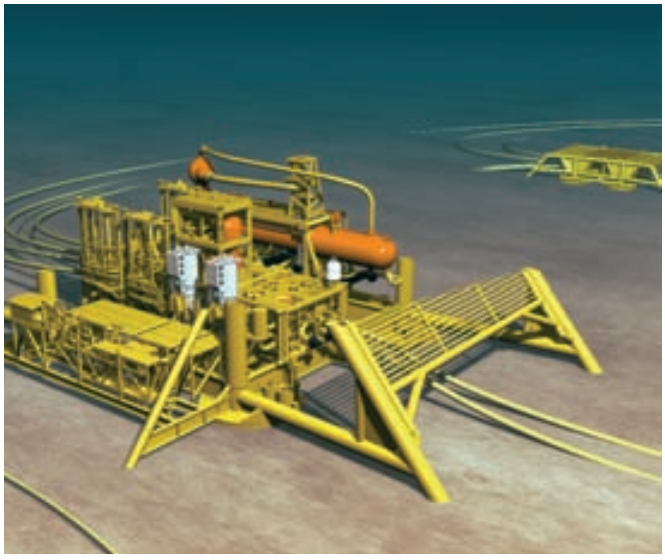
"I believe another driver will in the longer term be environmentally friendly Oil & Gas development, particularly when developments in the sensitive Arctic areas starts. Here, Subsea-to-Beach will be the most environmental friendly solution," said Tore Halvorsen, Senior Vice President, Global Subsea Production Systems, FMC.

What are the primary drivers for your business?

I believe the primary driver short term for our business is cost efficiency in development of Offshore Fields. I believe the primary driver longer term is cost efficiency in the operation of offshore fields (i.e. getting rid of the offshore platform). I believe another driver will in the longer term be environmentally friendly Oil & Gas development, particularly when developments in the sensitive arc-



Future development of more subsea separation and processing technologies can eventually lead to production from a Subsea field directly to the market — i.e. the "platform" is now put on the seabed. This means no offshore personnel, no helicopter service, no offshore hotels, no offshore cantinas, no offshore gas fired power plants; the list goes on.



tic areas starts. Here, Subsea - to - Beach will be the most environmental friendly solution.

How is the low price for oil affecting your business?

In the short term, there is a limited effect, as we are in a late cycle business, meaning that development projects have advanced quite far when we start to supply the Subsea equipment. In the longer term, we see that many operators are reconsidering their initial development plans — trying to find a lower cost development solution. This may affect the timing of some of the upcoming projects

Briefly describe your outlook for business (specifically FMC's Subsea business) in 2009 and beyond?

As described for the previous question, the 2009 business will be limited affected by the current situation. We do see some slippage of larger development projects — mainly due to re-evaluations of the development schemes.

However, we also see a number of smaller tie-back projects to existing infrastructure like satellite fields being developed and tied back to an existing platform or FPSO. This may compensate for a lot of the delays in the larger development projects.

What's happening today that will affect your business for the next 10 years?

One important trend is the drive for better and better utilization of the reservoirs. Remember that on average from a Subsea field, only 30-35% of the in-place oil is recovered. Meaning 65-70% remains in the reservoir if no other means of active recovery improvements is applied. Any technology that can improve this reservoir utilization will be important for the next 10-20 years. Also, the increased focus on cost, both development cost and operating cost will drive towards more and more advances in remote operation and control. I believe this will drive towards more and more use of Subsea systems with higher degree of processing on the seabed which will enable longer and longer transportation of produced oil and gas without final processing.

What would you name as the most significant technical advance during your career that has had the biggest impact to improve efficiency?

The fact that we have been able over the years to develop a reliable business where offshore platforms have been replaced with complete Subsea well systems is probably the most significant advances here. The line goes through a number of individual technologies that have all contributed to this major achievement.

New Bedford Ponds
Bathymetry

Prepared for Commissioner Ronald H. Labelle, Department of Public Infrastructure, New Bedford, Massachusetts

This report provides a volume assessment on the five ponds: Assawompset, Pocksha, Little Quittacas, Long, and Great Quittacas located within the towns of Lakeville, Rochester, and Middleboro in southeastern Massachusetts. A survey was conducted to collect the water depth levels throughout each of the aforementioned ponds. This data was gathered using state of the art autonomous underwater vehicles (AUV's), and the information processed through existing software augmented with a toolbox of custom utilities. This testing was completed over the course of the summer and early fall of 2008. Project funding was through the Public Infrastructure Department of the City of New Bedford; the UMass Dartmouth Advanced Technology and Manufacturing Center (ATMC) headed the effort with resources and assistance from OceanServer Technologies, YSI Environmental, Naval Undersea Warfare Center, and key personnel from the City of New Bedford. The basic goals of this effort was to improve information with regard to the bottom contours of the 5 pond system, provide data in an electronic format compatible with the existing GIS system in use for the City of New Bedford, and finally, provide an overall volume estimate of the pond system to aid in economic development decisions.

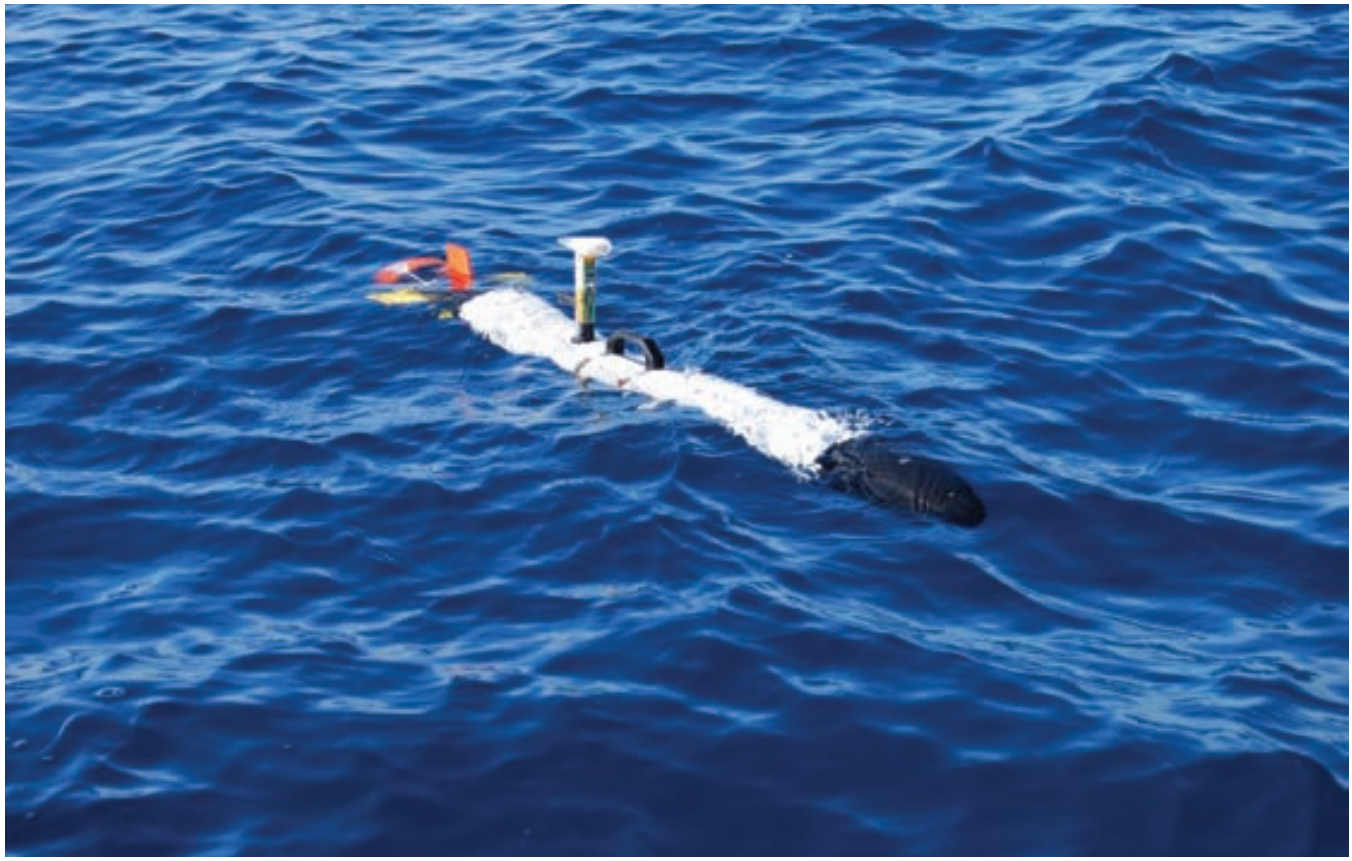
The origin of this project was based on need and opportunity. The city of New Bedford enjoys a large and pristine five-pond system as a supply source for the cities water. Any information related to the depth and bottom contour of the ponds was obtained in the late 19th century. Current information as to the volume of the ponds would be valuable in making decisions around economic development and system capacity. The University of Massachusetts Dartmouth - Advanced Technology and Manufacturing Center has had on-going research working with OceanServer, YSI, SAIC, and the Navy using small man-portable AUV's. This technology would offer a cost effective method to obtain accurate up to date information on the pond system at a level not previously possible.

An agreement was reached where the ATMC would conduct a series of pond surveys during a three-month period in the summer of 2008. Data would be collected using the AUV technologies mentioned above and analysis of the results would be done using a combination of existing and custom developed software tools. The surveys were conducted in a period between May and October of 2008 using various numbers of vehicles depending on the pond size and mission requirements as follows: Little Quittacas - May 12th - three vehicles, Great Quittacas - August 7th - three vehicles, Assawompsett - August 21st - three vehicles, also obtained some of northern Pocksha, Pocksha - September 19th - one vehicle, and Long - October 10th - three vehicles.

