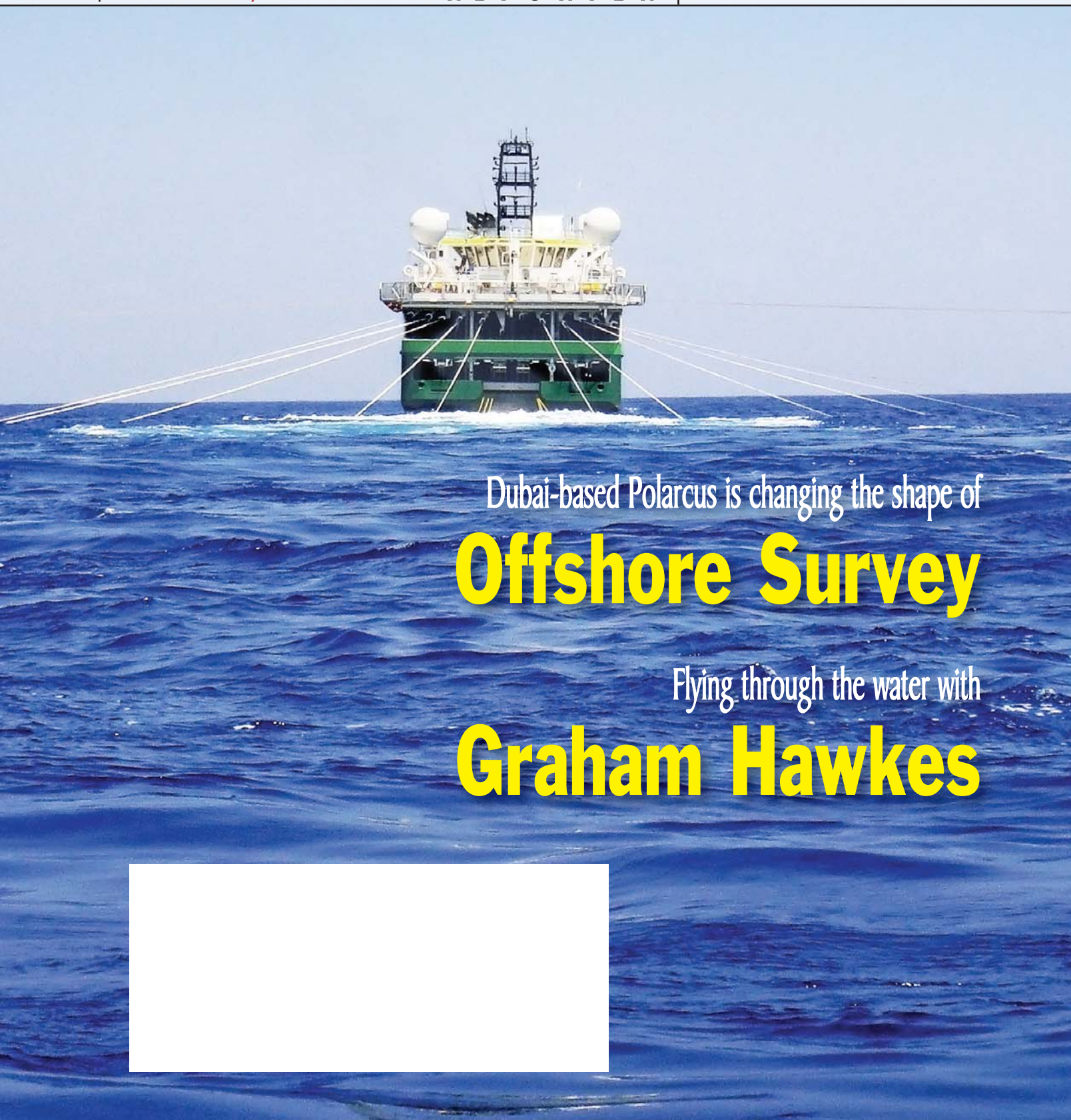
Vortex-induced Vibration of Deepwater Risers Tidal Energy: Can it be Made to Pay?

MARINE TECHNOLOGY REPORTER

April 2011 www.seadiscovery.com

5-minutes with
Charles Jones
President of Drilling & Subsea Division, Forum Energy Technologies



Dubai-based Polarcus is changing the shape of
Offshore Survey

Flying through the water with
Graham Hawkes

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April 2011

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Pictured on the Cover

is one of Dubai-based Polarcus' seismic survey vessel. The company, just three years old, has stepped into this arena aggressively, investing nearly $1.4 billion in eight state-of-the-art ships. **See Story Page 36**

(Photo: Polarcus Naila in Bergen; Courtesy: Polarcus)

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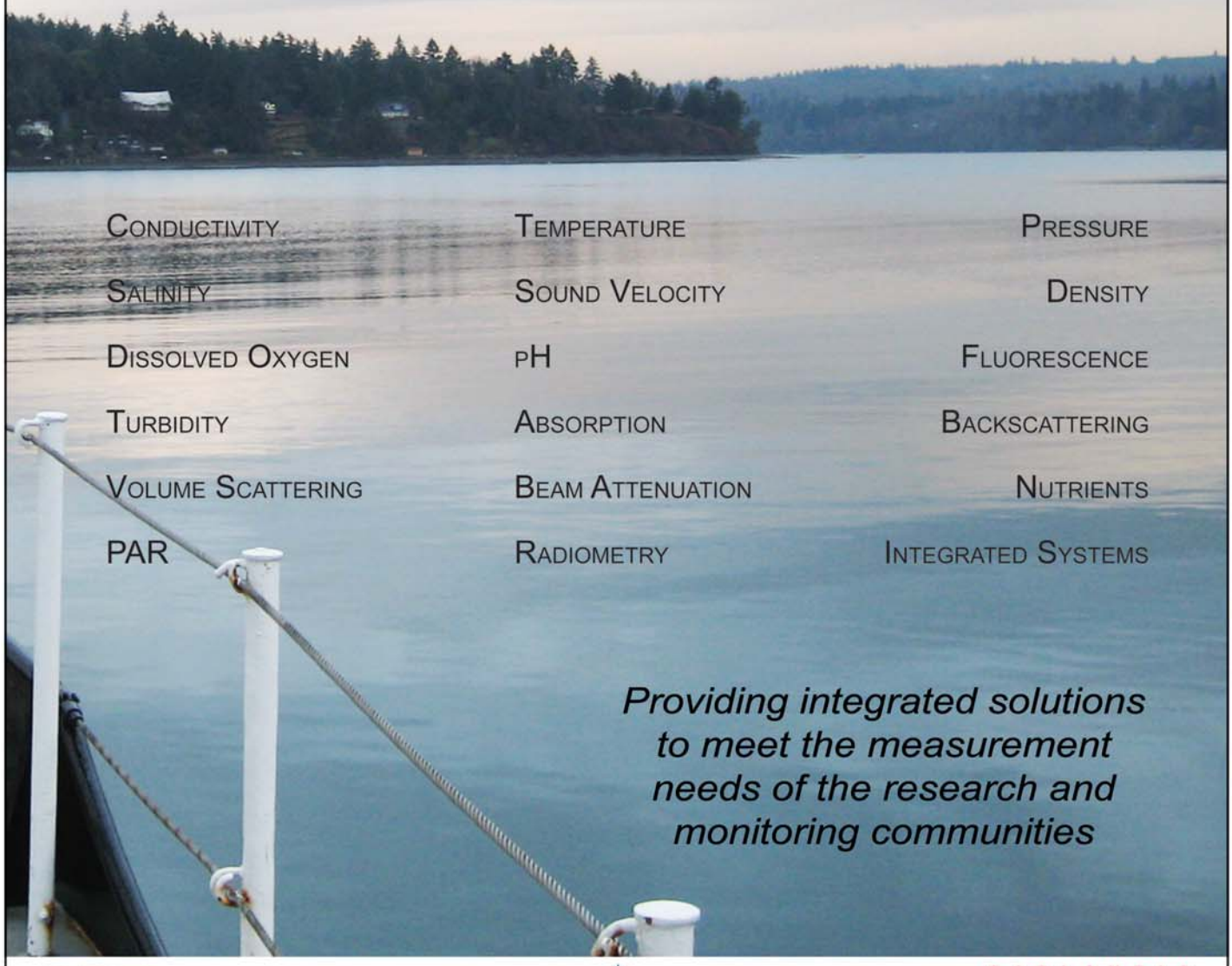

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See Story on page 18

William Kingston teaches innovation in Trinity College, Dublin, Ireland. He has held several U.S. and other patents for ocean-related devices, and originated research into the rock engineering approach to the capture of shoreline wave energy.
See Story on page 42

Chris Hartman has on-site, operational experience on major industrial, scientific and military projects. Indo-Pacific, Beaufort Sea-Artic, Siberia and GoM are some of the environments he's worked in, above and below the surface. He's a graduate of Marine Diving Technology-Santa Barbara and holds a Bachelor of Science degree in Technology. Chris.Hartman@AmericanAquanaut.com
See Story on page 46

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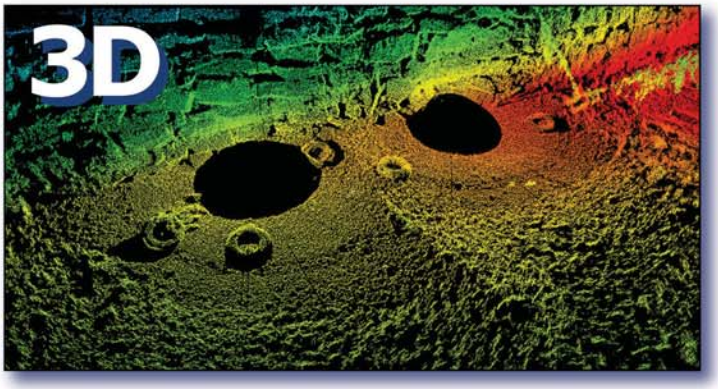

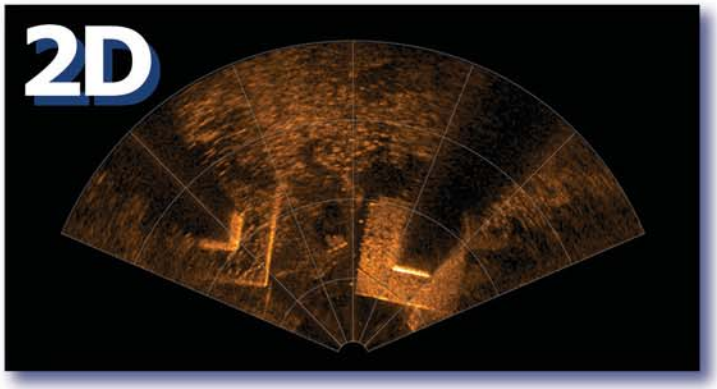

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While April 2011 is our traditional Offshore Annual, it is not fitting to start this space without discussing the massive earthquake and resulting tsunami which has wreaked havoc and inflicted a tremendous loss of life, property and created a looming nuclear disaster in Japan last month. I, like many of you, watched in disbelief and awe at the sheer power of Mother Nature, and while it is indeed a tragedy, to me it highlights more than ever the critical work that you do every day in the subsea sector, work that greatly enhances the world's knowledge of the portion of the earth's surface that we cannot see, helping to better understand and predict these events in the future.

As this is the "offshore" edition, I think you will find a more buoyant mood in the sector if you plan to attend the Offshore Technology Conference in Houston next month. $100+ per barrel of oil seems tends to make the offshore industry swoon (and the consumer curse!) The strong market has been lifted further by a quick string of deepwater permit approvals from the Bureau of Ocean Energy Management, a move applauded by the industry as the Gulf of Mexico gets back to the business of drilling for oil and gas in the wake of last year's Deepwater Horizon blow out and oil spill. A report on page 8 from IMA Associates offers a particularly bullish outlook for the Floating Production Systems, estimating an additional 120 to 175 units in the coming five years, dominated by activity to and from Brazil.

In the past few months I've had the opportunity to visit with two vastly different companies with business in the subsea sector: Polarcus in its Dubai headquarters, and **Graham Hawkes** in his workshop just across the bay from San Francisco. The latter, Hawkes, is surely a familiar name to most of you, as he has made a career of pushing commonly accepted boundaries with his underwater flying vehicles. Late last year Hawkes signaled his intention to re-enter the commercial space via Hawkes Remotes, designing and building a new family of ROVs designed to swim at full ocean depth. This story starts on page 28.

The latter, Polarcus, is a new name to the industry, just three years old but maturing fast. Executive Vice President **Peter Zickerman** explains how his company has invested nearly $1.4 billion in a fleet of state-of-the-art seismic survey vessels, outfitted and sized to meet most any need, to capture a significant portion of this business going forward.

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MARINE TECHNOLOGY REPORTER
www.seadiscovery.com
Vol. 54 No. 3
ISSN 1559-7415
USPS# 023-276

118 East 25th Street,
New York, NY 10010
tel: (212) 477-6700;
fax: (212) 254-6271

Marine Technology Reporter ISSN 1559-7415 is published monthly except for February, August, and December by New Wave Media, 118 E. 25th St., New York, NY 10010-2915. Periodicals Postage at New York, NY and additional mailing offices.

POSTMASTER: Send address changes to MARINE TECHNOLOGY REPORTER, 118 E. 25th St., New York, NY 10010-2915. Postmaster send notification (Form 3579) regarding undeliverable magazines to Marine Technology Reporter, 118 East 25th Street, New York, NY 10010.