The survey teams were made up of a combination of ATMC staff and interns supplemented with personnel from OceanServer, YSI and US Naval personnel from NUWC of Newport all of which offered AUV operational field experience. Various combinations of these personnel were utilized on each of the surveys. In all forty-nine survey hours, fourteen AUVs were utilized resulting in 182,604 bathymetry readings.

The methodology used in this assessment makes use of the Iver2 AUV's which provide tens of thousands of data sampling points per pond, compared to sub one-hundred sampling points as used in the manual depth hydrographic survey performed over a century ago. Modern GIS interpolation techniques provide an evaluation of each pond's bathymetric features by creating a high-resolution assessment of the pond's geometric characteristics. In doing so, the volume calculation techniques are more accurate than traditional methods, and a confident assessment is established. Prior to the development of this technology, updating bathymetry data required hundreds of manually obtained depth readings at a huge labor cost with results far less accurate than what has been accomplished here. This is one of the most significant reasons that this data has not been updated since the eighteen hundreds.

Autonomous Underwater Vehicles used on Long Pond.



Survey Approach/Process

Surveys were conducted using AUV's that collect a depth measurement each second during a pre-planned mission. Throughout the mission, vehicles traverse the pond areas recording geospatial data linking position with depth. These robust data sets were then translated into bathymetric surfaces for the five ponds.

There are a number of features that make this technology ideal for this application including: Lithium Ion power source (allowing the AUV to operate for greater than ten hours per recharge), 2-knot surface speed (providing quick data collection), 1-second data logging (provides robust data sampling), and GPS reference accuracy (enables pin-point accuracy of sample location). For further details regarding the Iver2 features, please refer to the AUV description outlined below.

ATMC selected ArcGIS for data processing; this software package is already in use by the city of New Bedford is ideal for interpreting data collected from the Iver2. ArcGIS provides spatial analysis tools to examine the depth levels of the pond for water volume calculations. ArcGIS features tools that offer many options for spatial modeling and visual analysis. Since the City of New Bedford already possess the platform, information collected during this project can be electronically cataloged and accessed when needed. Should update or spot surveys be completed in the future, analysis of changes can easily be compared, likewise other information on water quality and environmental factors can be layered on this base bathymetry information providing a more complete characterization of the water body.

AUV Description

An autonomous underwater vehicle is basically a robot capable of traveling underwater and recording data for post analysis with some software tool. The Iver2 AUV developed by OceanServer Technology was used throughout these surveys. This device is ideal for coastal and shallow water applications such as hydrographic surveys and environmental monitoring. This vehicle is single man-portable and features simple point and click mission planning. The Iver2 is fully capable of subsurface operations although all the missions for this effort were conducted on the surface. Moreover, it has the capability of detecting artifacts (natural or man made) through the use of side scan sonar.

Mission planning starts by downloading available geo-referenced charts, maps or satellite images into the Iver2's mission planning software and then clicking position waypoints where you want the vehicle to navigate to. This simple but powerful tool lets you program the vehicle and sensor parameters for each leg, or for a complete survey. A rugged battery operated Wi-Fi box enables transfer of mission files between the user's personal computer and the vehicle via a remote desktop user interface. The time stamped, geo-referenced mission data can be downloaded

The AUV range.

Table 1: Summary of All the Missions Developed

Pond	Date	AUV	Mission Hours	Sample Points	Surface Area (acres)	Volume (cubic feet) (millions)	Gallons Water (billions)	Gallons Water/inch (millions)
Little Quittacas	05/15/08	4	8:30:45	30,550	297	84.5	0.6	8
Great Quittacas	08/07/08	3	12:31:26	44,840	1,128	641	4.8	31
Assawompset	08/21/08	3	15:18:53	61,135	2,091	811	6.1	57
Pocksha	09/19/08	1	2:41:22	9,647	563	226	1.7	15
Long	10/10/08	3	10:09:49	36,432	1,721	627	4.7	47
Total		**14**	**49:12:15**	**182,604**	**5,800**	**2389**	**17.9**	

into post-processing programs while the vehicle is on the surface or after the project is complete.

Defining Vehicle Missions

The vehicle follows a predefined mission plan created by the user. This mission plan is created in a graphical user environment, allowing a user to draw a mission with the mouse on an image of the mission area. The software also allows for planning of multiple vehicle missions on the same map space. Operators can modify vehicle set points for each leg to a waypoint, speed, depth, special depth such as undulate or spiral dive for data collection. Additionally, operators can click and drag any waypoints to edit a mission. The program output is an ASCII mission file that is uploaded to the AUV via a wireless interface prior to mission start.

Volume Assessment Results

How data is represented in final form is important from several aspects. Graphical representations allow for complex data to be displayed in such a way that a simple glance can inform users at one level and yet provide addition information upon closer scrutiny. The data must be logical and uniform, to that end the pond depth data is represented in various shades of blue with darker blues representing deeper areas. Although any color spectrum can be selected, this convention is known and accepted as standard. Due to the wide range of depths between ponds, the same dark blue on Great Quittacas will represent a different depth in the Long Pond image. Depth scales should be studied in each graphic. When all five ponds are displayed on one image, the color scheme is uniform throughout the system. Unless otherwise stated, all measurements are given in feet.

Each of the sections below will display individual pond survey data, one figure will illustrate the mission data retrieved from the AUV's. These black like lines are actually thousands of individual data points containing location, time, speed, depth, heading, information as well as other parameters. It is this information that is input into ArcGIS.

After using ArcGIS's Spatial Analyst, the data points were then processed with respect to their individual depth values over the entire path interval. This effectively produces the image shown in the interpolated figures below, which visually represents the ridges and layer trends of the pond floor for a more dynamic interpretation

Long pond was examined on October 10, 2008 and again consisted of 3 individual missions logging a total of 10 hours and 9 minutes and producing 36,432 data points.

Conclusion

This report provides a volume assessment on the five ponds: Assawompsett, Pocksha, Little Quittacas, Long, and Great Quittacas located within the towns of Lakeville and Rochester, in southeastern Massachusetts. An up to date survey has taken place to collect the water depth levels throughout each of the aforementioned ponds. This information was collected using multiple autonomous underwater vehicles (AUV's). The resulting data was processed through ArcGIS software and volume assessments were computed.

The techniques utilized in these surveys are far more accurate and economical to obtain than traditional labor-intensive soundings. The ability to conduct these cost effective surveys is due to recent advances in AUV technology specifically in the development of an affordable AUV in the Iver2. As a result, the City of New Bedford now has a very solid and up to date estimation on the volume of water accessible to the city.

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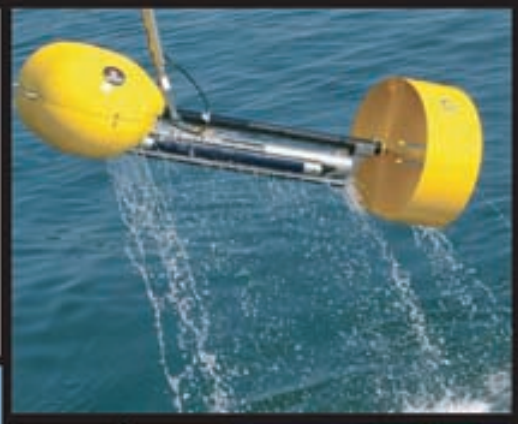

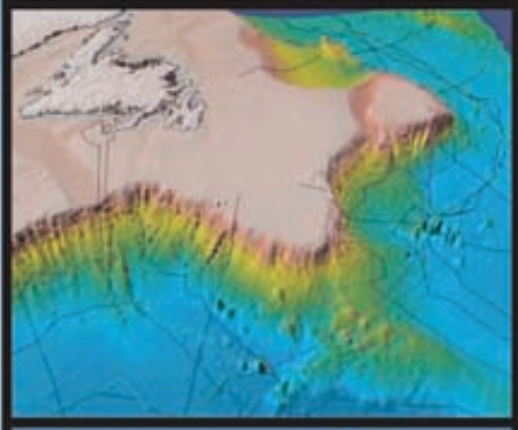

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MARINE TECHNOLOGY REPORTER

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MARINE TECHNOLOGY REPORTER

RDSea and Down East Instrumentation

Partnership in the Indian Ocean

RDSea and Associates, Inc. (RDSea), based in St. Pete Beach, Fla., has recently been awarded a prime contract from the First Institute of Oceanography (FIO), State Oceanographic Administration, Qindao, China to design, build and deploy a complete "Air-Sea Interaction" buoy and mooring system for climate research in the eastern Indian Ocean (IO). Partnering with systems integrator Down East Instrumentation, LLC, of Cary, North Carolina, engineering has begun on a state-of-the-art buoy system that will transmit subsurface oceanographic data along with a full suite of meteorological observations at the sea-surface via the Iridium Satellite Constellation back to China.

Left: Jeffrey Kinder, Managing Director, Down East Instrumentation, LLC
Right: Rick Cole, President, RDSea and Associates, Inc.