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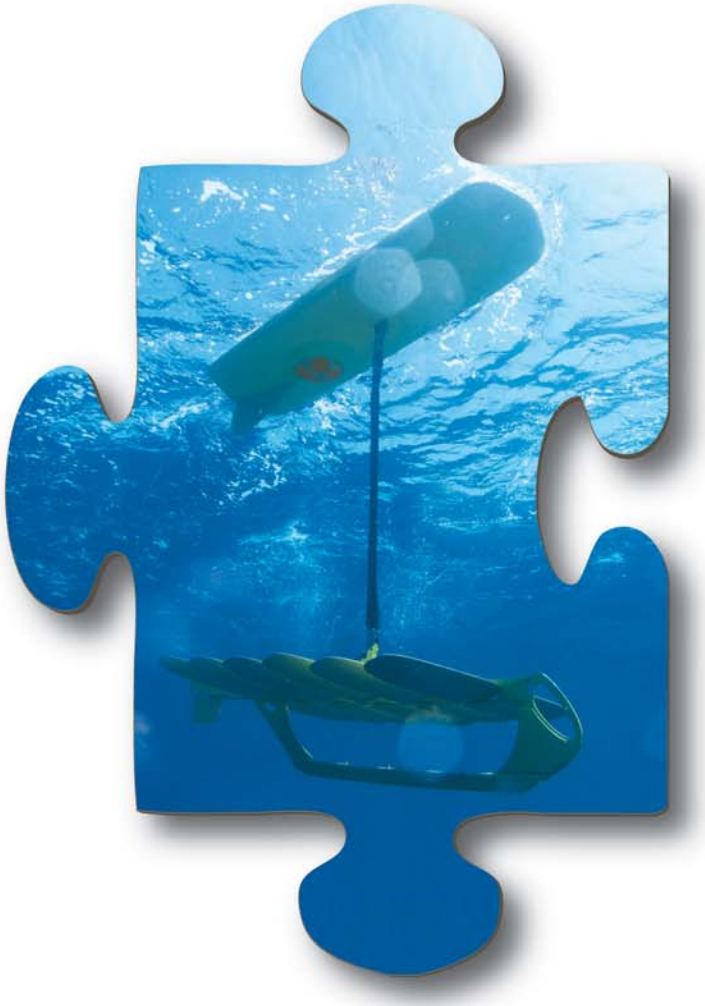
The Missing Piece in Your Subsea Puzzle



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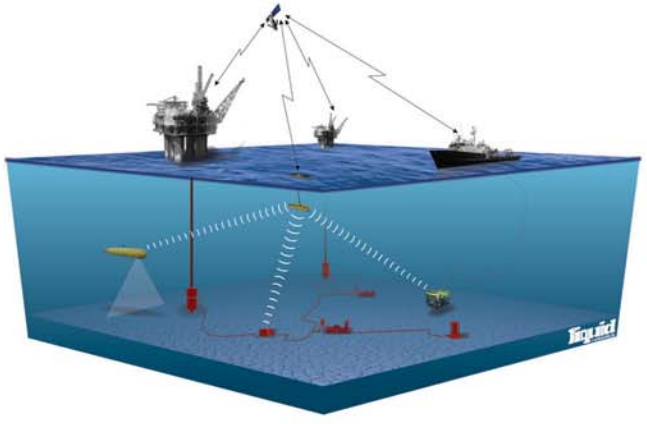

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120 to 175 Forecast Over Next Five Years

Floating Production Systems

The number of floating production systems in service continues to grow. There are now more than double the number of units ten years ago – 250 units now vs. 120 units in 2001. Order backlog, which now stands at 47 units, will increase the inventory by another 20 percent over the next several years. In a new in-depth analysis of the floating production sector, IMA identifies 194 projects in the planning stage that are likely to require a floating production system for development. Fifty-five of these projects are at the bidding/final design stage, with equipment orders likely over the next 12 to 18 months. Another 139 projects are in the planning/study stage, with orders likely in the 2013 to 2019 timeframe.

Floater Order Forecast

Overall, IMA expects orders for production floaters to average 24 to 35 units annually over the next five years. Around 80 percent of the units will be FPSOs. Capex thrown off by floater orders is expected to total $80 to 115 billion between 2011 and 2016. The forecast range reflects three potential crude pricing scenarios. The base scenario assumes oil stays in the $90-110 range, a price range IMA sees most likely over the foreseeable future. There is no indication of future slowdown in this sector. Deepwater fields are among the major sources of hydrocarbons yet to be found or developed. While no one knows the full extent of deepwater potential, the magnitude is undoubtedly huge. In Brazil alone, deepwater pre-salt resources are estimated at 70 billion barrels of oil equivalent, a figure that is likely to grow as more finds are confirmed. Some estimates see deepwater resources offshore Brazil, West Africa, elsewhere providing almost 14 million barrels of oil equivalent per day by 2030 – more than double the current contribution to global supply. According to Jim McCaul, head of IMA, "future growth indicators in the floating production sector are hugely positive. Global demand for oil continues to grow, the market is again threatened by MENA supply disruptions, oil prices have pierced $100 and virtually every major field operator has announced plans to increase offshore E&D expenditures. Deepwater drilling rigs now being built will add 38 percent to available drilling capacity, removing constraints on deepwater exploration." McCaul adds "if there is another business sector more strategically positioned for future growth, I'd like to know about it."

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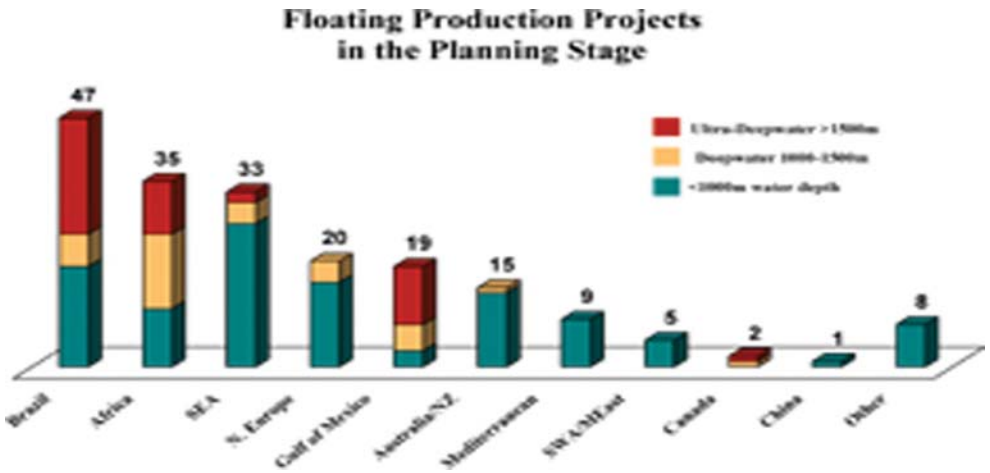

Schilling Robotics Expands Aberdeen Support Center

Schilling Robotics leased a new 15,000 sq. ft. building at Kirkhill Commercial Park in Aberdeen, Scotland. The new Aberdeen support center increases Schilling's local presence. "It has been a particularly busy time for us at Schilling Robotics and this move reflects our recent success and growth," said George Shirreffs, managing director of Schilling Robotics, Ltd. Schilling's Aberdeen operations are currently split between two buildings, and will be consolidating into this one location. The support center will include dedicated space for offices, a parts warehouse with over $3m of inventory, comprehensive workshop facilities, professional training facilities, and a dedicated ROV simulator for ROV pilot training. Additional yard space of 13,000 sq. ft. will also allow accommodation of larger equipment.

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ST Marine Delivers its First Seismic Survey Vessel

ST Marine delivered its first Seismic Survey Vessel to Swire Pacific Offshore Operations (Pte) Ltd. (Swire). In December 2008, ST Marine announced the contract to provide detailed design and to construct the 68-m vessel for Swire. Work commenced in 2009. The contract from Swire was awarded on the back of a charter which Swire secured with a major player in the seismic market. Swire provided the basic design and major equipment, including the seismic survey equipment for the vessel.

The 68 x 17.4m vessel, equipped with two medium speed diesel engines of 2880KW each, was designed and constructed in compliance with the rules and regulations of American Bureau of Shipping (ABS). The Vessel, named Pacific Finder, carries the ABS Class Notation +A1, +AMS,ACCU, E and Ice D0. The vessel also complies with the latest International Maritime Organization (IMO) MSC.266 (84) Code of Safety for Special Purpose Ships, 2008. Pacific Finder, a 4-streamer vessel, is to be deployed to carry out marine seismic survey in shallow waters for oil and gas clients in the Asia Pacific region.

The seismic survey vessel is capable of sailing at a select "survey speed" through the water with the hull and propulsion characteristics designed to produce low wake field turbulence while the survey is carried out.

"Ten Pack" Powers ROV

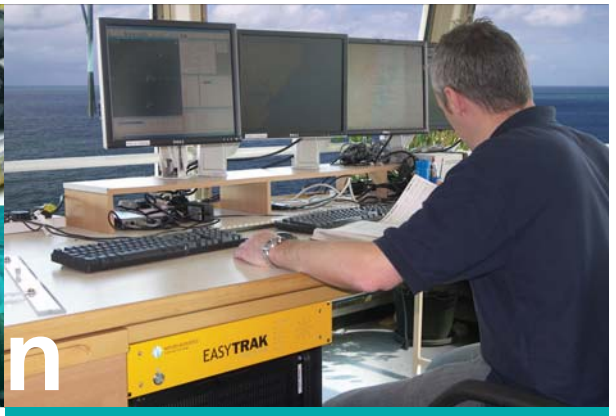
Packed with ten thrusters and with the capacity to carry a seven-function position feedback manipulator and five-function rate manipulator, the new Saab Seaeye Panther XT Plus has seen four systems sold for delivery this year.

With 50% more power, and swimming 30% faster, operators value the ability of the new Panther to hold steady in strong shallow-water currents. Although rated to 1500m water depth, the application of the Panther XT Plus in high current shallow water locations is creating the main interest from customers who wish to have more capability in these more difficult areas of operation.

To accommodate these larger and heavier manipulator arms, and provide additional capability for a greater range of tools and sensors, the vehicle payload has been increased by redesigning the frame and buoyancy of the Panther concept.

www.seaeye.com

At home in the ocean



Easytrak Nexus is the second generation USBL tracking system from Applied Acoustics.

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Subsea Deal to Aker Solutions

Aker Solutions won a letter of intent (LOI) by Statoil for the engineering, procurement and construction of a subsea production system for the Fossekall-Dompap project on the Norwegian continental shelf. Aker Solutions estimates the contract value to be approximately NOK 1 billion. Scope of work includes three template-manifold structures, 11 subsea trees, a control system and a tie-in system. The contract also contains several options for other field developments on the Norwegian continental shelf.

Seven Havila Naming Ceremony

Subsea 7, Havila Shipping and Havyard Design & Engineering held an official naming ceremony for the newbuild diving support vessel, Seven Havila, in Stavanger last month. The vessel, one of the most sophisticated of its kind, is 120m long with 1050 sq. m. of deck space and is capable of traveling at a fast transit speed of 17 knots. Owned through a Joint Venture with Havyard Shipping and Subsea 7, it is a DP Class III vessel, equipped with fully computerized diving systems and a 250 tons heave-compensated main offshore crane.

Designed by Havyard Design and Engineering, Norway and built by Havyard Ship Technology (previously Havyard Leirvik), the ship is capable of high speed transit, is classed for operations in ice and is fully NORSOK compliant. Accommodating a crew of 120, the vessel will operate with up to 24 divers.

"This is an exciting day for all concerned and is the culmination of a close cooperation with the owner, designers and the shipyard to create this state-of-the-art vessel," said Stuart Fitzgerald, Subsea 7's Vice President – Norway. "The addition of Seven Havila continues our fleet rejuvenation program and adds an industry-leading asset to our operations in

From left: Njål Sævik, CEO Havila Shipping; Øyvind Mikaelsen Vice President North Sea Canada & Russia, Subsea 7; Ingeborg Hagen, God Mother; Fabio Tocco, Captain Seven Havila; Geir Johan Bakke, President & CEO Havyard Group

Northern Europe. This key asset will assist us in winning challenging projects and work from a vessel which will differentiate Subsea 7 from its competitors in terms of safety, efficiency and productivity."

"Havila Shipping's goal is to be the leading provider of quality assured supply services to offshore companies," said Njål Sævik, Havila Shipping's CEO. "We have a top, modern fleet of platform supply vessels, anchor handlers and subsea vessels. Seven Havila is the new flag ship in our fleet and we are glad to have taken delivery of this vessel together with Subsea 7. We are looking forward to see her performing to the satisfaction of our customers in the years to come."

ABS Releases Guide for Offshore Wind Turbine Installations

ABS released a Guide for Building and Classing Offshore Wind Turbine Installations, the first Guide to address design considerations for the bottom founded support structure of an offshore wind turbine situated in tropical storm prone areas on the U.S. Outer Continental Shelf (OCS) such as the Gulf of Mexico and East Coast.

Guides developed to date have been primarily based on experience from European coastal waters. However, ABS' Guide is the first to specifically consider the conditions these structures may encounter in tropical storm prone waters. The Guide takes into account the IEC 61400 series of standards for wind turbines, the American Petroleum Institute's Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms (API RP 2A), ABS' offshore Rules and Guides and the unique environmental conditions on the US OCS.

Autosub AUV Completes Sea Trials

The Autosub L R engineering team, happy at the success and safe completion of the RRS Discovery Cruise 360: Alex Phillips, Maaten Furlong, Miles Pebody, Steve McPhail, Peter Stevenson, James Perrett, Mario Brito, Leo Steenson. Autosub LR , with top panel removed revealing the two main pressure spheres (forward – battery, aft – control system, ADCP).

Hosted by the research ship the RRS Discovery, the latest in the Autosub series of autonomous underwater vehicles (AUVs), Autosub Long Range, has reportedly completed its first set of sea trials in a location in the deep Atlantic Ocean, 300 miles southwest of the Canary Islands. Autosub Long Range is a new type of AUV developed at the National Oceanography Center (NOC) in Southampton, UK. By traveling rather slowly (0.4 metres per second), and keeping a tight rein on the power available to its sensors, it will be capable of missions of up to six months duration and ranges of 6,000 km. It can dive to a depth of 6,000 m. The vehicle will also have the capability of powering down and hibernating while anchored to the seafloor, waking up periodically or when it senses an interesting event. This opens up many interesting science mission opportunities, from, for example, long transects across the ocean basins to very detailed and long-term monitoring of a small area.

Autosub lowered into the water for its first deployment. Note the sea catcher release system, and the line on the tail, used to control the AUVs heading during launch (this is snapped off with a sharp tug).

The sea trials on Discovery in January were the first time that the AUV has been operated in water. The objectives of the trials were to confirm that the AUV could dive from the surface, control its heading and pitch accurately, and surface (giving good exposure to its radio antenna which are used for communications with operators anywhere in the world through an Iridium satellite modem).

Teledyne Webb Research Wins Coastal Glider Contract for OOI

Teledyne Webb Research (TWR) was selected to provide Coastal Gliders for the Ocean Observatories Initiative (OOI). The Slocum G2 gliders will support the Pioneer and the Endurance Arrays of the Coastal and Global Scale Nodes (CGSN) of the OOI. The contract, valued at up to$5.6m, includes a prototype vehicle to be delivered this year that will incorporate the specific sensor requirements of the CGSN. Production units will be delivered beginning in April 2012. The initial contract award is $260,000. Teledyne Webb Research was chosen by The Consortium for Ocean Leadership and the Woods Hole Oceanographic Institute (WHOI) to provide the gliders for this project that is funded by the National Science Foundation (NSF).

The Slocum G2 gliders are designed for long deployment endurance with the ability to maneuver and operate where the total water depth is less than 30 meters and up to 1000 meters along deeper coastlines. The modular vehicle construction facilitates both swappable payload bays for a multitude of integrated sensor suites and optimized buoyancy control for various depth regimes. The Ocean Observatories Initiative is a multi-scale observatory that will utilize a network of sensor systems to collect physical, chemical, geological and biological data from the ocean and the seafloor on coastal, regional and global scales. A unique cyberinfrastructure will make the data available to anyone with an internet connection.

http://www.oceanleadership.org/programs-and-partnerships/ocean-observing/

The Quest for Efficiency

By Jay Stittleburg, Area Manager (Americas) at ULO Systems LLC

WOW! What a wild ride the past few years have been for those of us in the oil and gas industry, the economy tanking, price of oil plummeting, and a terrible oil disaster in the Gulf of Mexico. But given these occurrences let's look at what has come out of it all; a demand for more stringent safety guidelines, a movement to save money and a quest for more efficient solutions. ULO Systems LLC is a company with over 45 years of experience in providing safe, economically efficient engineered solutions for:

- **Pipeline, cable, and umbilical support, stabilization, and protection utilizing fabric formwork and precast concrete mattress solutions**
- **Structural grouting for installation or repair and strengthening of offshore structures, including oil and gas platforms and windturbines.**

Fabric formwork solutions can provide the potential for hundreds of thousands of dollars in overall installation costs for offshore fields and pipelines. The equipment footprint and fabric forms require much less deck space and very little crane capacity allowing smaller vessels to be utilized for installation, thus the dayrates are lower and ULO's efficiency in installing fabric forms is quicker and more efficient than other alternatives, i.e. standard concrete mats and/or rock dumping. Additionally, long term maintenance costs are reduced based on ULO's track record of never having to replace a fabric formwork as they do not shift or topple due to currents and fishing activity.