The FIO-Buoy development and deployment is in support of the Indonesian Ocean Observing System (IndOOS) and its' mooring component The Research Moored Array for the African-Asian-Australian Monsoon Analysis and Prediction Program (RAMA). The project will consist of long-term measurements of currents in the Equatorial region of the IO using acoustic Doppler current profilers (ADCP) along with temperature, conductivity and pressure sensors (moored CTDs). Funding for the IndOOS falls under the Climate Variability & Predictability (CLIVAR), World Climate Research Program (WCRP). Contributing countries consist of: India, Indonesia, Australia, the USA, France, and China. Contributors to the FIO-Buoy system are: Mooring Systems, Inc. (Cataumet, MA), subcontracted to build the buoy and mooring, Teledyne RD Instruments (San Diego, CA), Teledyne Benthos, Inc. (North Falmouth, MA), Sea-Bird Electronics (Bellevue, WA), and ORE Offshore (West Wareham, MA), all are assisting with the science and technology transfer to the IO-rim countries to help establish their own observing capabilities in the region and to promote an oceanic observing level in the Indian Ocean and understand its' role in the global climate system.

RDSea's foundation was built on Federal programs such as the Equatorial Pacific Ocean Climate Study (EPOCS), the Tropical Ocean Global Atmosphere Project (TOGA) and the Tropical Atmosphere Ocean (TAO) Program that is ongoing today in the Pacific, maintained by NOAA's National Data Buoy Center (NDBC, Stennis Space Center, MS). RDSea is presently under contract to assist NDBC and Science Applications International Corp. (SAIC) on TAO with the transition of the array ADCPs to updated technology and scheduled to soon depart on NOAA Ship Ka'Imimoana from the Republic of the Marshall Is. (Kwajalein Atoll) to recover the last remaining "Narrow Band" ADCP deployed along the equator. Ironically, RDSea President and Founder, Rick Cole was on the NOAA research cruise that deployed the very first ADCP along the equator at 170W in 1987 by the University of South Florida (USF). Rick has been employed by USF's Ocean Circulation Group for the past 20 years working on blue and shallow water physical-oceanographic programs spanning the Pacific and Atlantic Oceans, the Gulf of Mexico and the Caribbean Sea.

Down East Instrumentation provides clients with fully custom, integrated payload solutions for oceanographic buoy systems. Utilizing their extensive experience in the marine technology field, they design and fabricate cost-effective, sensor-based control and power sub-systems for the next generation of remote, real-time monitoring platforms. Down East will be responsible for designing and building the solar-charging energy sub-module that will generate power for the FIO-Buoy system. Atmospheric observations will be provided by their Automated Buoy Weather Station, a turnkey meteorological sensor package specifically designed for remote, offshore monitoring systems.

Down East will also provide the measurement and control functionality for the buoy system to include the acquisition and logging of the MET data as well as the information from the seventeen sub-surface sensors measuring temperature, salinity and currents in the upper 700-meters of the water column. The Sea-Bird inductive modem system will be used to acquire data from the mooring line with hourly data transmission from a redundant Iridium transceiver array. Down East Managing Director Jeffrey Kinder began his career at the Woods Hole Oceanographic Institution. While there, he was involved in several international programs, most notably the World Ocean Circulation Experiment (WOCE), as well as the Joint Global Ocean Flux Study (JGOFS). Following that, he was the chief engineer responsible for designing, building and maintaining the near real-time buoy array segment of both the Carolinas Coastal Ocean Observing & Prediction System (CaroCOOPS) and the Coastal Ocean Research & Monitoring Program (CORMP). Both programs have combined and evolved into a sub-regional component of the SouthEast Coastal Ocean Observing Regional Association (SECOORA), one of 11 regional associations tasked with carrying out the charter of the US Integrated Ocean Observing System (IOOS). Combined, RDSea and Down East Instrumentation have well over forty years experience within the oceanographic community.

Genet Named COO

SeeByte announced that Stuart Genet, an experienced business planner and organizer, has joined SeeByte full time in the capacity of Chief Operating Officer after working with the company as a consultant since it's inception in 2001. "Stuart Genet is the right person to oversee SeeByte's commercial future," said David Lane, SeeByte's CEO.

Stuart Genet

New Zealand-born Genet, 49, is an entrepreneur and private company analyst.

WHG Promotes Two

Woods Hole Group hired Jim Bajek, Senior Project Manager and Senior Marine Ecologist, and Dr. Heidi Clark, Environmental Scientist. Bajek, who will maintain a

Jim Bajek

Heidi Clark

Salazar Schedules Meetings on Energy Development

Secretary of the Interior Ken Salazar will host four regional public meetings in April to present Interior's findings on Outer Continental Shelf (OSC) energy resources and potential environmental impacts from their development. At the meetings, the Secretary will also hear comment from public officials, interested organizations, advocacy groups and private citizens on OCS's development. The meetings will be held at the Atlantic City Convention Center in Atlantic City, New Jersey, on Monday, April 6; Tulane University in New Orleans, Louisiana, on Wednesday, April 8; Dena'ina Convention Center in Anchorage, Alaska, on Tuesday, April 14; and at the University of California-San Francisco's Mission Bay Conference Center in San Francisco, California, on Thursday, April 16.

If persons cannot attend in person, or are unable to speak at the meetings, they are welcome to submit written statements, comments or documents, either at the meeting or during the extended public comment period. Written comments can be either submitted at the meeting or thereafter throughout the extended public comment period electronically at www.MMS.gov, "Five Year Program," "How to Comment," or by mail to Renee Orr, Chief, Leasing Division, Mineral Management Service, MS 4010, 381 Elden Street, Herndon, VA 20170-4817.

private independent consulting business in addition to his new responsibilities at Woods Hole Group, has more than 30 years experience in coastal and fresh water regulatory permitting, dredged material management and environmental assessment. He has extensive experience with the United States Army Corps of Engineer (USACE), including former employment at the New England District. Mr. Bajek will be the Senior Project Manager on Woods Hole Group's recently awarded USACE contract that can extend for up to five years, with an estimated budget of $15m.

Dr. Clark has 12 years of consulting experience with environmental and ecological industry, government and private research organizations. She recently consulted on natural resources damage assessments for marine and coastal damage from oil spills, and also has expertise related to assessing environmental impacts from energy projects.. Dr. Clark also is expert with nutrient dynamics in coastal systems, holding a Doctor of Philosophy in Environmental Science and a Masters in Forest Science from Yale University, a Master of Science from the University of Massachusetts, and a Bachelor of Arts from the University of California-Santa Cruz.

Mako DeepWater Expands Staff

Mako Deepwater increased its engineering and production staff in response to a record backlog and continued strong demand for its intervention tooling and deck equipment business lines. Tom Ayars, Mako DeepWater's President said "I'm appreciative for the loyal support our customers have shown us. With their help we've been able to defy the downward trend some companies are experiencing in the oil industry. Our intervention tooling business gets stronger by the day and the addition of the deck equipment product line in Q3 2008 has proven to be a good move for us with the award of four projects in the last several months. To continue providing our clients with fast response and reliable service, we've been pleased to have the opportunity to expand our staff, creating jobs in a softening economy."

www.makodeepwater.com

Tyco Sets Subsea Comms Mark

Tyco Telecommunications announced the successful demonstration of 40Gb/s transmission over ultra-long haul distances. The test was conducted using dark fibers on the existing Tata Communications TGN-Pacific submarine cable system that links Tokyo to multiple USA West Coast city PoPs. The data reportedly was carried from Toyohashi, Japan to Los Angeles without the need for regeneration. The demonstration marks the next step in the ongoing progression of undersea cable data rates and will ultimately enable such undersea cable systems to carry more capacity over existing links.

Aker Solutions Wins Riser Contract

Aker Solutions won another contract for the delivery of a deepwater drilling riser system to Daewoo Shipbuilding & Marine Engineering

(DSME). Contract value is approximately $36.5 million. This is the fifth deepwater drilling riser system contract DSME has awarded Aker Solutions since last year, taking the total drilling riser orders from the Korean yard up to NOK 1 billion. Delivery of the drilling riser system is scheduled for 2011. Contract party is Aker Solutions Malaysia Sdn. Bhd.

Sonardyne Expands in Houston

Sonardyne Group managing director, Barry Clutton, officially opened the new premises of Sonardyne Inc. in Houston, Texas. The event was marked by a customer 'Open House' with equipment demonstrations and tours of the new facilities. Richard Binks, UK sales director, together with representatives of Sonardyne's Survey Support Group were also present to celebrate the occasion.

Sonardyne has had an office in Houston for over 15 years, acting as a regional sales hub for the company's subsea acoustic products. At twice the size of the previous office, the new facility has been made possible by strong sales growth within Sonardyne's core North American business.

In a short presentation to invited guests and employees, Binks expressed confidence in the company's prospects and that further growth will be stimulated by the new premises and its amenities. These include a dedicated sales conferencing and customer training room, advanced repair and calibration facilities and space enough to create opportunities for local assembly of products. The new office also contains a purpose-built 10 ft. deep, in-floor test tank for acoustic source level and systems testing.