ULO Systems is a leader in structural grouting of new or existing platforms. It is imperative in today's economic layout that companies look at ways to extend the life and usefulness of their current assets. ULO has the ability in-house to design solutions that will repair and/or strengthen existing offshore structures resulting in a longer design life and therefore allow revenue producing activity beyond its original lifecycle. This is essential as the number of existing platforms that are reaching their original design life is increasing and in need of repair and strengthening. ULO Systems accomplishes this in many ways including split sleeve grouted clamps, member/leg infilling, conductor strengthening, reinstatement of collapsed tubular, and leak sealing and/or repair and reinstatement of corroded pipes or caissons to name a few.

ULO Systems also offers specifically engineered precast concrete mattress solutions that are designed in-house to the client's exact specifications. ULO concrete mattresses can be shipped directly to the desired location (mobilization port) in 'kit' form reducing handling and transport costs. They are then assembled and cast utilizing local content under ULO supervision to ensure QA/QC. The final step is to load them on the transport and/or installation vessel and proceed to the project work site.

ULO Systems takes great pride in our work and look to engineer solutions for our clients that are safe, cost effective, and efficient. We look at the best interests of all parties that are involved and design accordingly. Over the past 10 years ULO Systems has executed well over 300 projects with zero lost time incidents, a track record that we are proud to share. Adding to our safety success is that fabric formworks are user friendly stitched textile that significantly increases the safety for divers as they are lightweight and pliable compared to a concrete mattress swinging in the currents on a crane. Furthermore, our offshore Party Chiefs have a minimum of 25 years experience and work extremely effectively with the dive superintendants and/or ROV operators during the installation process. Efficiency IS the name of the game and ULO Systems LLC offers solutions that can keep your new and existing assets working for you for many years to come. All of our technical proposals are engineered solutions performed in-house at no cost to our clients. We ask for all companies in the oil & gas and alternative energy markets to allow us to provide an engineered solution for your project that can have long lasting economic and practical effects.

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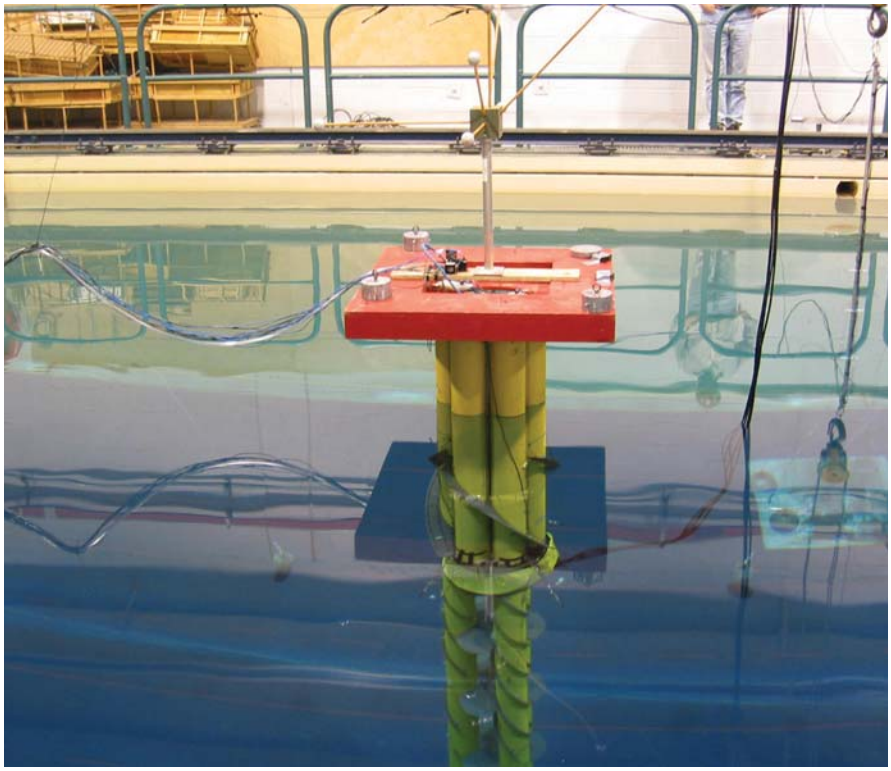
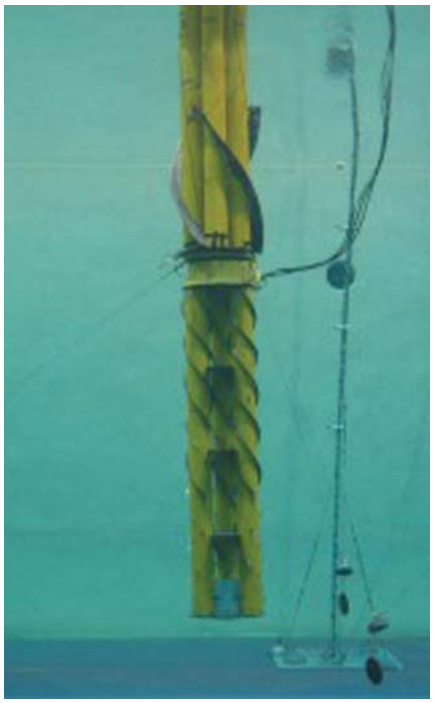
Deepwater Risers &
Hydrodynamic Performance Research

by Andrew Safer

Vortex-induced vibration (VIV) is a key issue for oil companies that are planning deepwater projects (water depth over 1,000 feet or 304 meters). VIV is the motion generated by the flow of water against the riser (the cylinder that connects the drilling or production platform to the subsea wellhead), producing vortices that are shed alternately from one side of the riser to the other. The longer the riser, the greater the VIV-induced loading, so VIV suppression devices are a critical component in deepwater riser design. As an eddy or vortex is shed from the cylinder, an area of low pressure is created pulling the cylinder to that side. Since the vortices are shed alternately from each side, this creates a cyclical loading on the cylinder ultimately leading to motion in the cross-flow direction. In order to minimize the concurrent shedding of vortices along the entire length of a cylinder, strakes are fitted to break up the vortices, thus significantly reducing the associated motion. (A strake is a spiraling strip engineered to break up uniform flow over cylinders such as on smokestacks (subject to wind loads)).

Oceanic Consulting Corporation of St. John's, NL, Canada, provides commercial research and development services to the marine industry, including conducting experiments on full-scale strakes and fairings (an auxiliary structure that serves to reduce drag) for oil majors and vendors to ensure they will provide the required VIV mitigation for specific offshore





installations. Using a high-speed experimental rig designed and built in-house, Oceanic evaluates these devices in the 200-m wave/towing tank (12 m wide by 7 m deep) at the National Research Council's Institute for Ocean Technology (IOT-NRC) in St. John's. The maximum carriage speed is 10 meters per second. Between July 2010 and January, Oceanic completed a series of strake and fairing experiments for an oil and gas company. Over the past nine years, Oceanic has conducted numerous strake and fairing experiments for oil industry clients. Oceanic's recent research was among the world's first experiments involving two risers in tandem configuration using full-scale

Dan Walker, President, Oceanic

Paul Herrington, Senior Consultant, Oceanic

specimens, one upstream from the other.

Oceanic's Senior Consultant Paul Herrington notes that in recent years, "more and more installations have multiple risers coming up through the water column that are getting closer and closer together. They're trying to incorporate more production facilities in a smaller location." This requires mitigating the VIV generated by multiple risers. In the recent research campaign, Oceanic evaluated the performance of fairings and strakes on tandem-oriented cylinders at distances ranging from three-cylinder diameters to 20-cylinder diameters apart. To do this, they used a high-Reynolds-number experimental rig capable of evaluating up to 23"-diameter cylinders in both single and tandem configurations. ('Reynolds number' is a non-dimensional measurement that takes into account three key parameters such as diameter, velocity and viscosity of the water. Offshore installations typically involve flows at high Reynolds numbers.) Oceanic built the rig in 2002 to evaluate 12"-diameter cylinders for their first DeepStar project. DeepStar is a Houston-based joint industry project between oil companies, vendors, academics and research institutes whose focus is to develop deepwater technologies. While the rig was set up in the towing tank to conduct the recent experiments, Oceanic also investigated fairings for two other clients to reduce the set-up and take-down costs for each project.

Over the last five years, Herrington notes, Oceanic has seen a marked increase in research involving fairings because they reduce the drag more significantly than strakes. **"With some fairing designs, the size of the fairing can be doubled for the same drag of a similar size strake," he adds. "As a result, Oceanic has been able to investigate larger-diameter cylinders—up to 23 inches, compared to up to 18 inches with strakes."**

Owen Oakley, a research consultant with Chevron's Energy Technology Company in San Ramon, California,

has been heavily involved with fluid dynamics research, particularly the physics and modeling of vortex-induced vibrations. He recalls Oceanic's early work for DeepStar: "They were the first to assemble a test rig where we could investigate cylinder vortex-induced vibrations in multi-degrees of freedom at full scale. We also looked at different cylinder roughnesses and the effect of ambient turbulence. It was quite revealing and set us on the path to a whole series of experiments." Oakley adds that most testing had been done in laboratories at small scales and industry needed to understand if the physics was similar at higher Reynolds numbers. "If you're going to try to dangle an array of risers in 10,000 feet of water and expect them to last 20 years, you can't afford to allow them to fatigue," he added. "We absolutely need to be able to predict what the currents and excitation are going to be, and ensure we can suppress vibrations adequately over the life of the structure. We have done extensive studies on how to reduce riser vibration with strakes and fairings, and how marine growth might reduce their effectiveness. We come to Oceanic to do these tests because they are equipped to run them at essentially full scale." Confirming Oakley's assessment, Herrington notes that since these offshore installations are such large capital programs which require assurances against VIV failures, Oceanic integrates with a variety of industry stakeholders such as oil companies, equipment suppliers, and multiple joint industry projects, including both DeepStar and the Norwegian Deepwater Programmes. Oceanic Consulting Corporation President Dan Walker started the company in 1993 to promote contract research using the test facilities at the Ocean Engineering Research Centre at Memorial University of Newfoundland, the Institute for Marine Dynamics' (now the National Research Council's Institute for Ocean Technology's) towing tank, ice tank and offshore engineering basin, and the flume tank and Centre for Marine Simulation at the Marine Institute, all located in St. John's. In 1996, Oceanic built their first experimental rig to test fairings that had been developed to reduce the drag on the cables of a seismic array. In 2003, they conducted a variety of experiments on what was to become the world's first cell spar facility in the Red Hawk field in the Gulf of Mexico. These included evaluating the VIV characteristics and resistance drag loads of the floating production facility, and the hydrodynamic loads on strakes. Most of Oceanic's full-scale VIV work has been completed for projects in the Gulf of Mexico where there are loop currents, and offshore Brazil, where there are deep surface currents.

Worldwide Internet Based Data Acquisition from

Remote Platforms

A novel concept for using a low power web server integrated in a data acquisition platform for transferring data using "http" was developed by SAIV. The data is directly transferred from a field station to the end user without any intermediate links via the Global System for Mobile Communications (GSM).

By Bard Sagstad, SAIV AS & Trygve Gytre, Institute of Marine Reseach

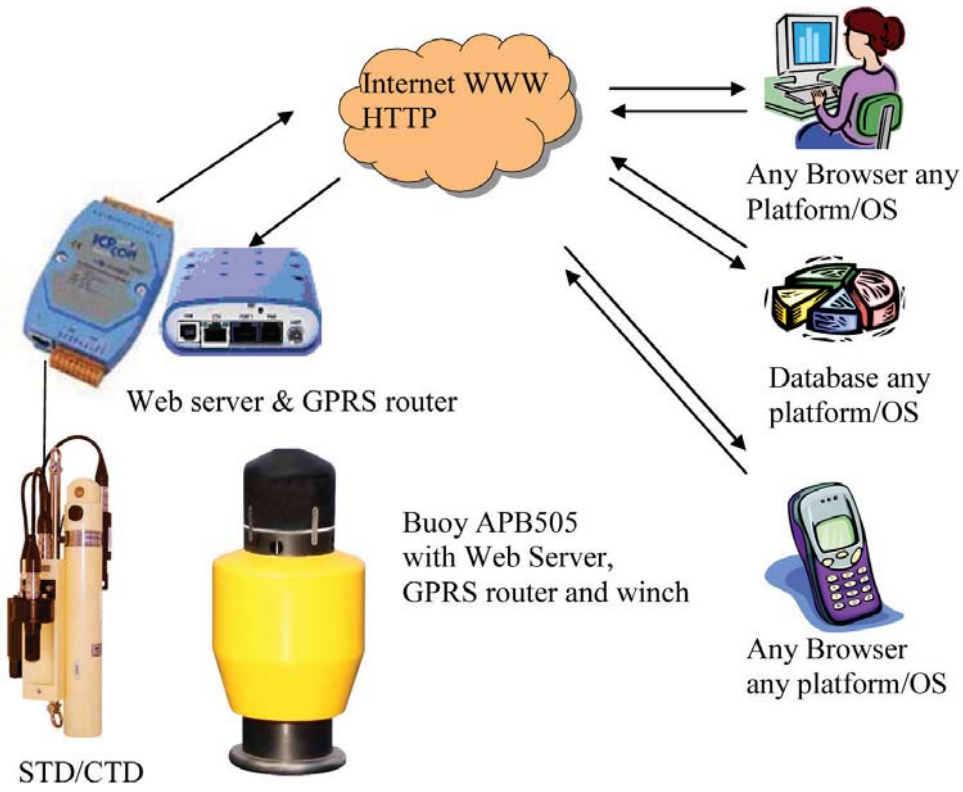
The need for remote controlled environmental sensors in aquatic environments is accelerating. The growing business of intensive fishfarming in large scale pens, as well as the increased need for continued environmental monitoring of standard variables has made it necessary to focus on the development of reliable, flexible and automatic control of the monitoring systems.

The Norwegain company SAIV has specialized in design and production of innovative marine/aquatic sensors and data acquisition systems. Their best known products are the STD/CTD probes model SD204 and a family of high accuracy water level/pressure sensors.

Recently SAIV started to use a new low power, fast web server on data acquisition systems in order to communicate data worldwide between remote instrument platforms and their users using the hypertext transport protocol "http". This report describes the use of and experiences with the http - protocol in two actual data acquisition projects: A tidal measurement system for the Faeroe Islands authorities and an intelligent fish welfare monitoring system for the Norwegian aquaculture industry.

Background

Traditional data communication systems for data



Web server with dynamic HTTP using GRPS router to the WWW: Many users can connect at any time without interrupting measuring sequence at the platform.

exchange with remote observation platforms (typically moored oceanographic buoys and ships of opportunity) are still primarily based on modem interconnection between the observation platform and the user. However, modem-based communication systems suffer from several shortcomings:

1. Only one user can connect to the system at a time;

2. The connection may be interrupted if new users try to connect the system;

3. They generally need complicated "black boxes" of specialized software;

4. If connection is interrupted during the transmission, the downloading process must be repeated from the start;

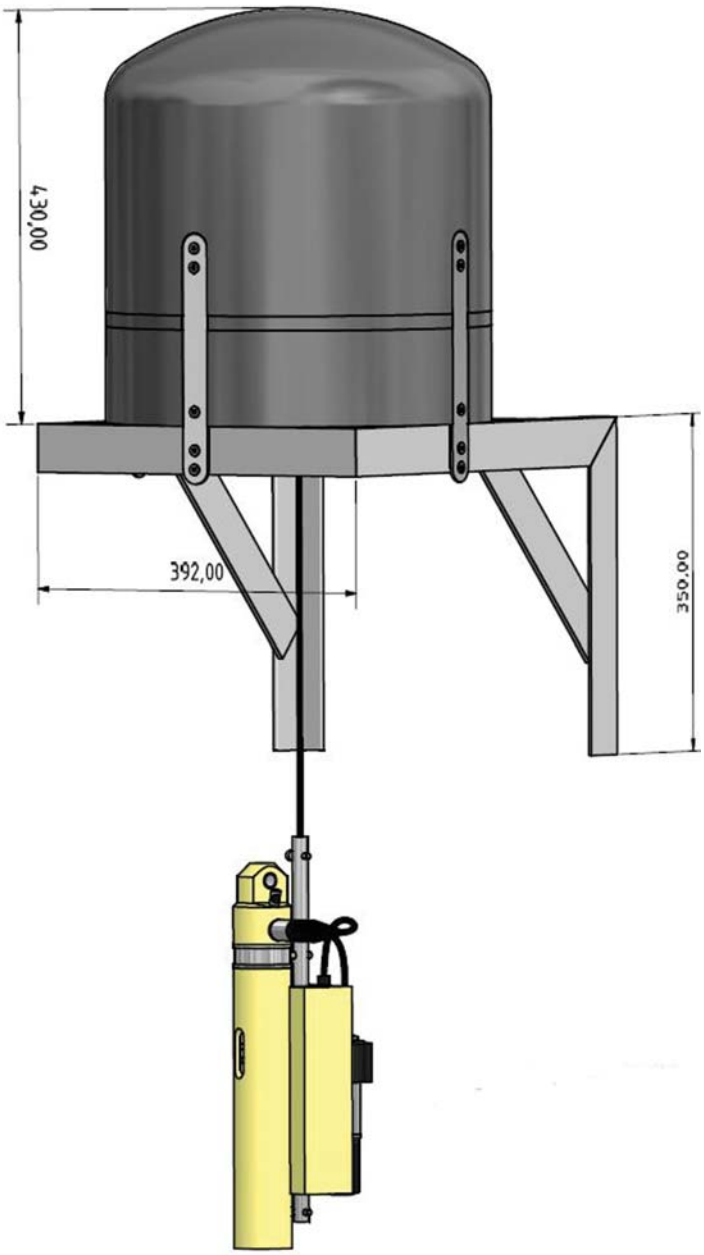
5. Many GPRS formatted - communication solutions are blocked by the typical firewalls used in large corporations.

Using the Internet Via an Embedded Web Server

Improvements in traditional modem based data communication are developed. New networks based on GPRS (General Packet Radio Service) which is a part of the GSM (Global System for Mobile Communication) allow direct communication to the internet in the receiving "top" end. Connection to the internet is still limited to land and coastal regions, but access to open sea is increasing.

Using GPRS alone is possible, but it represents only the first step on the path to efficiently use the internet for remote data acquisition. Full use of the internet potential can be obtained by simply adapting to the existing TCP/IP (Transport Communication Protocol / Internet Protocol). The "http" (hypertext transport protocol) has long proved to be the most successful communication protocol so far. All that is needed to gain full use of the internet is therefore to select a suitable embedded web server to the subsystem and apply the "http" protocol to communicate data. This is what SAIV has done in their two new data acquisition system to be described here.

The embedded web server which has been upgraded with a new TCP/IP protocol and with DOS based software has shown to be successful for supplying fast and trouble free data communication. Using a 40 MHz MCU (Micro Control Unit) the boot time is typically 0.1 seconds. After the web server with software has started, the system becomes operative within 0.3 – 0.5 seconds. In comparison, a typical embedded Linux OS system working with much higher frequency needs approximately five seconds to start and an additional 2 – 3 seconds to start the web server. During this time lots of codes must



Profiling Control Unit APC506 with bracket.

be exchanged, and as all programmers have experienced: Lots of codes tend to generate lots of bugs.

SAIV's technology for web based data exchange may become a forerunner for future fast and simple data exchange via the internet. By including servers with individual IP address in data platforms like moored buoys, ships of opportunity and land-based instrument installations; both recorded data and vital information needed for service and maintenance will become worldwide and immediately available via any browser. In the future satellite based GSM stations will cover most parts of our globe. This year SAIV has completed two projects based on an embedded server, which are described here as illustrative examples:

Example 1: Water level stations on the Faeroe Islands.

SAIV has supplied and installed a total of eight water level stations for Landsverk, Torshavn on the Faeroe Islands (figures 5 to 7). The water level stations have been in operation for more than three years, and reported the water level and temperature continuously via the internet. Each station consists of a water level sensor TD301R, a Web Server and a GPRS router. The sensing element in the TD301R is a unique pressure sensor with built-in temperature compensation, a feature that maintain the high accuracy (0.01%) over a broad temperature range (-2 to +40 deg C). Atmospheric pressure is directly compensated for by an air pipe inside the cable. The air pipe is vented through a Goretex filter on the On-land-Unit.

Example 2: Automatic Profiling Buoy APB505

The production of Atlantic salmon in large fish pens is an important and expanding business in Norway. Open fish pens for Atlantic salmon may be more than 50 m in diameter and 40 m in depth and contain more than 200,000 individuals. In order to fully control and maintain the fish welfare in such densely populated biological systems a frequent profiling of sea parameters like temperature, oxygen saturation, salinity, fluorescense, turbidity and current velocity is generally needed. Equally important is correct assessment of the fish welfare based on these observations. Unfavorable living conditions may cause bad fish health and slow growth. Serious lack of oxygen may cause mass deaths. Therefore, in order for a fish farmer to be continuously kept updated with his fish welfare status, SAIV, in cooperation with the Governmental Institute of Marine Research (IMR) in Bergen has developed an innovative new profiling buoy APB505 for continuous monitoring and documentation

of the pen environment.

The APB505 is originally designed for monitoring water quality in the fish farming industry. It is, however, equally well suited for any application that needs automatic profiling of data. If the users want to use their own buoys or floats, SAIV can supply the APC506 Profiling Control Unit. The buoy contains a control unit, CU801B, an Embedded Web Server, a GSM/GPRS/EDGE router, a winch, a short range radio for communication with sensor unit, and NiMH battery back-up. In fish farm applications it is normally powered from external supply, but can also be equipped with solar cells. The control unit can be remotely programmed to desired profiling frequency and depth. In between profiles, the sensor unit rest inside the buoy above water level. In this position the sensor unit can be flushed with fresh water (optional feature). The measured data is transmitted to the control unit, and the Embedded Web Server produces a web page reachable on the internet at the address: www.station.saivas.net ("station" to be given by the user). The user will provide a SIM-card, and when buoy is powered up, the APB505 configure itself. Besides control functions and data collection, utility data are also available, e.g. diagnostic info for the buoy and sensor unit.

The Welfaremeter

The IMR has developed an expert system called the Welfaremeter (http://www.imr.no/welfaremeter/index.htm). Basically, the Welfaremeter consist of the APB505 buoy, a multi-sensor probe SD204 with a built-in short range radio transmitter/receiver and an expert software to analyze the incoming data. The control unit takes care of external communication with

the outer world via the embedded server as described above. The internal communication between the multi-sensor probe and the control unit goes via short range radio. Before measurements the probe is switched on via radio. After measurements the acquired data are downloaded from the probe to the control unit via short range radio. All control functions including download of measured data can be carried out via the internet according to the instrument web menu. The winch is programmed to take the multisensor probe down to a range of specified depths and then pull the probe back into the buoy for data readout and rest.

Successful automatic long term monitoring of the fish welfare in a fish pen involves satisfactory solutions to three basic problems:

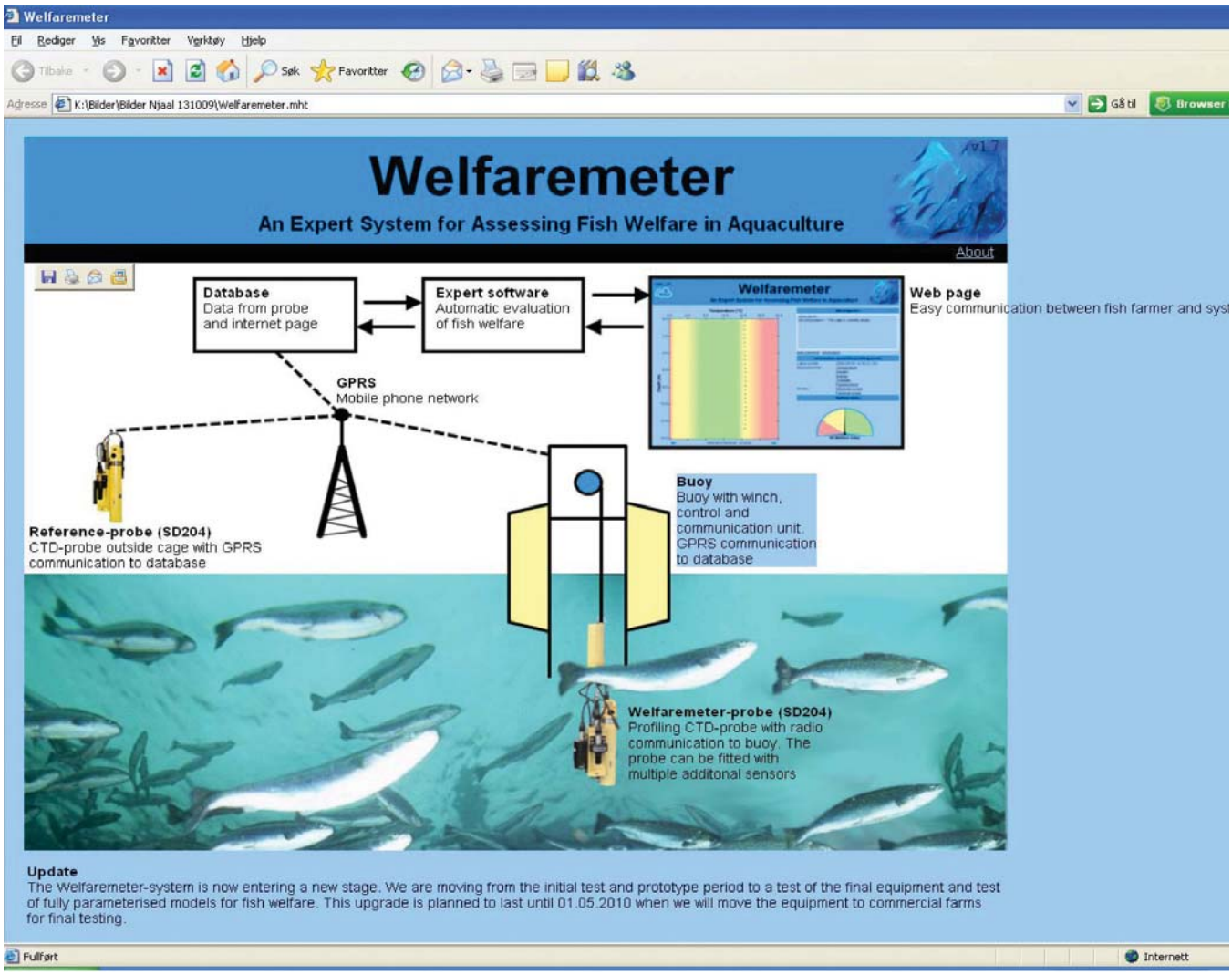
1. Maintenance of the instrument accuracy
2. Satisfactory data communication
3. Automatic data assessment

Biofouling of the sensors is the dominant cause of changes in instrument accuracy when measuring in shallow depths. Biofouling has been successfully avoided by keeping the multi-sensor probe in darkness and in dry air inside the buoy between measurements. An option for flushing the probe sensors with fresh water after each profiling is available but probably not needed.

Both the local communication between the control unit and the multi-sensor probe based on embedded server inside the buoy and the worldwide data communication via the internet has proven to function extremely well. No major problems have been observed.

The multi-sensor probe generates a large amount of data to the connected browser, too much information to be easily evaluated by a typical fish farmer. Therefore in order to make the life easier for the fish farmer and the fish farm owner who may be situated in a foreign country, a dedicated expert system for analyzing the data has been

Diagram of the IMR Welfaremeter.



designed. All received data from the APB505 buoy are automatically stored in a central data base. As soon as new data sets arrive in the database, they are automatically analyzed by an expert software, which evaluates the information from each sensor and calculates a total welfare index. The index rates the total welfare by a presenting it on a scale from 0 (terrible) to 100 (excellent). The results are immediately transferred to the fish farmer via the internet. The welfare index is based on a model of the capacity of the fish to extract oxygen from the water and is a measure for how much additional stress the fish can tolerate. The fish farmer can use the welfare index to improve the fish welfare by managing circulation, meal times, meal composition and time for next net cleaning. This will contribute to increased fish welfare and improve the fish farm productivity. Equally important: The fish farmer gets a reliable day to day documentation of the general welfare situation in the pen. This may be needed when the fish are sold.

www.saivas.no

APB505 Buoy.

Flying through the Water with the Greatest of Ease with

Graham Hawkes

Mad Scientist. *Not Really;* **Goof-off obsessed with subsea flight.** *Partially;*
Inventor, Engineer, Visionary who seeks open access to the seas: ***Absolutely!***

By Greg Trauthwein, Editor

Graham Hawkes needs no introduction to the subsea community, as he has made a profession of headline-grabbing innovations that have helped to revolutionize the capabilities of manned submersibles since the late 1970s, when he co-founded Offshore Systems Engineering (OSEL) in England, where he designed and managed the manufacturing of the atmospheric diving systems, the Wasp and Mantis. Hawkes designed the Deep Rover submersibles which were featured in James Cameron's 3-D IMAX film, "Aliens of the Deep," and he designed a significant percentage of manned vehicles used by science and industry, and additionally, many of the Remotely Operated Vehicles originally built by Deep Ocean Engineering, a company co-founded with Dr. Sylvia Earle.

His passion, though, has traditionally been subsea "flight," a passion which led to the invention and continued refinement of the Deep Flight series of winged submersibles. Throughout his career, Hawkes has exhibited a knack for pushing the boundaries of subsea vehicle capabilities. Today, Hawkes, 63, is still pushing the boundaries of common acceptance, introducing to the market Hawkes Remotes Inc. (HRI), a pure commercial endeavor and a company with an initial product lineup consisting of a family of three ROVs which incorporates new proprietary fiber-optic tether technology and high energy-density batteries to enable range, depth, and deployment capabilities well beyond those of current-generation ROVs.

Hawkes Remotes Inc. (HRI)

Hawkes is a master at finding and utilizing the best

"The math (for underwater flight) is the same as for airplanes. It is so obvious that it should have been done a long time ago. Advances are limited by imagination, not technology."