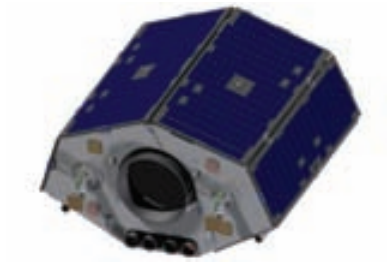
New Option for Underwater Nav

Teledyne RD Instruments (RDI) released its new self-contained Explorer Doppler Velocity Log (DVL) for precision littoral underwater navigation applications. Now, in addition to Teledyne RDI's remote head Explorer, the self-contained configuration offers users Teledyne RDI's proven Broadband technology packed into a single housing for your "power & go" applications. The unit is rated to 500m to cover your littoral navigation needs.

www.rdinstruments.com/explorer.html

Planet Ocean Signs Deal

Planet Ocean signed a teaming agreement with nearby Surrey Satellite Technology Ltd. to explore the opportunities for using bespoke micro-satellites in the oceanographic sector, particularly with respect to oil & gas operators moving into more extreme environments where traditional data sources may not be available. SSTL has been sending small satellites into space more successfully



and more economically than anyone else in the world for nearly three decades.

www.planet-ocean.co.uk

Down East Delivers Monitoring Buoy System

Down East Instrumentation delivered and installed a second real-time meteorological & oceanographic monitoring buoy system to the Carolinas Regional Coastal Ocean Observing System (Carolinas RCOOS). The first system was delivered and deployed off the coast of Wilmington, NC in May 2008 and has been continually operating since then at their ILM2 site. The latest system complements their array of real-time monitoring buoys and coastal platforms that comprise the observational component of the RCOOS. Carolinas RCOOS is a sub-regional component of the Integrated Ocean Observing System (IOOS); a federal-regional partnership working to provide new tools and forecasts to improve safety, enhance the economy, and protect our environment. The buoy system is also an addition to the inventory of monitoring assets maintained by the Southeast Coastal Ocean Observing Regional Association (SECOORA), of which Down East is a member. The Carolinas RCOOS supports the mission of SECOORA (www.secoora.org) to meet geographically specif-

ic needs and enhance the nation's ability to observe and understand US waters.

The system was successfully deployed in Feb. from the R/V Savannah, operated by the Skidaway Institute of Oceanography. It is currently situated at the FRP2 site off the coast of Hilton Head Island, SC. The buoy is outfitted with Down East's Automated Buoy Weather Station, a turnkey atmospheric sensor package designed and built specifically for the harsh conditions associated with coastal and deep water buoy moorings. Atmospheric parameters measured include air temperature, barometric pressure, relative humidity and wind speed and direction. An onboard GPS receiver tracks the buoy's watch circle and keeps its controller/data logger real time clock synced to UTC (Universal Coordinated Time). Additionally, a Sea-Bird Electronics (Bellevue, WA) SBE-37 Micro Cat is integrated into the system to provide sea surface temperature and salinity. All of the sensors are sampled once an hour and the data is telemetered to shore using the Iridium (Bethesda, MD) satellite communications network. Data received is posted to the Carolinas RCOOS website

www.carolinasrcoos.org

CTG Delivers SeaSoar

Chelsea Technologies Group recently sold a SeaSoar Towed Undulating System to the UTM CSIC in Spain. UTM required a towed vehicle with capability of undulating down to depths of 500m. The SeaSoar was fitted with a Seabird Electronics SBE 911 CTD, with dual C and T sensors fitted each side of the SeaSoar. Future planned expansion includes the integration of a Brooke Ocean Technologies LOPC, together with Turbidity, Chlorophyll and PAR Sensors.

Huawei Marine Wins Sub Cable Contract

Huawei Marine Networks won a turnkey contract signed with Tunisian Telecom in Tunisia for the supply of a submarine cable system called HANNIBAL System project linking Tunisia and Italy. The HANNIBAL System will stretch about 170km and connect Kelibia, Tunisia and Mazara, Italy across the Mediterranean Sea, with a maximum capacity of 3.2 Tbps.

Aker Solutions Wins Shtokman Contract

Shtokman Development AG has awarded a consortium comprising Aker Solutions, Technip France and SBM Offshore a contract for the Concept Definition and Front End Engineering Design (FEED) for the Floating Production Unit (FPU) for the Integrated Development of the Shtokman Gas & Condensate Field Phase I project. The contract value is Euro 25 million. The scope of work includes design, FPU concept definition, FEED design for the hull, turret and mooring system and topsides. The work will be performed by an integrated team involving the three partners of the Consortium, with Aker Solutions as leader.

FMC Wins $82m Order

FMC Technologies received orders from BP for the manufacture and supply of additional subsea systems for their projects in the Gulf of Mexico. The awards, valued at approximately $82m in revenue, are call-offs from a frame agreement that was signed in November 2006. Under these call-offs, FMC's scope of supply will consist of nine subsea trees including controls, an installation and workover control system and other related equipment. All equipment will be designed and manufactured at FMC's Houston facility. Deliveries will commence in mid-2009 and will continue through 2011. "We are pleased to be a part of BP's notable deepwater projects," said John Gremp, Executive Vice President of FMC Technologies. "Today's announcement complements our recent awards from BP for the development of subsea systems for deepwater West Africa."

IXSEA Training Courses in Aberdeen

Throughout 2009, IXSEA Aberdeen is offering regular product training on the OCTANS gyrocompass, GAPS USBL system, and PHINS INS. Further training will be offered on the DELPH range of geophysical software. Courses are held at the IXSEA offices in the Aberdeen Science and Technology Park. Courses are delivered by IXSEA's in-house engineering team. Training material is continuously updated to take account of the latest developments. IXSEA also offers client specific courses and training on IXSEA's geophysical products can be arranged.

Email: ech@ixsea.com

New Tool For Marine Geology

The Chelsea Technologies Group has recently delivered a Nu-Shuttle system specifically configured for marine geology applications. Working with Sequoia Scientific (Bellvue, WA) a redesigned compact version of the LISST 100x instrument has been installed in the Nu-Shuttle undulating towed vehicle. This is complimented with a Sontek MiniADP, OBS3+ optical backscatter sensor and MINIpack CTD-fluorimeter package. The system will be towed behind a survey vessel enabling real time profile of suspended sediments throughout the water column.

The standard LISST 100x, redesigned into two smaller pressure housings resulting in a more compact unit with better flow orientation, provides real time data on particle size distribution and volume concentration. The Sontek ADP 1.5 MHz was selected due to its small, compact size and ability to provide water current data during the survey.

Call for Papers

Northeast Shore & Beach Preservation Association
Northeast Chapter of the International Erosion Control Association
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts
September 21-23, 2009

Prospective authors are invited to submit a two page, single-spaced abstract including figures to:

Dr. J. Richard Weggel, P.E.
Department of Civil, Architectural & Environmental Engineering
Drexel University
3141 Chestnut Streets
Philadelphia, PA 19104

Abstracts are due by: May 15, 2009.

Notification of acceptance of abstracts will be mailed by June 12, 2009. Abstracts of accepted presentations will be printed and distributed at the conference. Authors of accepted papers are required to present the paper and register for the conference. No further paper will be required; however, presenters are encouraged to prepare a paper for submission to Shore & Beach, the Journal of the American Shore & Beach Preservation Association.

www.ieca-nechapter.org/coastal2009.html

COOEC Chooses New ROVs

In a major breakthrough into the Chinese oil and gas industry, Saab Seaeye has sold two Panther Plus electric work ROVs to China's largest off-shore engineering company, COOEC. It follows an earlier sale of a Panther Plus and represents an expanding capability for COOEC who are part of China National Oil.

Of the two vehicles sold to the Chinese off-shore company, one will operate from a Tether Management System, while the other is free-swimming. Technical support will come from Saab Seaeye's distributor in the region, Blue Whale Offshore Engineering Technology Company.

The ROV can cut wire rope and soft line up to 1.5 inch (38mm). It can carry out visual operations with high quality video systems. Perform pre and post drilling site survey. Undertake guidance and orientation for BOP and riser connection, depth and orientation of wellhead and BOP stack. It can also clean wellhead and bulls eyes, and change out AX wellhead gaskets.

www.seaeye.com

New Scientific Training for Sonar Experts

Six acousticians and sonar experts will gather in Newport, Rhode Island on June 1-4, 2009, to teach an innovative new course, Advanced Topics in Underwater Acoustics. This four-day course summarizes some of the "leading-edge" topics in underwater acoustics, providing an in-depth treatment of current topics of interest. Focus areas are sound propagation in deep and shallow water, ambient noise, sonar arrays, sonar signal processing, active sonar technology, and marine mammals mitigation.

The instructors include Dr. William Carey, Dr. Allan Pierce, Dr. Richard Evans, Dr Edmund Sullivan, Dr. Bill Ellison and Dr. Peter G. Cable. Dr. William Carey and Dr. Allan D. Pierce are both Professors and Editors. Dr. Evans is an applied mathematician well known for his expertise in computational acoustics. Dr. Edmund J. Sullivan, formerly from the Naval Undersea Warfare Center and the SACLANT Undersea Research Centre, specializes in Sonar Signal Processing. Dr. Peter Cable, formerly from the Naval Undersea Warfare Center and BBN Technologies, specializes in sonar signal processing and sonar system studies. Dr. William Ellison, President and Chief Scientist of Marine Acoustics Inc., is an expert in ASW performance analysis, computational performance prediction tools, ASW and the effects of sound on marine wildlife. The course will at the Marriott Residence Inn Newport Middletown, Rhode Island. The location is close to one of the Navy's leading research centers, the Naval Undersea Warfare Center in Newport, RI, so that NUWC employees can take advantage of the training, while minimizing travel costs. For more information contact Applied Technology Institute at (888) 501-2100 or register online at

www.ATIcourses.com

New Forward Looking Sonar Simulator

BlueView Technologies teamed with Marine Simulation to develop a sonar simulator based on BlueView's line of forward looking multibeam imaging sonars. The new computer based simulator is designed to be used with ROVsim Pro, Marine Simulation's flagship undersea ROV simulator and will be offered as an optional module later this quarter.

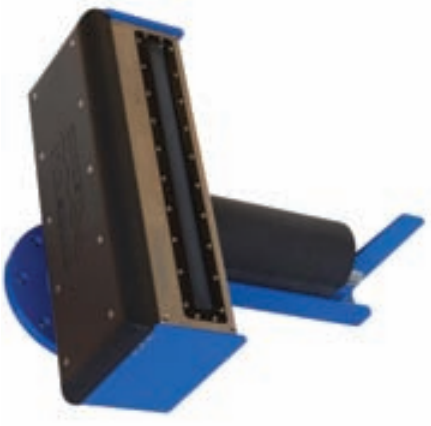
ROV pilots can now quickly learn how to navigate in low visibility conditions using the sonar's real-time feedback.

Implementing the very latest in 3D graphics and physics simulation technologies, the ROVsim Pro system is designed from the ground up to assist institutions meet the growing demand for professionally trained ROV pilots and operators. ROVsim Pro can be delivered in a wide variety of configurations and later be upgraded as future needs require. By modularizing the design and separating the program into distinct applications communicating over a simple network, ROVsim Pro can be used in virtually any training environment. ROVsim simulators are currently being used by ROV operators, universities and training centers in 11 countries worldwide.

www.blueview.com

R2Sonic, LLC

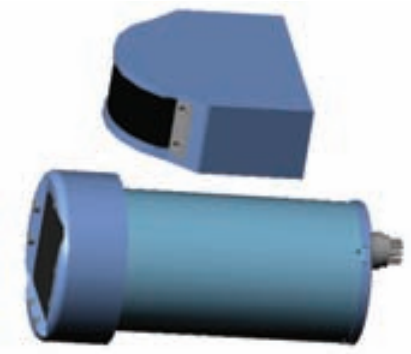
R2Sonic introduced its fifth generation Sonic 2024 Broadband Multibeam Echosounder system. The Sonic 2024 is designed to provide users maximum survey flexibility with selectable wideband frequencies in the 200kHz to 400kHz band. The advanced system architecture, with embedded processor and controller, eliminates bulky processors and inter-



face bottles. The focused 0.5° x 1° beam widths, coupled with ultra high 60kHz signal bandwidth, are designed to provide excellent resolution over bottom features and imagery. The Sonic 2024 provides productive swath coverage up to 150° (7.4x WD) with selectable ping rates up to 100 Hz enabling faster survey speeds, reducing survey time and costs.

www.r2sonic.com

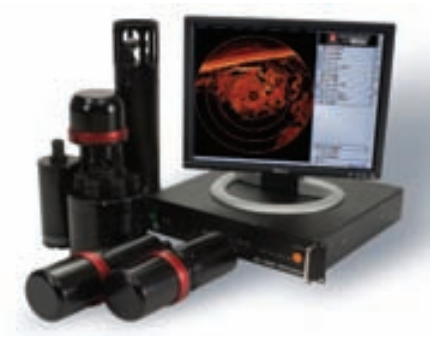
FS-3DT Bistatic 3D Forward Looking Sonar



The FS-3DT Bistatic sonar from Farsounder is a design to mount the transmitter and receiver in separate, but smaller, form factor modules. "Listening to our customers over the years, this concept is something that we have been contemplating for quite a while," said Matthew Zimmerman, VP Engineering. "Hydrodynamics can be a major consideration for some vessels, such as high speed catamarans, and very fine line motor and sailing yachts. These new modules will have a significant impact for such streamlined vessels." Separation of the module s can be horizontal or vertical allowing greater installation flexibility.

www.farsounder.com

New Scanning Sonars & Profilers



Subsea Kongsberg Maritime was scheduled to debut two new sonar products from its sonar division, Kongsberg Mesotech Ltd. The 1171 Series is a complete range of multi-frequency, fast scanning obstacle avoidance imaging and profiling sonars, which have been developed to meet the requirements for both shallow and deep ocean applications.

The dual transducer design allows optimized operational configuration for both long range obstacle avoidance and shorter range imaging detail. The transducer is protected within an oil-filled, pressure compensating dome.

www.kongsberg.com

Swedish Coastguard Selects Easytrak

The Swedish Coastguard has recently awarded Applied Acoustic Engineering a contract for two Easytrak Portable subsea tracking systems through its partner CA Clase AB of Göteborg. Easytrak is a USBL tracking system that can provide vital location information on moving targets such as divers and ROVs operating out of sight underwater, and will be primarily used in the authority's search and rescue.

www.appliedacoustics.com

Highest Resolution Magnetic Sensing

PNI Sensor Corporation announces availability of the MagIC ASIC. When used in conjunction with PNI's SEN-XY magneto-inductive sensors, the MagIC facilitates six times greater magnetic resolution and sample rates than the current PNI solution. The MagIC is a new magneto-inductive drive circuit enabling PNI's SEN-XY to more precisely and rapidly sense magnetic fields while drawing very little power.

Email customerservice@pnicorp.com.

GRL Opens ROV Pilot Support, Assessment Center

General Robotics Limited (GRL) opened a ROV pilot support and assessment centre in Aberdeen, intended to help both individual pilots and ROV operators extend and evaluate piloting skills. GRL with the

Reson Demos Waterside Security Solutions

The SeaBat 7112 and SeaBat 7123 waterside security systems were tested during NATO Harbor Protection Trials (HPT08), according to Reson. In September the NATO Harbor Protection Trials (HPT08) took place in Eckernfoerde, Germany under the auspices of the Maritime Capability Group 3 on Mines, Mine Countermeasures and Harbor Protection.

For the first time this year it was decided to look at all possible terrorist threat scenarios for the protection of ships in harbors' or berthed. These were to include attacks from the air, above water and underwater attacks. The waterside trials were designed to test the equipment in a range of realistic scenarios including Harbor inspection, inspection of a mooring and swimmer detection.

A number of companies were selected to participate in these trials in order to demonstrate their systems capabilities and Reson participated in cooperation with UK based company BAE Systems and Italian companies WASS, SELEX and Calzoni.

BAE Systems participated with the Talisman Automated Underwater Vehicle (AUV) which was designed to meet a range of operational requirements dependent on customer requirements. The Talisman can be operated fully autonomously on pre-programmed missions but also has the capability for the operator to intervene throughout the mission should the operational situation change. The operator communicates with the vehicle and systems via RF or Iridium SatCom (while the vehicle is surfaced) and via acoustic communications systems (when ve-hicle is underwater). For the trials the Talisman was fitted with a nose mounted Reson SeaBat 7123 with a dedicated software interface specifically developed to exchange target

information and receive control commands. It is believed that this was the first time that a Forward Looking MCM sonar has been fitted to an AUV.

During the exercises the Talisman was tasked to perform a harbor inspection, berth inspection and the search of an area immediately outside the harbor using SeaBat. Various Mine Like Object's (MLO's) were deployed in and outside harbor and the mission was to find and identify these objects.

Operating at 240kHz the Seabat 7123 was reportedly able to collect good quality imagery and provide a detailed survey of the harbor bottom. However, the cluttered nature of the harbor bottom made it difficult to distinguish the MLO's immediately. This issue would be addressed by building a detailed database of the harbor bottom, then using that data on subsequent re-inspections to identify new and potential threat objects,

www.reson.com

assistance of veteran ROV pilots and trainers, has developed Assessment Metrics software which used with a ROVolution simulator, objectively assesses a pilot's performance of key ROV flight maneuvers such as maintaining a flight path and tether management. The software also evaluates core competencies, like the use of navigation aids, spatial awareness and time keeping.A problem for trainee pilots is often the lack of opportunity for hands on experience. The Center offers preconfigured scenarios running on GRL's simulators from basic offshore tasks to the most complex subsea interventions.

www.generalrobotics.co.uk

ROS Unveils New LED Spotlight

Remote Ocean Systems (ROS) unveiled a new LED spotlight at this year's Underwater Intervention show in New Orleans. ROS' new MV-LED is innovative because it runs directly off of AC power. The dimmable MV-LED can be connected to the exact same power supplies and dimming circuitry previously designed for halogen lamps. Combine that with the MV-LEDs variety of connector, wiring, and mounting options, and it's clear that the MV-LED is a true "drop-in" replacement for its halogen predecessors.

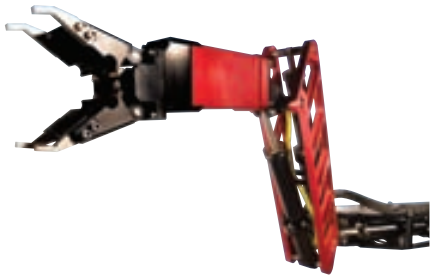
www.rosys.com

New Universal Camera Head

R. Brooks Associates added the new B618-UCH Universal Camera Head to its line of specialty video cameras for industrial applications. Robust design and construction enables the B618-UCH to operate in dry or wet environments at temperatures ranging from 32° to 120° F (0°to 49° C) and at submersed depths to 200 feet (61 m). The B618-UCH housing is made from anodized aluminum making it resistant to oxidation in salt water applications. This camera provides full color video with 18X optical and 4X digital zoom, 355° pan and +/-150° tilt capabilities for 100% visual coverage, and 70 watts of high intensity illumination. The B618-UCH is easy to set up and operate with intuitive user controls and quick disconnect cables.

www.rbrooks.com

Electric Manipulator Arm



CSIP will launch what it reports to be the market's first five-Function Electric Underwater Manipulator Arm, ARM 5E, at Ocean Business stand H2. ARM 5E has a minimum lift capacity of 25kg and can be mounted in the same footprint as a conventional hydraulic arm but does not require the use of a skid, valve pack or hydraulic pump. This saves weight and allows greater vehicle maneuverability. Like hydraulic arms, the five-Function Electric Arm can be used for clearing debris, turning values and cutting but has more incremental movement, allowing for greater accuracy and more precision in operation. ARM 5E uses a digital positioning feature to achieve accuracy of 0.5mm and the computer control electronics use position feedback to detect where the arm is at all times. ARM 5E also features a learning function which stores the maneuvers performed by the arm and combines with a memory function for repeated actions.