Graham Hawkes from the cockpit of the Super Falcon

technology available in pushing the capabilities of his subsea vehicles. "People would have been building battery-powered ROVs in the 1970s, but there were no batteries," Hawkes said during a recent interview at his harbor side workshop just across the bay from San Francisco. Battery power density and fiber optics are the keys to the new HRI, as Hawkes said that the right battery technology has just come along in the last year to make this vision a reality.

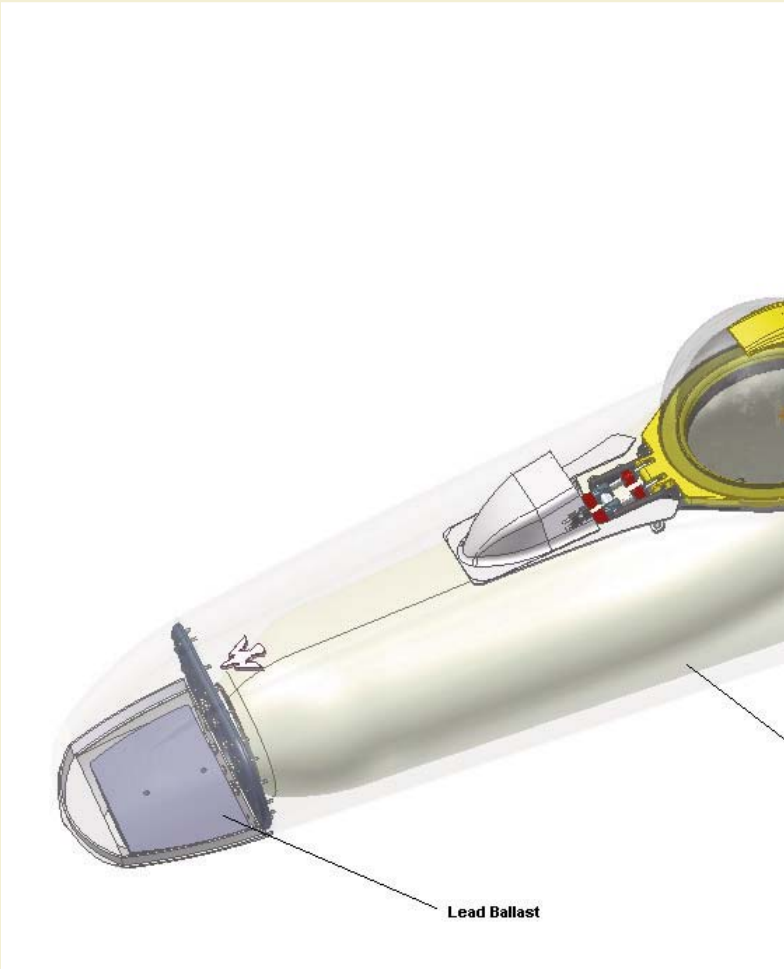
HRI's ROVs leverage SpiderOptic technology, which uses thin armored fiber-optic tethers that pay out as the vehicles move, reducing drag, improving performance, and eliminating the need for cumbersome ship-based support infrastructure. HRI's SpiderOptic cartridge systems will be available in single-use (disposable) and reusable configurations, and are designed to be easily and quickly swappable in the field. In addition, all HRI vehicles will be made available for full ocean depth, building on a suite of tested components developed for the full ocean depth Challenger manned deep sea submersible.

"I think the answer is low-cost, remotely operated vehicles that can go anywhere under the ocean, and we've got that with HRI," Hawkes said. "SpiderOptic technology fundamentally changes the way ROVs move through the water. By using thin tethers deployed directly from the vehicle, we will fundamentally alter the performance and efficiency of deep sea and long range deployments. This technology also gives HRI's ROVs a decided advantage in portability, enabling rapid response deployments and utilization from smaller ships of opportunity."

Ditching the ship altogether, or using the smallest, most cost-effective vessel possible, is a recurring theme in Hawkes long career of innovation. "If you can compete with a system that depends on a ship, game, set, match, it is over," said Hawkes. The biggest challenge in the endeavor, as always, is money to design, build and trial a concept. "You can't make these kinds of leaps in technology while you are trying to sell a product."

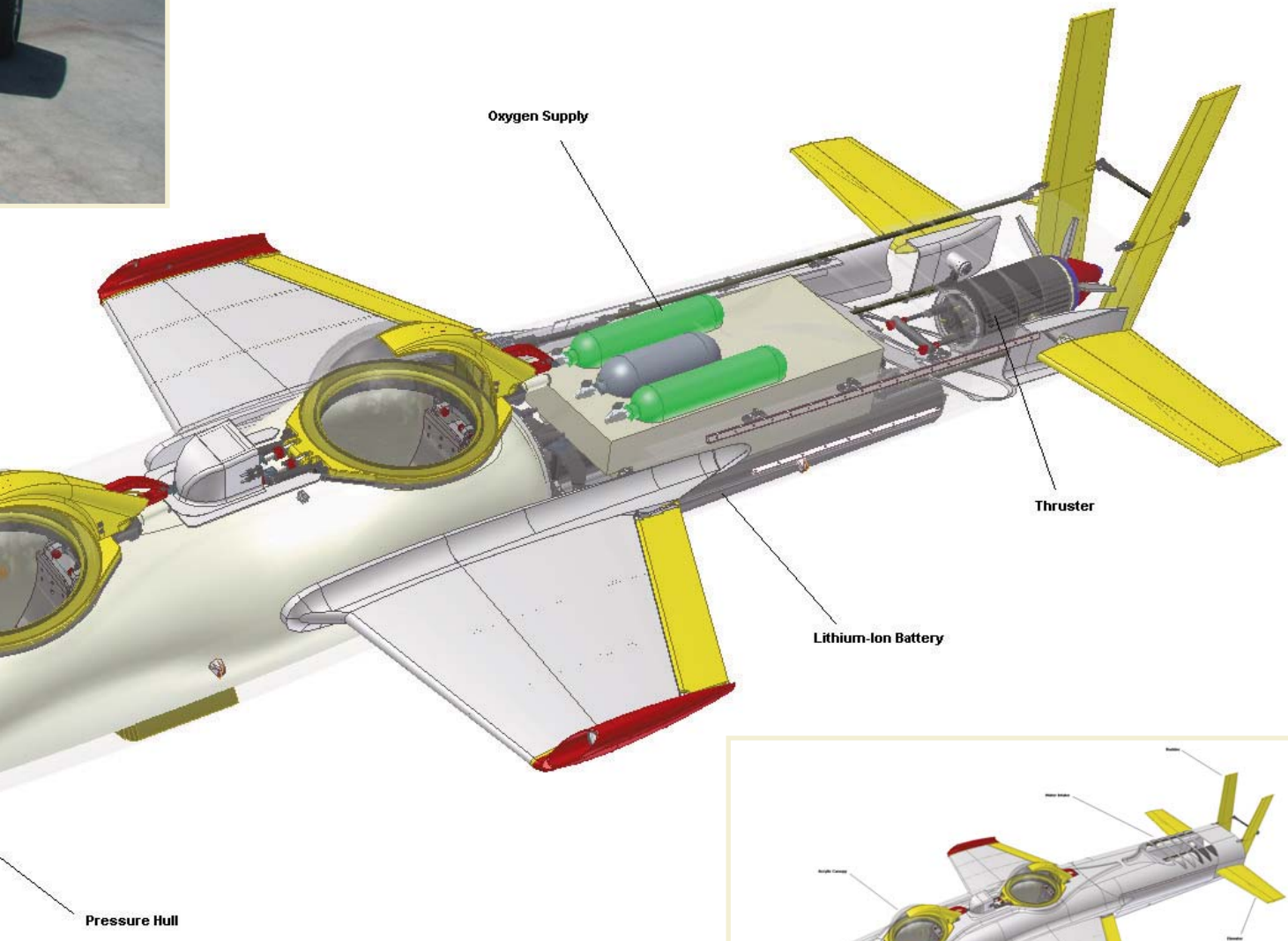
To drive home the point of portability, Hawkes reminisced the original "sea trials", when he and his wife Karen loaded all of the gear into Karen's Jeep Cherokee, rented a 30 ft. boat and dropped a test vehicle into the ocean for several hours; and it worked. "The Jeep was the key, as it has to be transportable," Hawkes said.

HRI is currently developing three different ROV models for launch in 2011. **The company's first vehicle, the U-4000 will be optimized for long-range survey, observation, and light intervention, making it ideal for remote inspection, repair and maintenance work (IRM)**



"We haven't mastered the ocean space until we can access it intelligently and cost effectively."

Left: Graham and Super Falcon in Point Richmond, Calif.
Below: Super Falcon schmatics, with "skin off" and "skin on"



in commercial subsea environments as well as for a range of oceanographic applications. The U-4000 will have a range of as long as 20km from its launch point, allowing it to be deployed for certain tasks from shore or from an ocean platform instead of from a ship, further reducing cost of operations as compared to current ROV systems. HRI's next two ROVs will be launched after the introduction of the U4000, and will include the T-6500, designed for a broad range of tasks below the launch point, and the F-11000, a hybrid AUV/ROV model, with up to 6 knots forward thrust and a large payload for sensory and survey equipment.

Underwater Flight

"Submarines are balloons underwater," said Hawkes, which most succinctly helps visualize his passion, his obsession, with proving and perfecting underwater flight. "I want to do barrel rolls with whales" in his beloved DeepFlight Super Falcon, his personal submersible that he often takes out of Monterey Bay, and elsewhere around the world. The first DeepFlight submersible was unveiled by Hawkes Ocean Technologies (HOT) in the late 1990s. HOT is now on its fifth generation winged submersible, and sold its most recent vehicles to venture capitalist Tom Perkins and entrepreneur Sir Richard Branson. "At the time, I just wanted to do something better. I truly felt we had to make a breakthrough, and I just wanted to have some fun with it (DeepFlight)."

Hawkes fascination with aviation and subsea navigation is palpable, and he admits that as a child he envisioned designing airplanes, not submarines. "The early days of aviation are analogous to what we are doing," said Hawkes. "In the early days, they simply didn't know what they were going to do with them." In the same breath, he readily admits that **"DeepFlight Super Falcon has no earthly purpose other than to prove the point that flying through the oceans is a better way to access the space than sinking like balloons."** With his own Super Falcon, Hawkes has, however, established the craft as an Ambassador to the oceans, and is taking "Kids to Kings" on sub-sea flights in order to make the public more aware of our blue planet. The pinnacle of Hawkes development — a full ocean depth vehicle able to fly in the deepest recesses of the planet for hours on end — is a dream deferred by the untimely death of adventurer **Steve Fossett** in 2008. Fossett held numerous world records; he was the first person to circumnavigate the world solo in a hot-air balloon and the first to fly a plane solo around the globe without refueling. HOT built, but has not yet 100% completed, the world's deepest submersible, DeepFlight Challenger, for Fossett, who had planned to dive the sub to a record solo dive of 37,000 feet. "We were four weeks away from sea trials when Fossett was lost," said Hawkes. "He was planning to get a world record than hang it in the Smithsonian. Once he reached the bottom, he was going to do a very long exploratory run of about six hours," Hawkes said. Hawkes' team is currently working on the vehicle for new owners.

"I think when they look back, they will see what we have done as the birth of underwater flight," said Hawkes.

www.hawkesremotes.com
www.deepflight.com

"As a legacy, I don't want to be known as a guy who just played around in the ocean. This is an ocean planet, and we have to have access to that space."
— Graham Hawkes

The first vehicle scheduled to come out of the Hawkes Remotes Inc. will be the U4000, a vehicle the company is developing for use in the oil & gas and environmental sciences field.

Karen and Graham aboard S/Y Maltese Falcon with Super Falcon (Sea of Cortez)

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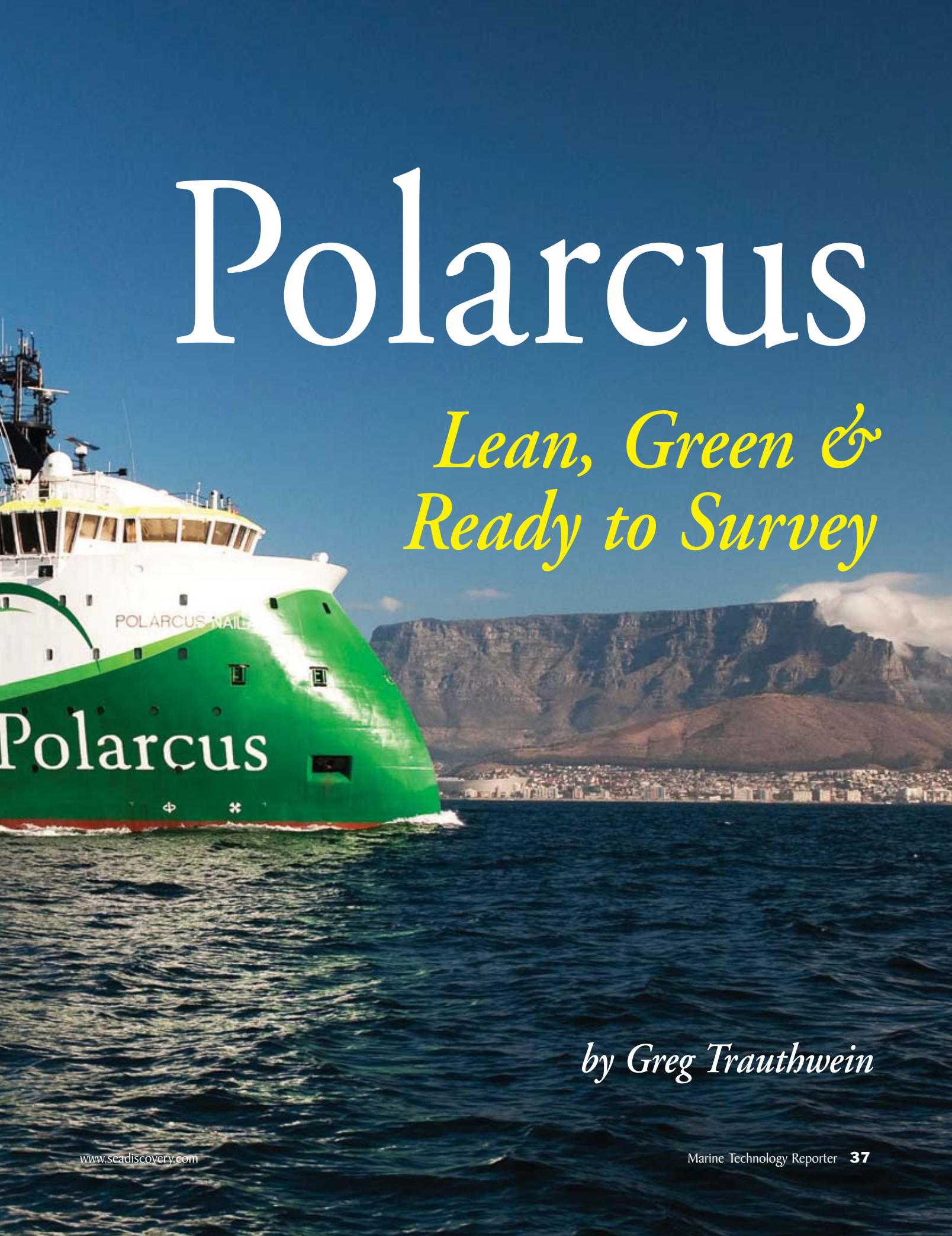


by Greg Trauthwein

By 2012 there will be 65 high-specification seismic survey vessels on the market, meaning that in just over four years from its founding, Dubai-based Polarcus will own nearly 15 percent of the market. The company is quickly amassing its fleet of $170m, ultra-modern seismic survey vessels in hopes of delivering a unique value proposition to the companies who employ them, according to Peter Zickerman, Executive Vice President.