ROV Buoyancy Packs

Balmoral Offshore Engineering, the Aberdeen-based subsea polymer engineering specialist, has been working with the industry to create a new range of ROV buoyancy to meet continuing deepwater demands. The company's latest composite is available in five standard grades: The 415kg/m3 LD1500PF system is depth rated to 1500msw; LD2000PF is a 430kg/m3 system rated to 2000msw; LD3000PF is 470kg/m3 3000msw; LD5000PF is 510kg/m3 rated to 5000msw while the LD7000PF at 540kg/m3 is rated for work to 7000msw. The improved low density materials allow for increased levels of uplift within a defined volume. These advantages can be used in a number of ways such as reducing vehicle dimensions or increasing uplift without changing the overall dimensions, or both.

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Phone: +886-2-66000960
Fax: +886-2-27677635
Email: info@stei.com.tw
URL: http://www.allstar-stei.com.tw
Product: Oceanographic & Hydrographic Monitoring and Survey instrumentation provider.

Bowtech Products Ltd
Marketing and Project Co-Ordinator John Rushworth
Howe Moss Crescent Kirkhill Industrial Estate Dyce
Aberdeen, AB21 0GN
United Kingdom
Phone: 4401224772345
Fax: 4401224772900
Email: johnr@bowtech.co.uk
URL: http://www.bowtech.co.uk/
Product: Subsea Cameras, Lights, Cables, SEA CON® connectors, Video Control Systems, Xenon Strobes, Fiber Optic Multiplexers, Pan and Tilts, Electrical Slip Rings, Fiber Optic Rotary Joints

Deep Mar Services Limitada
Director Luis Bicho
Largo Frederch Engels nr. 4 Luanda, Angola
Phone: 244. 923 67. 03 .99
Email: dms@netcabo.co.ao
Product: Deep Mar Services S.A is an Angolan ROV services provider in Angola West Africa with an estimated of 20 ROV Pilots, all Angolan.

ECA (Etablissement de Montpellier), Formerly ECA HYTEC
Director Pierre Emmanuel GAILLARD
501 Rue de la croix de Lavit BP 4403
MONTPELLIER Cedex 5, 34197
France
Phone: 00 334 67 63 64 00
Fax: 00 334 67 52 14 88
Email: sales@hytec.fr
URL: www.hytec.fr
Product: Eca Montpellier manufactures: - Observation class II ROV (Product name: H300 MK II) - Work Class ROV (Product name: H1000) - Hybrid free-flying ROV and Crawler (Product name: Rovingbat)

International Submarine Engineering Ltd.
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Tel: 604-942-5223
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Email: info@ise.bc.ca
Web: www.ise.bc.ca

ISE Ltd is a world leader in the design and development of autonomous and remotely operated underwater vehicles as well as a systems integrator of robotic platforms. ISE's vehicles and equipment are found in all sectors of underwater activity including offshore, cable maintenance, marine science, oceanography and naval mine countermeasures. For over 35 years ISE has been one of the few sub sea companies that has experience in the development of all underwater vehicles. This combined with the experience that stems from integrating a host of payloads into these vehicles provides ISE with the ability to assist clients in finding the right solution to their needs.

EdgeTech
Simon Reeves
4 Little Brook Rd.
West Wareham, MA 02576
Phone: 508-356-9704
Fax: 508-291-2491
Email: reeves@edgetech.com
URL: www.edgetech.com
Product: EdgeTech manufactures standard and engineered to order sonar systems including side scan sonar, sub-bottom profilers and combined, integrated and modular systems for towed, AUV, ROV and custom platforms.

Hagglunds Drives Ltd
Marketing Manager Brian Holmes
Foxbridge Way
Normanton, Wakefield, WF6 1TN UK
Phone: 01924 220100
Fax: 01924 890111
Email:
brian.holmes@uk.hagglunds.com
URL: www.hagglunds.com
Product: Hydraulic motors and complete drive systems for winches and ROV deployment

Japan Deep Sea Technology Association
Executive Director Shinichi Takagawa
1-12-10 Uchi-Kanda
Tokyo, 101-0047 Japan
Phone: 03-5283-7173
Fax: 03-5283-7172
Email: takagawa.desta@nifty.com
URL: http://homepage2.nifty.com/desta/
Product: Association of Marine Related Companies in Japan to promote Marine Science and Technology, and Industries

LYYN AB
CEO & President Bengt Sahlberg
Ideon Science Park
Lund, 22370 Sweden
Phone: +46462865792
Fax: +46462865799
Email: info@lyyn.com
URL: www.lyyn.com
Product: Based on understanding of the human vision system, LYYN plug-n-play products improve visibility in real-time video, reducing fog, snow, rain, dust, lowlight and turbid waters.

Mariscope Meerestechnik
General Manager Christian Haag
Gettofer Strasse 1 24251 Ostdorf1
Kiel, Germany
Phone: + 56 65 434324
Fax: + 56 64 282896
Email: info@mariscope.de
URL: www.mariscope.de
Product: ROV, deep sea cameras, special oceanographic instrumentation

Phoenix International Holdings Inc.
7171 Highway 6 North, Suite 210

Houston, TX 77095
Email: rkeith@phnx-international.com
Product: Phoenix is a comprehensive provider of underwater services and solutions ranging from air diving thru ADS to ultra deepwater ROVs from DP 2 support vessels.

Saab Seaeye Ltd
Sales Manager James Douglas
20 Brunel Way, Segensworth East
Fareham, PO15 5SR UK
Phone: +44 (0) 1489 000
Fax: +44 (0) 1489 001
Email: rovs@seaeye.com
URL: www.seaeye.com
Product: Electric ROVs. With over 450 systems supplied to the Oil and Gas, Defense, Scientific, Environmental and Oceanagraphic markets our vehicles have a wide range of applications and provide a range of solutions to their operators.

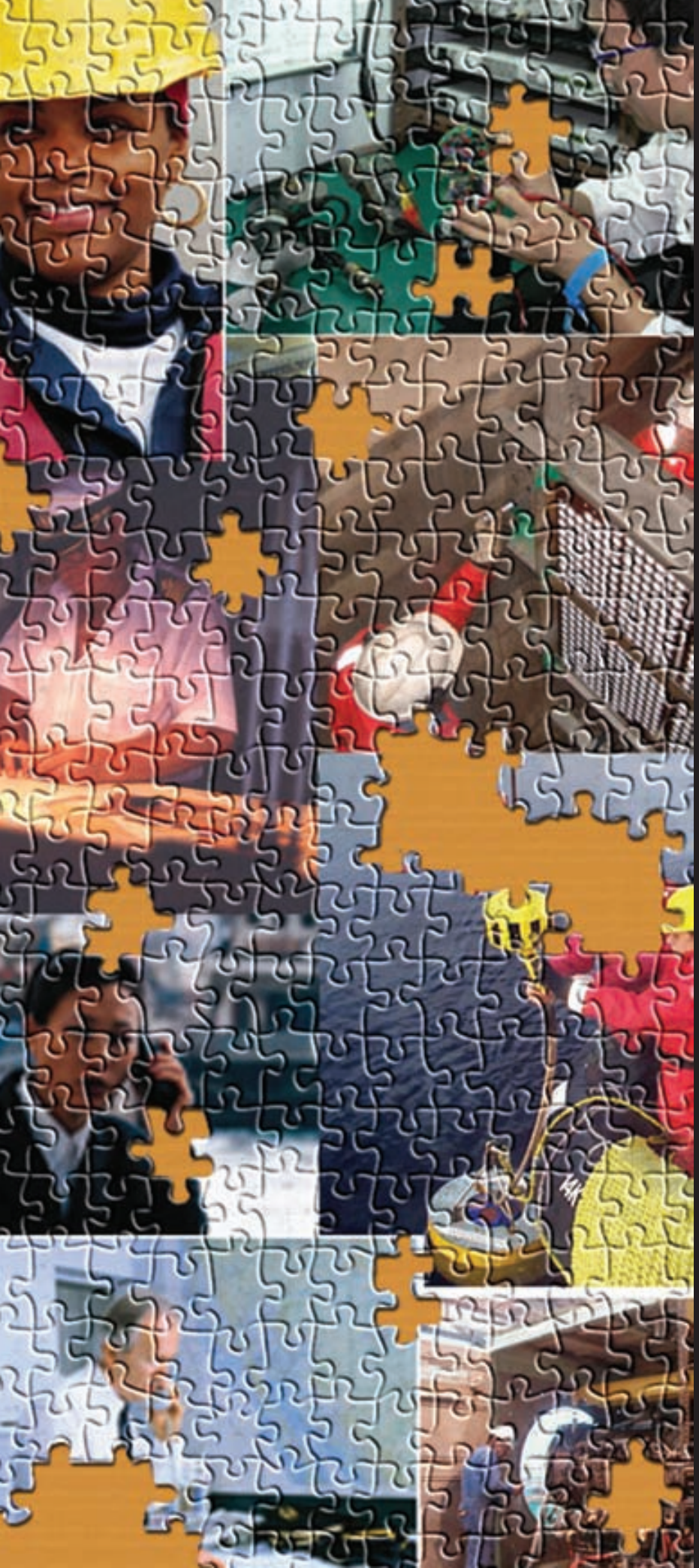
Scan Pacific Marine, LLC
Sales Manager Oyvind Kleven
909 West Esplanade Avenue, Suite 104
Metairie, LA 70065
Phone: 504 466 5788
Fax: 504 466 5703
Email: oyvind@scanpacificmarine.com
URL: www.scanpacificmarine.com
Product: Manufacturer's representative MacGregor Hydramarine cranes and ROV launch and retrieval systems, MacGregor Plimsoll winch systems, Norsafe A/S lifeboats, rescueboats, davits.

SEACON Brantner & Associates, Inc
1240 Vernon Way
El Cajon, USA 92020
Phone: +1-619-562-7071
Fax: +1-619-562-9706
Email: seacon@seacon-usa.com
URL: www.seacon-usa.com
Product: Electrical Connectors - Fiber Optic Connectors - Underwater Switches - Cable Assemblies - System Solutions

Selman Marine Design Ltd.
Technical Director Andy Selman
12 Oxhill Road
Dumbarton, West Dumbartonshire G82 4DG, UK
Phone: +44 1389 734245
Fax: +44 1389 602947
Email: Enquiries@selman-marine.com
URL: www.selman-marine.com
Product: An independent engineering company providing design and analysis of systems and vessel structures including development and integration. Solutions range from a simple approaches through full dynamic vessel motions, stability and structural FEA analysis including for vessel design, ROV and LARS system.

Webtool
Marketing Manager Richard Shortland
c/o Allspeeds, Royal Works, Atlas St,
Accrington, BB5 5LW
Accrington, BB5 5LW UK
Phone: +44 (0) 1254 615100
Email:
richard.shortland@allspeeds.co.uk
URL: www.allspeeds.co.uk/webtool
Product: Hydraulic subsea guillotine cutting tools capable of cutting a wide range of materials such as stell wire rope, cable and risers.

Werum Software & Systems AG
Sales Manager Carsten Stein
Wulf-Werum-Strasse 3
Lueneburg, 21337 Germany
Phone: +49 4131 8900-123
Fax: +49 4131 8900-20
Email: stein@werum.com
URL:
www.werum.com/en/mdm/marine/project/rov-kiel/rov-kiel.jsp
Product: Werum provides a special data management system for ROV, it manages research data collected by ROV sensors. References: ROV Kiel 6000 and ROV Quest.



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Dawn Trauthwein in the U.S. at +1.631.868.3575 or Email: dtrauthwein@marinelink.com

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Welding Inspector - Subsea

Job Description:
Monitor and inspect subcontractor sites: perform audits, NDE, weld fit-up, hydrostatic, functional testing.
Review documentation, issue non-conformance reports: assist the project team to ensure timely delivery o meet quality requirements.

Job Requirements:
Certified Welding Inspector (CWI) required (Senior CWI preferred).
Level II NDE: RT, PT, MT, and UT
Knowledge of industry codes API 6A, 17D, ASTM, ASME, AWS D1.1.
Candidates will need a minimum 5 years experience with offshore pipeline/jacket installation projects in order tto qualify for a work visa to join this highly successful team.
Applicants must be educated to degree level; all applicants need to demonstrate at least ten years of oil and gas work experience.
Candidates will need the ability to work effectively as part of a multicultural: multi-disciplinary team working on major oil & gas offshore platform projects.
Besides professional skills the candidate should possess excellent command of the English language; with strong communication and report writing skills, both verbal and written.
Our client places real emphasis in written communication skills; please ensure your resume reflects your ability to communicate in a clear and concise manner in English.
Please register online on our website: only online applications will be considered for vacancies.
Work Offshore Asia has oil jobs in Australia, Brazil, Brunei, China, Dubai, Hong Kong, Japan, India, Indonesia, Korea, Malaysia, Singapore, Thailand and Vietnam.

More information at www.SeaDiscovery.com

Oceanographer

Growing company in the field of operational oceanography seeks oceanographer.
Experience & Skills Desired:
M.S. required in physical oceanography (meteorology considered);
Field work experience, remote sensing skills, and GIS desired;
Excellent oral and written communications skills;
Successful candidate will be required to analyze data, write reports, prepare proposals, and communicate with clients;
Must be willing to travel and work weekends when necessary;
Other:
Software skills at an M.S. Oceanography level – please list.
Matlab skills required.
Resume should respond to desired skills listed above.
Horizon Marine, Inc. is a leader in commercial oceanography providing services of real-time ocean current monitoring and forecasting for the offshore industry. Excellent working environment, compensation, benefits. Salary to be commensurate with experience.

More information at www.SeaDiscovery.com

Marine Inspector

Environment Department of Dubai Municipality (http://www.environment.gov.ae) is looking to hire a Marine Inspector to work with Marine Environment and Wildlife Section. The Marine Inspector will be based in Dubai and will serve under the direction of the Senior Officer. The successful candidate will work under a two year renewable contract with Dubai Municipality.

Responsibilities include:
- On-site inspections of coastal areas, construction sites and provide guidance to site owners/occupiers on how to prevent actual and potential pollutions relating to their activities.
- Compliance inspections/assesses compliance with existing law and regulations.
- Sampling and analysis of seawater components, desalinization, and studying the effects of pollutants.
- Collection, preservation and species identification of phytoplankton and zooplankton.
- Collection, preservation and species identification of benthic organisms.
- Manage the Marine Research Laboratory.
- Operation and maintenance of marine monitoring equipment, including multi parameter probes, water samplers, plankton nets, fishing gear, and research equipment.
- Have knowledge of the principles, methods, techniques, materials, supplies, and equipment.
- Provides reports to the Team Leader, Environmental Protection Manager, Environmental Department.
- Ensures that the Incident database and other departmental records are accurate and up-to-date.

Qualifications, skills and experience
- The position requires a B.Sc/M.Sc. in science or education with working knowledge of biology, chemistry, and marine science. Experience in educational outreach is essential. A general background in database management and GIS will be given preference. Work consists of tasks that require skill in field collection techniques as well as laboratory techniques and procedures. Additional requirements include exceptional oral and written communication skills, and a willingness to work independently as well as with team. The ability to produce written reports of a high standard.
- The ability to communicate with a variety of groups and individuals.
- The ability to meet objectives on time, to manage costumers and provide services.

More information at www.SeaDiscovery.com

Research and Development Engineer

Teledyne Webb Research is a global leader in the manufacture of autonomous vehicles for oceanographic research and monitoring. We are located on Cape Cod, Massachusetts and currently have an opportunity for an outstanding individual as a full-time Research and Development Engineer.

Education/Experience: BS degree in an engineering discipline, Master's degree preferred with 8+ years experience in an oceanographic instrument/vehicle manufacturing or ocean related scientific environment essential. Broad engineering/applied physics skills required to solve inherently multi-disciplinary problems/product development requirements. Experimental skills from conception, set-up, execution, and interpretation are essential. Knowledge of all phases of Microsoft Office required. Working knowledge of Solid Works and Lab View (preferred). Experience in the oceanographic instrument/vehicle field is critical.

Description/Duties:
The successful candidate will play a critical role in the Research and Development team which will be dedicated to market driven new product development and existing product re-engineering. Requires high energy, creative individual with ability to plan and implement project tasks and hit critical completion dates. The essential functions of this position include new design/research and R&D to Engineering/Production support.

More information at www.SeaDiscovery.com

Sales Manager

CodaOctopus Products is a leading subsea technology supplier serving a varied worldwide customer base which includes the offshore oil and gas sector, worldwide port and harbour authorities, underwater construction, academic and military markets. As part of the CodaOctopus Group we have offices and sister companies in the UK, the USA and Norway. We are experiencing continued growth and are now recruiting for a Sales Manager.
Experience in the field of ROV operations or marine construction will be an advantage to applicants along with knowledge of multibeam sonar technology, motion reference systems and geophysics. Applicants are likely to have had a minimum of 3 years' experience at a similar level.
You will possess excellent verbal and written skills in communicating and negotiating at all levels. Experience in selling equipment into the marine environment, both directly to customers as well as through a network of worldwide representatives, would be an advantage, but not essential.
While based in our Edinburgh, UK office, considerable UK and worldwide travel is a requirement. A very competitive salary is offered along with other associated benefits.

More information at www.SeaDiscovery.com

Marine Surveyor/Navigator

Responsible for making sure the laying of cable at the ocean's floor is being done to contract and technical specifications according to navigational charting.
-Previous Surveying experience
-Exposure to ROV technology
-Must have experience with up to date navigational systems.
-Experience with Winfrog
-Must have great communication skills
Project will be a series of 6-8 week trips at sea for about a year, possible extension. 7 day work week while on project, pay range is about $400-$450 per day while on project.

More information at www.SeaDiscovery.com

Skipper / Boat Driver for OBC/TZ project

Terra Seis, an international seismic data acquisition company is conducting a 2 month shallow marine / TZ project in Cameroon. We pay a USS day rate, plus comprehesive insurance, full board and tickets.

More information at www.SeaDiscovery.com

Graduate Research Assistant

The School for Marine Science and Technology at the University of Massachusetts Dartmouth invites applications from qualified students to our Masters and Ph.D. programs to work on problems relating to ocean turbulence and mixing. Present research areas include numerical modeling of small-scale mixing in the ocean and/or oceanographic field studies using dye and drifter release experiments. Positions carry a tuition waiver, as well as an annual stipend.
A bachelors or masters degree in oceanography, physics, engineering, applied mathematics or related field is required. Applicants should have strong mathematical and computer skills and some background in physical and/or earth sciences.
Review of applications is ongoing, and will continue until positions are filled. Full-time enrollment beginning Fall 2009 is expected.
Applications to our graduate program are available from our website:
http://www.umassmarine.net/admissions/.
For more information, please also visit our websites: http://www.smast.umassd.edu
and
http://www.umassmarine.net.
Interested applicants should also send a statement of interest, current resume, GRE scores, and a copy of academic transcripts to:

More information at www.SeaDiscovery.com

GIS Specialist

I.M. Systems Group, Inc. (IMSG) www.imsg.com is currently seeking to hire a GIS Specialist to work at the NOAA Fisheries Office of Habitat Conservation, Habitat Protection Division (HPD) in Silver Spring, Maryland. The position will provide Geographic Information System (GIS) support and services to all staff of the HPD and all activities will be under the direction of the HPD chief. In addition, the candidate will develop GIS tools and conduct spatial analyses for NMFS to manage the essential fish habitat (EFH), hydropower, deep-sea coral, and renewable energy programs.
The Habitat Protection Division (HP) of NOAA's Office of Habitat Conservation is responsible for ensuring that NOAA trust resources have sufficient healthy habitat to sustain populations. Conservation and protection of these habitats across the United States is accomplished through partnerships with other federal and state agencies, NGOs and private entities.