To date Polarcus – which Zickerman calls "a pure-play Seismic 3D/4D marine geophysical company" – has ordered a series of eight vessels at a price tag of $170m per. Of this eight, the first six are being built down the road from Polarcus' HQ at Dubai Drydocks (three of which are already delivered); and the additional pair will be built at Ulstein. The cumulative $1.36b total investment in new ships is significant, as is the varying capabilities of each: the first two vessels are equipped with 10 streamers; numbers 3 and 4 have 12 streamers; numbers 5 and 6 have eight streamers; and numbers 7 and 8 offer 14 streamers. Why the variety?

"We collect data, and it's all about getting the best data. Larger vessels with more streamers are more expensive, and the vessels with smaller capability are more efficient on the smaller jobs," said Zickerman.

The Fleet

Central to the Polarcus story is the incorporation of the latest technologies, leveraging emerging capabilities to help its clients maximize the potential of new and existing energy fields. The company brings to market ultra-modern seismic vessels, all incorporating advanced maritime and environmental features including the innovative Ulstein X-BOW design and capable of operating in the most challenging of conditions.

Perhaps the most challenging, the Arctic, presents an intriguing business opportunity, as the region potentially

The company brings to market ultra-modern seismic vessels, all incorporating advanced maritime and environmental features including the innovative Ulstein X-BOW design and capable of operating in the most challenging of conditions.

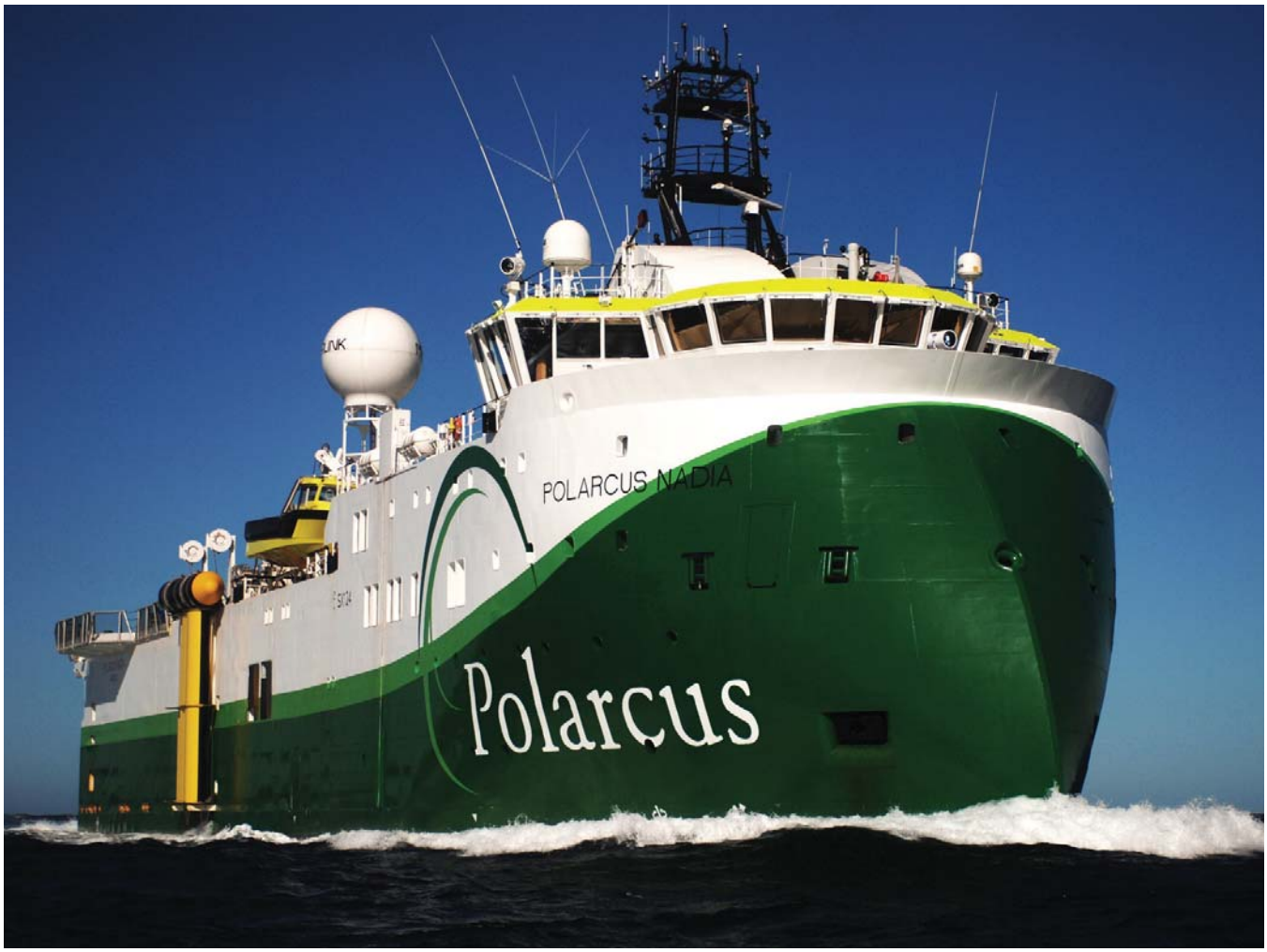


Photo Courtesy Polarcus

"We are becoming more comfortable with our capabilities, thus entering more turn-key projects," said Zickerman. "This comes with more risk, but also with more reward."

Photo Courtesy Polarcus

holds more than 27% of the world's reserves, according to estimates from USGS. BP plc estimates that the Arctic Ocean may hold around 200 BOE, or between 25% and 50% of the world's hydro carbons still to be discovered. To help tap the power, half of Polarcus' fleet will feature an ice-class notation from DNV to allow the ships full access to this resource rich arena. While the company has come out the gates strong to soon claim a significant portion of the global seismic survey capability, it has built its fleet astutely and is in no rush to go beyond the original order for eight vessels at the moment. "Right now we are not rushing to build more vessel," said Zickerman. "That will be driven by day rates, and if the situation presented itself we would not hesitate to push the button. From where we sit, 65 vessels (the world fleet) is unsustainable on the low end. It's a good number for now, but eventually – as the Arctic and Australia open up – there will be a need for more."

"We don't guide dayrates, but analysts expect day rates (in this sector) to rise 10 to 15 percent," said Zickerman. "Day rates, on a weighted average, were about $350k/day in 2006. Honestly, we're not hoping that it goes back to this height, because it would spark another building boom; a gradual rate increase (and a steady oil price) is preferred."

A "Green" Pedigree from Birth

Many marine companies "talk the talk" when it comes to the marine environment, but few actually "walk the walk" as tightly as Polarcus. A point on the corporate Vision statement summarizes nicely:

We are investing in the latest new-build vessel designs from Ulstein Design AS and the most technologically advanced seismic and navigation systems available today from Sercel and ION to ensure that our seismic fleet is one of the most modern and advanced fleets in the world, able to meet the current and projected future needs of the industry. We believe that our operations will be amongst the cleanest in the offshore seismic industry, and capable of working in the broadest range of operating environments.

"Starting from scratch, we knew we could choose the best technologies and build them into the vessels from the start," said Zickerman. According to Zickerman, the accrued technology – from diesel-electric propulsion, high specification catalytic converters, double hull and water treatment systems – means that Polarcus vessels produce five times less emissions than similar capability ships, and he noted: "we don't (yet) get paid for it, but we are seeing more clients interested in this factor.

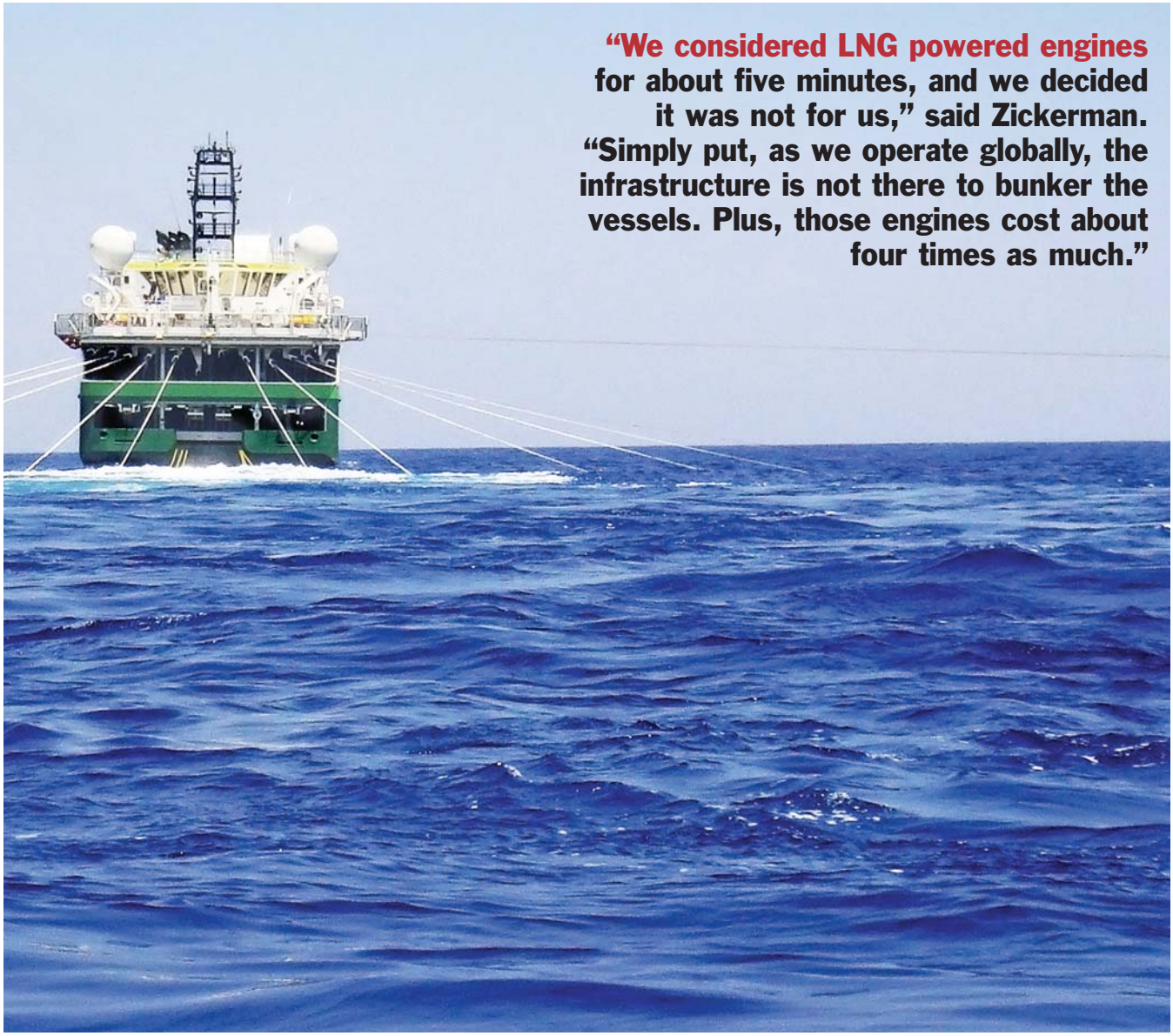
The company is dedicated to running clean ships and minimizing its operations impact on the environment, a fact proven in the high-spec design on its fleet of eight newbuilds, and confirmed via the DNV CLEAN DESIGN notation. The CLEAN-DESIGN notation recognizes that the company has systems in place to control and limit operational emissions and discharges to air and water, along with recognizing our investment in defensive design elements such as a double hull.

In addition, the company measures its emissions on a per vessel, per month basis. Reportedly, Polarcus is the

first and only seismic company to receive the Det Norske Veritas Vessel Emissions Qualification Statement, awarded to the Company in Q2 2010. This qualifies its emissions reporting methodology and accuracy of data, verifying our ability to predict the exhaust emissions footprint for any project and then, post-project, to subsequently provide actual emissions measurements. The results also provide us with a real time ability to optimize operational performance during the course of a survey in order to reduce the overall emissions footprint.

The company has installed an Alfa Laval ballast water management system on its newest vessels, Polarcus Asima, which is the first IMO-type approved system in the world, that offers ballast water treatment that is 100% chemical free.

"It is in the Polarcus DNA to build and maintain 'green' vessels and operations, both for today and for the future," Zickerman said. Testament to the green mandate is the new Polarcus Alima, which incorporates sophisticated seismic technology and is capable of towing 12 streamers, with a 100m lateral separation between streamers. It is a 3D/4D seismic vessel built to the Ulstein SX134 design and Ulstain X-BOW hull. While Polarcus is aggressive in its adoption of advanced technology, it does so with limits according to good business practice. "We considered LNG powered engines for about five minutes, and we decided it was not for us," said Zickerman. "Simply put, as we operate globally, the infrastructure is not there to bunker the vessels. Plus, those engines cost about four times as much."



"We considered LNG powered engines for about five minutes, and we decided it was not for us," said Zickerman. "Simply put, as we operate globally, the infrastructure is not there to bunker the vessels. Plus, those engines cost about four times as much."

Photo Courtesy Polarcus

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Tidal Energy

How it can be made to pay

by William Kingston

It is probably inevitable that in the first stages of tidal energy development, the focus should have been on the devices which capture the energy of the tidal stream. But whether this type of energy ever becomes commercial, actually depends more on the costs of anchoring and maintaining the equipment and delivering the energy it produces to shore than on the efficiency of the energy extractive devices themselves. For example, the lowest cost claimed to date by any developer for deployment alone of a single megawatt turbine is more than $4 million which would make tidal energy altogether uneconomic. However, at the recent International Ocean Energy Conference in Bilbao, Spain, two related inventions were revealed which promise to reduce these costs substantially.

Hydrofoil Anchoring

The first of these is hydrofoil anchoring, in which some of the energy in the tidal stream is turned into a downward thrust to help hold the equipment in position. After its invention in 1968 for a fishing application, 'spoilers' which do the same in air became standard on high performance cars. Next, Robert Gordon University in Aberdeen, Scotland, developed a hydrofoil device for anchoring tidal turbines. Tank and river tests showed that a prototype which was 90% lighter than the nearest equivalent gravity base system, could secure a 5m dia. turbine against sliding on a rock sea bed surface in a 3 m/s flow. The latest invention combines the hydrofoil approach with the plug and socket tension-leg anchoring of the offshore oil industry. The holding power of a hydrofoil anchor combined with even a shallow socket in the sea bed is clearly much greater than if friction alone is relied upon.

The cost advantage of using the tidal flow's own force to counteract its tendency to sweep away whatever is held to the sea bed, is clear. For example, the monopile which supports Marine Current Turbines' 1.2MW unit in Strangford Lough, Ireland, is 1,000 tons in weight, and the Atlantis version of comparable power that is going for test in Scotland, needs no less than 600 tons of gravity to hold it in place on the sea bed against the force of the tide.