More information at www.SeaDiscovery.com

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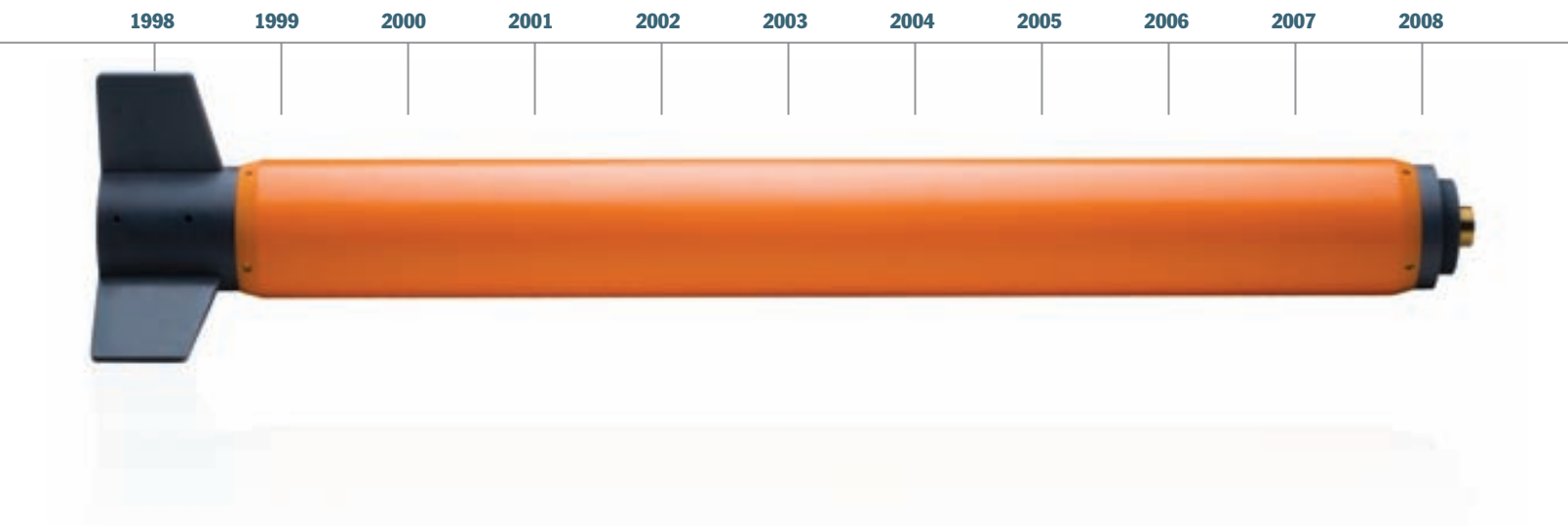
C2	VideoRay LLC	www.videoray.com	(610) 458-3000

Wine destined for the Roman colony in Cartagena finally turned up 2200 years later. It would have remained undiscovered at the bottom of the sea outside the Spanish harbor but for the sharp-eyed marine explorers of the Aurora Trust. After spotting the Roman wreck on a sonar map of the area, they sent down a Saab Seaeye Falcon ROV to investigate. Their discovery was the sight of thousands of amphora of wine, the clay jars still carefully packed in the hold of the ship where they had lain undisturbed for over 2000 years. (see inset image below)

(Photos courtesy of Saab Seaeye)

This space is reserved each month for the month's most interesting, off-beat image. Submit your images (300 dpi/.jpg) and a short (approximate 100-word) description to Greg Trauthwein at trauthwein@marinelink.com.

We got it right the first time



When we designed SeaSPY we set out to build a magnetometer that would last. A magnetometer that would not only collect data, but would be the most accurate magnetometer in the world. A magnetometer that would be free of heading errors, sensor orientation restrictions and consumable parts. A magnetometer rugged and reliable enough that our customers would use it for decades.

It seems like only yesterday when we sold our first SeaSPY, but it's already been one decade. And after 10 years and hundreds of SeaSPYs we are excited that our manifesto still holds true. We continue to look for ways to ensure that SeaSPY does the best job for our customers. And every time we do, we make the improvements backward compatible to the first SeaSPY ever sold. By the way, the first SeaSPY owner retired, but his magnetometer is working strong for a new company.

Collecting data is not the end of the story. It's the beginning.

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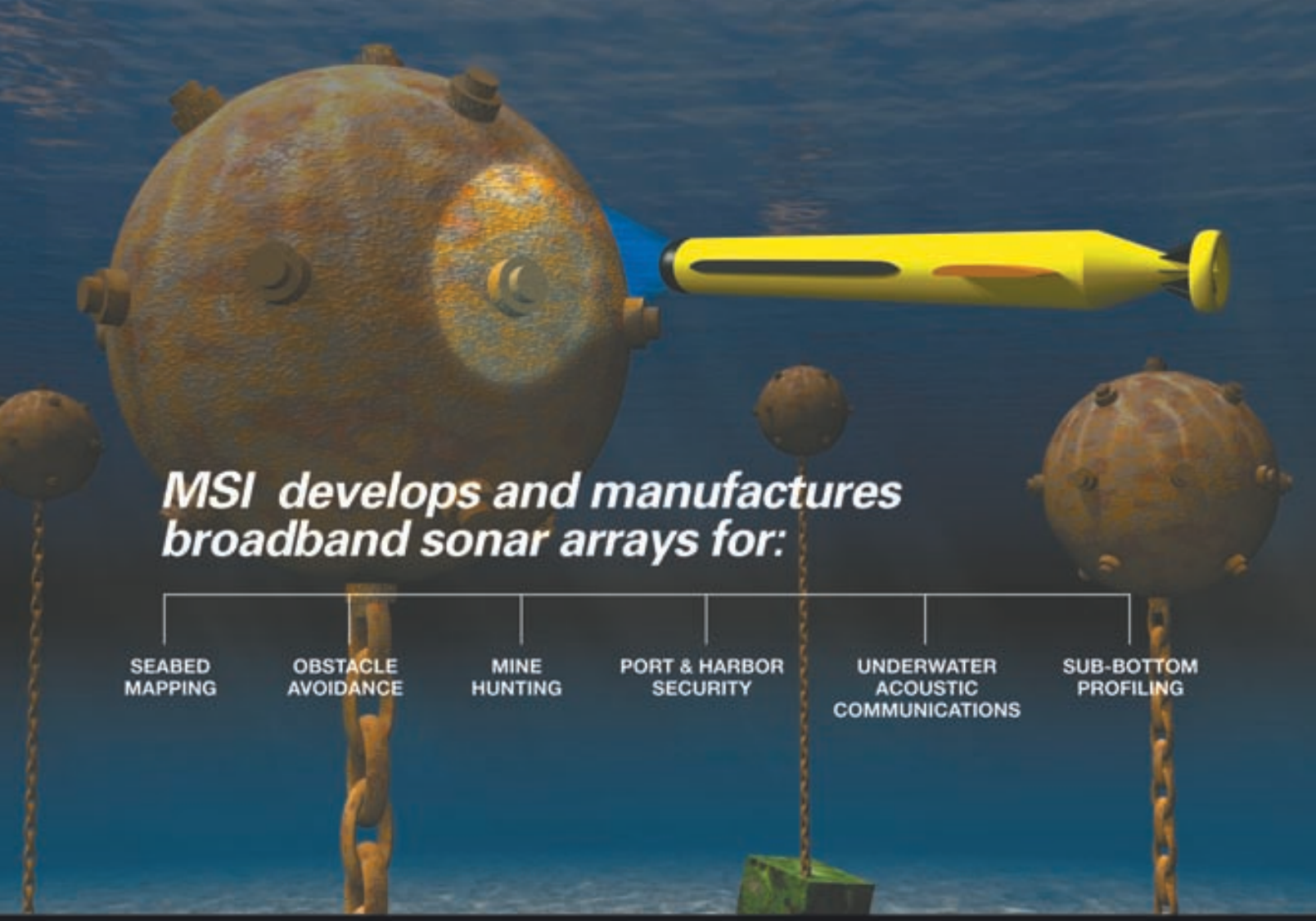

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- UNDERWATER ACOUSTIC COMMUNICATIONS
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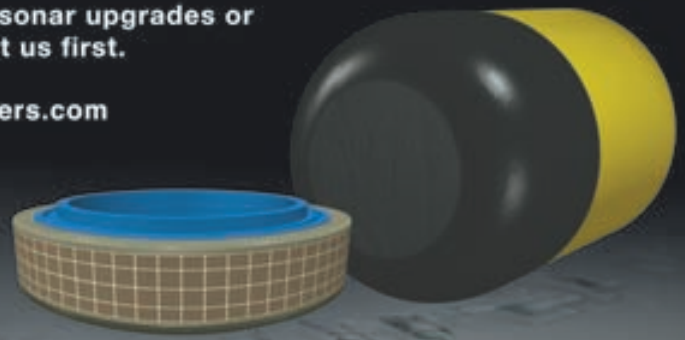

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