Because of the cost of cabling, if tidal energy is to be economic, turbines must be installed in large farms, with multiple units feeding into a common connector. A multiplicity of anchor sockets would be essential for this. Downward-thrusting hydrofoils can also be used to position a ROV or AUV while it is drilling these sockets in a tidal stream. Drilling from the surface in tidal locations would always be expensive, and in the strongest of them may even be impossible, because of the force of the tide on the drill string. Without hydrofoils, an autonomous drilling vehicle would have to be very large and heavy, and would require a correspondingly expensive barge to deploy it. It would be unusual for the sea bed below a tidal stream to consist of sediment rather than rock, because of the scouring effect of the tidal flow over geological time. However, in any such location, an ROV or AUV fitted with downward-thrusting hydrofoils can install suction anchors. Other features of this hydrofoil invention

HOW TIDAL ENERGY CAN BE MADE TO PAY

TIDAL ENERGY WILL ONLY BE ECONOMIC WHEN:-

NO INTERFERENCE WITH NAVIGATION

COMPLETELY INVISIBLE

LARGE SWEPT AREA TO EXPLOIT SLOWER FLOWS

SAFETY FROM STORM WAVE DAMAGE

MINIMAL DRILLING COST IN ROCK FOR ANCHORING

NO SPECIAL TENDER NEEDED TO POSITION OR RETRIEVE

INVENTIONS THAT DELIVER ALL OF THESE ARE:-

WO2007/086037 (SYSTEM)

ANY TYPE OF TURBINE IS CONNECTED TO ANY TYPE OF ANCHOR

BY A PAIR OF TELESCOPIC TUBES WHICH PIVOT ABOUT

THE ANCHOR IN THE PLANE OF THE TIDAL FLOW

TURBINE ALWAYS BELOW SURFACE UNTIL RETRIEVED

OPERATING LEVEL CAN BE DROPPED TO AVOID STORM WAVES

FIG. 1

WHEN TIDE FLOWS –
- SYSTEM PIVOTS IN ARC ABOUT ANCHOR
- TURBINE IS CARRIED DOWNSTREAM
- COMBINED TUBE LENGTH IS MAXIMIZED

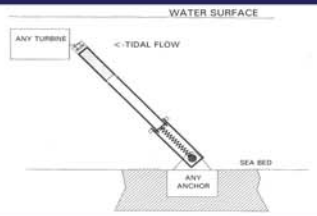


FIG. 2

AT TIDAL CHANGE-OVER –
- BUOYANCY MOVES SYSTEM TO VERTICAL
- COMBINED TUBE LENGTH IS MINIMIZED
- TURBINE BELOW WATER LEVEL AT TOP OF ARC

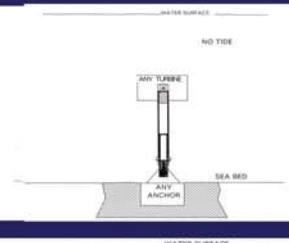


FIG. 3

RETRIEVAL FOR MAINTENANCE –
- TUBES LOCKED BY SIGNAL BEFORE FLOW DROPS
- SO NO LENGTH REDUCTION AT TIDAL CHANGE
- AND TURBINE BREAKS SURFACE AT TOP OF ARC

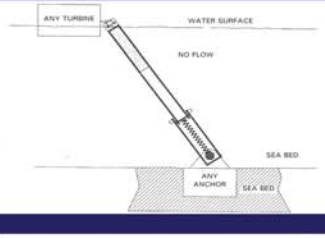
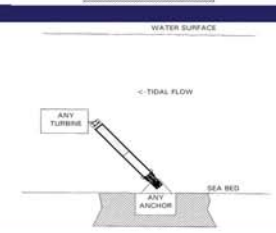


FIG. 4

PROTECTING BLADES FROM STORM WAVES
- TUBES LOCKED BEFORE FLOW STARTS
- SYSTEM OPERATES AT LOWER LEVEL
- AS WAVE EFFECTS ARE REDUCED WITH DEPTH
- LONGER BLADES AND GREATER SWEPT AREA
- ENABLES EXPLOITATION OF SLOWER FLOWS



WO2010032232 (ANCHORING)

FIG. 5

- DOWNWARD FORCE FROM HYDROFOILS (LIKE SIMILAR AEROFOILS ON RACING CARS)
- MUCH SHALLOWER SOCKETS IN SEA BED
- FOR SAME HOLDING FORCE
- GREAT SAVING IN DRILLING COSTS

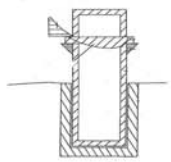


FIG. 6 (a)
- HYDROFOILS CAN HOLD AUV IN POSITION
- PROVIDE DOWNWARD THRUST FOR DRILLING
- EVEN IN STRONGEST TIDAL FLOW
- REDUCING DRILLING COSTS STILL MORE

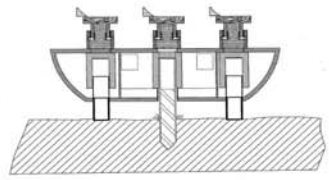


Fig. 6 (b|)

- FOILS FOLD TO AID AUV MOBILITY

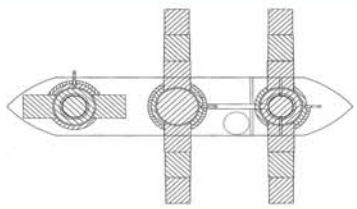


FIG. 7
- GENERATOR OR WATER PUMP CAN BE IN ANCHOR PLUG
- AUTOMATICALLY LOCKED BY TIDAL FORCE
- NO SPECIAL TENDER NEEDED FOR REPLACE-MENT OR RETRIEVAL

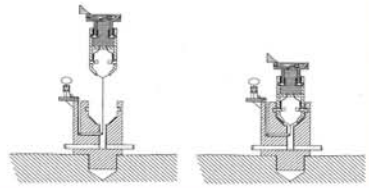
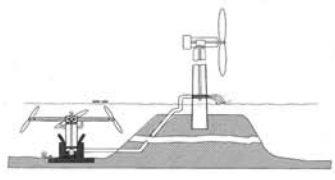


FIG. 8
- SYSTEM CAN TRANSFORM OUTPUT AND STABILITY OF OFFSHORE WIND TURBINES.
- e. g. BY PUMPING WATER TO PELTON WHEEL



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TRINITY COLLEGE, DUBLIN

include automatic adjustment of the foil area according to the tidal force. This deals with reduction in flow rate near the sea bed due to boundary layer effects, and also makes the foils self-cleaning. This can be important in certain sites, where build-up of marine growth on them would reduce efficiency. It also gives ease of deployment, and is necessary when the foils are used with ROVs or AUVs. Also, the downward force can positively lock plug and socket together, as well as sealing them if the system is being used to pump water. At tidal null points, the plug is free to be removed, which makes it possible to position generators or pumps in sockets, combined with ease of retrieving them for maintenance.

Telescopic Connector

The second invention to arouse interest at the Bilbao Conference was the introduction of a telescopic section into the connection between a tidal turbine and its anchor. The total length of this connection is more than the water depth, and it moves in an arc about its axis on the anchor in the plane of the tidal stream. Its two components are spring-loaded, so that when the flow acts on the turbine, it pulls them to their maximum combined length, but as the power in the flow drops in the approach to a tidal change point, this length is correspondingly reduced to a minimum.

The benefit of this is to allow the turbine to operate close to the surface when the tide is running, but without breaking through it at the top of its arc, because it is drawn downwards by the contraction of the length of the telescopic link, towards the anchor as the tide falls. This enables the system to operate normally in the area of highest flow (three-quarters of the energy is in the upper half of the water column). It also means that a tidal farm offers no obstacle to navigation, nor can it give rise to objections from environmentalists, since its equipment and operation are always below the surface and invisible. This invention consequently opens the way to the exploitation of tidal streams in areas of natural beauty or where navigation (whether commercial or pleasure) cannot be subject to any restrictions, such as the Solent or Severn in the UK, or the Straits of Gibraltar.

A key aspect of this invention is that the components of the telescopic section can be locked together by a remote signal at different combined lengths. If this is done when the tide is flowing, the usual reduction in length at the tidal change period will not take place, so the turbine will then break the surface and be available for replacement or maintenance. If the components are locked instead during a tidal null point, when the flow commences again their combined length will still remain at a minimum. The system will continue to operate, but at a lower depth, until it is unlocked. Since wave forces are attenuated with depth, this provides a way to eliminate danger to turbine blades if a storm is forecast, with minimum loss of output.

This feature also opens the way to exploitation of sites which have lower current speeds than the tide races which have attracted the first wave of interest in tidal energy. It enables longer turbine blades of lighter construction to be used because they will not have to withstand fluctuating stresses from storm waves.

This pair of inventions can also be expected to make a significant contribution to the economics of offshore wind energy. Wind farms are often located on sandbanks which themselves cause tidal currents to accelerate along their perimeters. The energy in these can be captured to reinforce the generating capacity of wind turbines at all times and to continue to provide regular output when there is no wind. The complete predictability of tidal energy goes a considerable distance towards compensating for the irregularity of wind power, thus greatly improving the economics of a wind farm on its own.

Endorsement from Experience

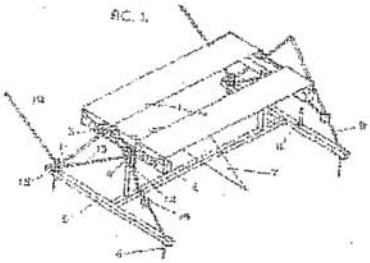
This new approach to the anchoring of tidal turbines receives endorsement from Marine Current Turbines' practical experience, which has led them to a fundamental design change, also revealed at the Bilbao Conference. Their Strangford Lough unit is surface-piercing, and could not be replicated in numbers in any site which is open to navigation. Neither could environmentalists be expected to approve an array of highly visible devices of this kind. However, MCT revealed at Bilbao that they now intend to move to a sub-surface system. This would require them to be able to gain access to their turbines for maintenance or repairs without the need of specialist vessels with powerful lifting gear to bring up the equipment every time access is needed. Consequently, in their SeaGen 2 system, a pair of struts holds a horizontal streamlined structure on which rotors are deployed across the direction of the current. Because the struts can move in an arc about an axis on an anchor, the structure can be floated to the surface for access and maintenance. The resemblance to the telescopic connector invention just described will be evident.

Hydrofoil anchoring patents evolution

Kingston 1968:

Hydrofoil system for longshore fishing and other underwater purposes

Publication number: GB1131856 (A)
Publication date: 1968-10-30
Inventor(s):
Applicant(s): KINGSTON WILLIAM +
Classification:
- international: *A01K73/05;* A01K73/00
- European: A01K73/05
Application number: GB19650051107 19651202
Priority number(s): GB19650051107 19651202



Robert Gordon University Aberdeen 2007:

(12) **United States Patent**
Owen et al.

(10) **Patent No.: US 7,275,891 B2**
(45) **Date of Patent: Oct. 2, 2007**

(54) APPARATUS FOR CONTROLLING UNDERWATER BASED EQUIPMENT

(75) Inventors: **Alan Owen**, Ellon (GB); **Ian Gordon Bryden**, Ellon (GB)

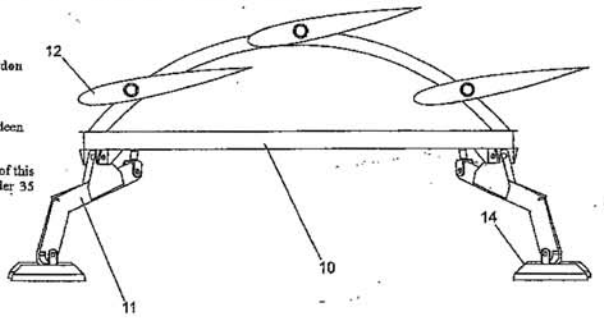
(73) Assignee: **Robert Gordon University**, Aberdeen (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 10/526,264

(22) PCT Filed: Sep. 5, 2003

(86) PCT No.: PCT/GB03/03845

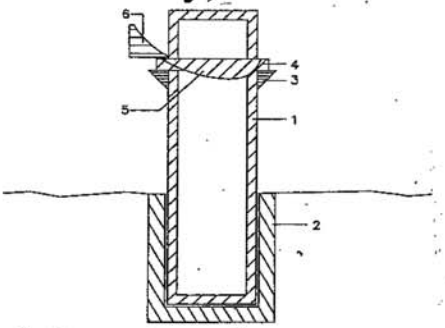


(Research cost £0.25 million; prototype could hold a 5m turbine in a 3m/sec flow, by friction only)

Kingston 2010:

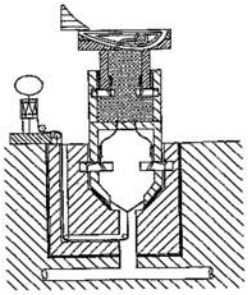
TIDEWAY ANCHOR SYSTEM

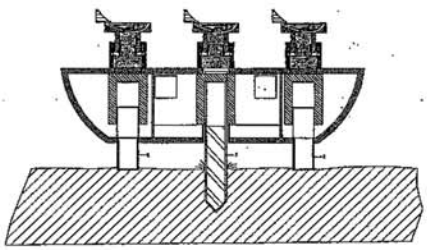
Publication number: WO2010032232 (A1)
Publication date: 2010-03-25
Inventor(s): KINGSTON WILLIAM [IE] +
Applicant(s): KINGSTON WILLIAM [IE] +

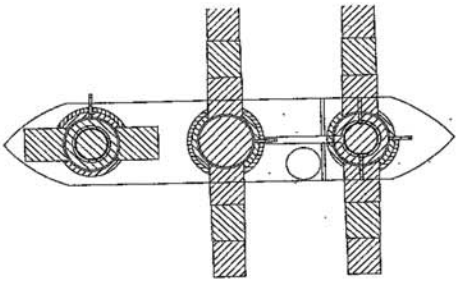


Hydrofoil plus plug & socket

(Extensible foils maximize downward thrust, and also enable ROV/AUV to drill in a tideway):







(Image Courtesy William Kingston)

Project Palau

A 7-year misson to find the cure starts with logistical nightmares

by Chris Hartmann

In January 2008, Bobby Adams and Chris Hartman were assigned by their company — Deep Marine Technology, to carryout one of the largest, most comprehensive, subsea medicinal research expeditions in U.S. history. Deploying a fleet of manned submersibles, support equipment and a highly trained team of submersible pilots.

The project brought them and their equipment halfway around the world, to the remote location of Palau. **Intelligent planning and attention to every detail for the seven year expedition was critical, a premise which was put to the test before the project even began.**

Hundreds of feet below the surface of the Pacific Ocean, miles off of the island nation of the Republic of Palau in a one-man submersible called Deep Worker 2000, a mechanical chamber 5 feet by 3 feet, (roughly the size of a formulas one race car cockpit) working deep under the ocean water in darkness, the team quickly learned about the science of deep sea medicinal research and their unique opportunity to help rid the world of cancer. But before getting to this point they went through a journey that proved more challenging than the mission itself.

Alameda, CA, was the designated launch point for the expedition, the reason, twofold; DOER, based in Alameda, is a large scale, cutting edge, subsea exploration preparations company. In a matter of weeks DOER built (from aluminum ingots) and integrated, highly functional custom robotic arms for each submersible, outfitted customized support containers and provide superior cost saving advice regarding long-term deployment strategies in Palau which they had previous experience with. Second; Alameda, next to Oakland, was the port town for Horizon Lines, who later shipped the subs to Palau, almost.

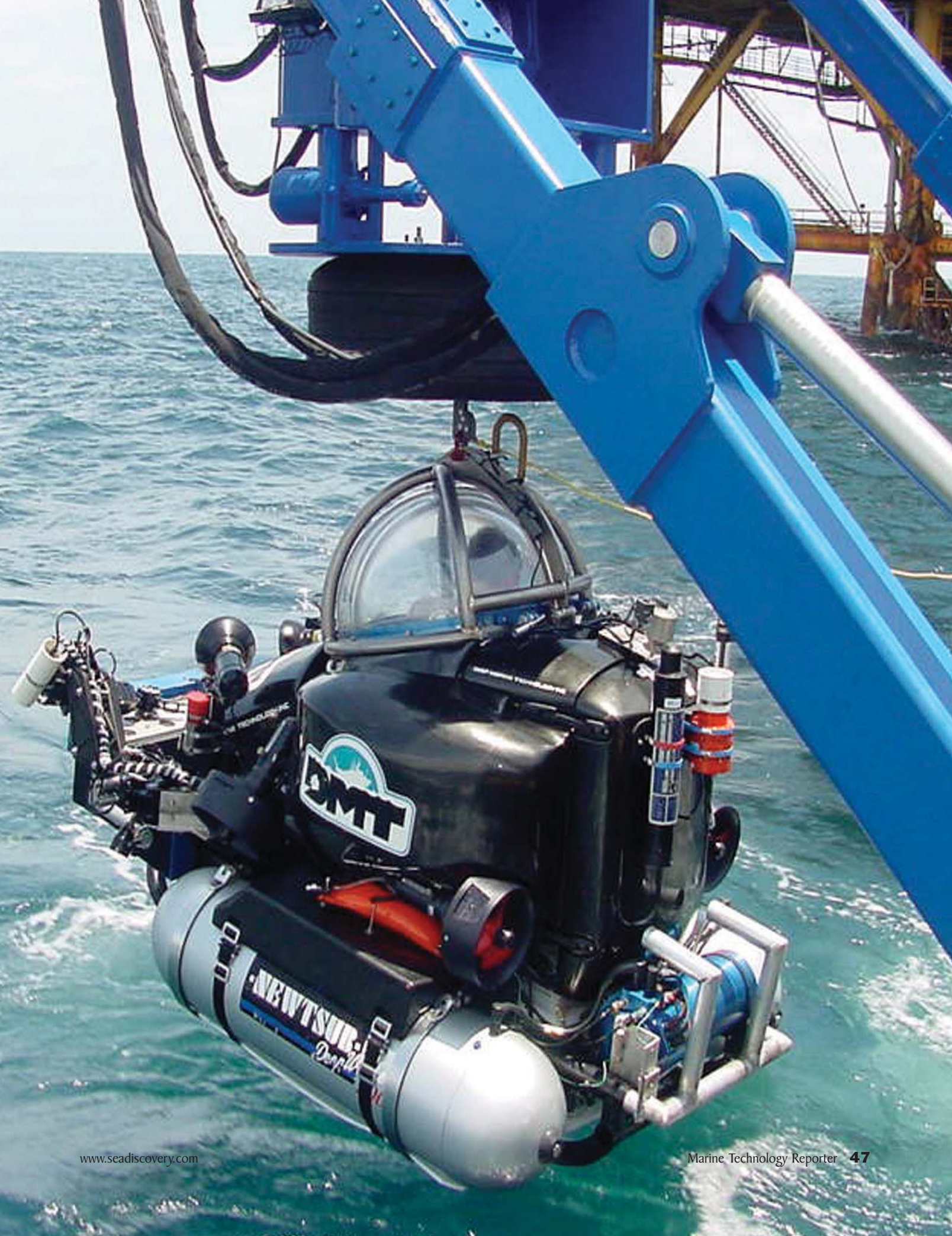
Just before the subs deployed to Palau, the U.S. State Department took a keen, and to this day still unexplained, interest in the project. The assumption was that the project caught State's eye given Palau's proximity to Guam and the proposed build up of forces (specifically U.S. nuclear submarines) at that base. Interestingly, Adams found out that manned submersibles can be classified as WDS (weapons delivery systems) by the State Department as well as other U.S. government and foreign agencies. Notifying the State Department and foreign governments is essential, to resolve issues in advance.

Several days before the subs and equipment were to arrive Palau, Adams received confirmation that the containers had been damaged in Guam. Immediately, Adams dispatched Hartman to Guam for investigation. Upon arrival, he met with port authorities to gain access to the containers to inspect the equipment. Due to heightened security constraints at the port, a proper inspection on port premises was not possible, and Hartman only gained access to the containers long enough to open them, make a quick visual inspection and shoot some pictures before port authorities shut down the port for security reasons.

Between information Hartman was able to collect from the Port Authorities in Guam and the reports Adams received from the shipper, **the team discovered that while lifting Deep Worker #17's container out of the hold of the ship, it was dropped from a height of approximately 40 ft. onto the second container which housed Deep Worker #18. With more than 600 containers onboard, this was an unfortunate incident to say the least.**

It became apparent that a proper assessment of the damage was not possible without completely unloading both containers to inspect the submersibles and equipment. Adams and Hartman arranged with the shipping company and the port of Guam to transport the damaged con-

In a matter of weeks DOER built and integrated, highly functional custom robotic arms for each submersible.


SMT
NEWTSUIT

tainers to Palau so they could unload the containers and conduct a proper inspection of the subs and support apparatus. It was going to be a one-way trip for the containers; due to the damage they suffered they could no longer be certified for shipping so Palau would be the end of the line for them.

Once the containers reached the secure compound area of the research facility the team began the tedious process of unloading and surveying the Deep Workers and ancillary support apparatus. Knowing the potential damage a 40 ft. drop could do to a submersible they really were not sure of the condition of Deep Worker #17 or #18 and the equipment inside the containers. Upon initial glance it became obvious that their attention to detail during the refurbishment of the containers and the effective reinforcement paid off. Deep Worker #18 and the contents of its container were undamaged even though it was on the receiving end of Deep Worker #17's container's 40 ft. drop. Deep Worker #18's container had sustained major external damage, but it did its job and protected the contents from damage. Deep Worker #17 and its containers contents were another story, as the sub broke loose from its tie downs and impacted the wall of the container, its contents shifted as well. But considering that it sustained a 40 ft. drop the damage was not nearly what was expected. The container suffered much more external and structural damage than the other but did a noble job of protecting its contents, all things considered.

It was the potential unseen damage that was a concern. The team could not be certain about what the drop had done to the overall structural integrity of the sub. They consulted with numerous experts in submersible design, structural engineers, and stress analysis specialists trying to ascertain if Hull #17 was clear to dive.

Due to the lack of accurate information about the incident itself (the team later discovered the drop could have exceeded 50 ft.)and the unknown variables of the impact and stress to the hull, they had no choice but to consider hull #17 a loss and salvage what they could for spares. The force from the drop had possibly compromised the structural integrity of the hull, which could lead to a catastrophic failure at depth, especially since they would be taking the Deep Workers to their maximum working depth of 2000 ft. They discussed the concerns with Lloyds (the certification agency for the Deep Workers), senior management at DMT and the insurance company. All were in agreement, the decision was made, Hull #17 was a total loss and was sent back to Alameda.

Adams had a third Deep Worker at the shop in Houston (Hull #14) but it was out of survey. He made the decision to send #14 to Alameda, meeting #17, thereby DOER could remove the manipulator, pan & tilt and other components and install them on Hull #14 getting her ready quickly, replacing #17. In the meantime they had to figure out a way to become operational even if only in a limited capacity. Safety is the most critical aspect of any submersible operation and even more so in remote locations. A comprehensive safety program with specific procedures and protocols for every phase of operations is mandatory. Adjustments were made to their existing procedures adapting for the situation, environment and locale. Adjustments also were made while integrating the apparatus to a new-build unproven vessel, in foreign waters with an inexperienced crew and operating only one sub when there should be two. They made sure any changes or new procedures were thoroughly addressed, discussed and

approved by all senior personnel, management, safety and legal departments back at corporate in Houston. They were also sure to include everyone in pre job/pre dive safety meetings and took the time to address concerns.

Daily training during the set up phase in Palau was essential for local personnel. Drills and simulations took place in classrooms; then dockside; and finally onto the dive support vessel. After this was completed it was time to head offshore for hands-on training. Locating a secluded nearby cove, conducting launch and recovery training ops as well as emergency drills and simulations was very beneficial for all individuals involved. Utilizing the vessel as a floating classroom and training facility they practiced techniques and fine tuned procedures until all involved were confident and proficient in their skills. Dive ops could now be conducted in a safe and efficient manner.

Despite the delays and loss of Deep Worker #17, the team had to figure out how to become operational – even if in a limited capacity – so the client could start making collection dives. The original dive plan was to have both Deep Workers aboard, diving one at a time, keeping the other in standby on the deck in case it was needed to back up or assist the other sub. Self-rescue was one of the most critical aspects of dive ops in a remote location such as Palau, unlike the GoM, North Sea or other areas where subsea activities were ongoing and numerous vessels with ROV's onboard were always available to address problems. The solution for one-sub ops was tethering Deep Worker #18 and limiting operating depth to 800 ft. This was a proven method which had been utilized by DOER with a Deep Worker several years prior on a similar project in Palau. Tethering the Deep Worker negated some of its maneuverability potential, but it was the only option to become operational. The client was happy and most importantly, conducting specimen collection dives in one of the most incredible, unexplored underwater areas on our planet. Once Deep Worker #14 arrived the team could remove the tether and fly unrestricted as the Deep Workers were designed.

Unfortunately this was never forthcoming, as the global economic meltdown helped to bankrupt DMT as the project was barely out of the gate, keeping Project Palau far from full-stride.

Hundreds of feet below the surface of the Pacific Ocean, miles off of the island nation of the Republic of Palau in a one-man submersible called Deep Worker 2000 ... the team quickly learned about the science of deep sea medicinal research and their unique opportunity to help rid the world of cancer.

Forum Energy Technologies is a new name, but it has quickly established itself as a subsea leader.

Five Minutes With

Charles Jones

President of Drilling and Subsea Division, Forum Energy Technologies

by Greg Trauthwein

Can you tell us a bit about your experience in the maritime/subsea sector?

Jones My background has primarily been related to offshore and subsea hardware used in the energy sector. Customers in this area are primarily involved in the exploration, drilling, completion and production of hydrocarbons in deep water and harsh environments like the Gulf of Mexico, Brazil, West Africa and the North Sea. I was fortunate to enter the industry at a time when numerous technological challenges were presenting themselves and as a Mechanical Engineer my education affords me the ability to participate in many of them. As the industry was developing methods to economically operate in the harsh environment of the North Sea, we did not necessarily realize the preparation that was occurring for learning how to move effectively into deep water. Much of the operating techniques, hardware design and risk management skills we use today are a result of the work done in the harsh environment of the North Sea. I was lucky to work for several of the large manufacturing companies providing drilling and production equipment into this market during years of great technological development.

I understand that Forum Energy Technologies is a relatively new company. Can you please provide a brief corporate history/structure?

Jones Forum Energy Technologies was formed in August of 2010 to create a significant, broad based supplier of products and services to the energy industry. Forum Energy Technologies resulted from the merger of five portfolio companies owned by the same private equity sponsor. The companies were:

- **Forum Oilfield Technologies** - provided globally a wide range of drilling capital equipment and consumables to drilling companies and their suppliers.
- **The Triton Group** - made available a wide range of remotely operated vehicles (ROVs), subsea hardware,

"Previously, remote operations were treated as contingency measures and the hardware was designed as such. Today, dependence on the ROV for critical tasks related directly to the success of the operation are routine. This has allowed dramatic changes to occur in equipment design, resulting in simpler designs that are more cost effective and reliable."

— *Charles Jones*

rental equipment, geoscience and simulation technology to offshore construction and service companies.

• **Global Flow Technologies** - offered a wide range of gate, globe, check and ball valves primarily to the downstream market.

• **Allied Technologies** - supplied engineered process systems and field services from the well head to the refinery.

• **Offshore Joint Services** - provided offshore pipeline field joint coating service and technology to the offshore pipeline construction industry and field installation equipment to the onshore pipeline construction market.

Today, Forum employs 2200 employees in countries around the world. We are located in most of the areas that are strategic to energy exploration and production. This includes North America, Europe, the Middle East and Southeast Asia. More than 60% of our sales are outside the United States and 40% are directly related to offshore activity. We now operate the business in two distinct segments, "Drilling & Subsea" and "Production & Infrastructure," to ensure better alignment with customer interests.

When and why was Forum created?

Jones Knowing our history, it is easy to understand why we have built a very strong platform upon which to continue our growth. Forum was created because we believe there is significant opportunity for a new, fresh, strong supplier of product technology to the energy industry; a supplier that is focused on identifying and developing only the best new products without carrying the baggage of the past. We believe Forum will become recognized as "the" place people will want to work because our practices, ethics and culture are focused on becoming a large company with a small company feel. People are the key to success and we are working hard to build a team of the best.

What do you count as your core business strength?

Jones Currently, our core strength is our broad product offering that covers numerous markets, all positioned to leverage growth opportunities. We have a substantial ongoing mergers and acquisitions (M&A) effort that is backed by major investment in new product development. Often, growth companies focus solely on M&A, especially those backed by private equity. Forum is different because our sponsor is patient, thus giving us the ability to invest in internal efforts like new product development while simultaneously pursuing M&A."

While your product and service offering is diverse and comprehensive, what one or two areas of your business bring in the lion's share of business?

Jones Currently, our "Drilling & Subsea" segment is the largest, most profitable part of Forum. Part of this is because Forum Oilfield Technologies was significantly larger than the other businesses but also because of strong growth we are seeing in the subsea business which is our second largest business. However, we are working hard to grow the "Production and Infrastructure" segment, especially with the vast opportunities now being presented in North America related to shale based activity."

Biography Charles Jones

Charles is a native Houstonian and graduate of the Advanced Management Program at Harvard Business School. He holds a Mechanical Engineering degree from the University of Houston where he serves as chairman of the Deans Leadership Advisory Board. Previously, he was President and Chief Executive Officer of Forum Oilfield Technologies which specializes in the design, manufacture and installation of specialized products and equipment used primarily in the drilling industry.

Formerly, Charles was Executive Vice President and Chief Operating Officer of Hydril Company which was sold to Tenaris S.A. in February 2007 for $2.1B. Hydril distinguished itself as the industry leader in specialized products enabling drilling the world's deepest and most challenging wells. During his tenure the company executed a successful turnaround, became public through an IPO, held a secondary stock offering, paid off $80m in debt and paid dividends to shareholders exceeding $180m. Before joining Hydril, Charles served as Director of Subsea Business for Cooper Cameron Corporation where he developed the global subsea production business. He is responsible for engineering and installation of numerous deepwater subsea production systems, holds several patents and has 30 years of energy industry experience.

What business trends in the offshore industry have most significantly influenced the creation/direction of FET?

Jones Clearly, the deepwater trend has influenced our thinking because there are relatively few large providers of offshore and subsea products and services. Customers have been very supportive of our efforts so far and indications are this will strengthen, provided we continue to deliver on our promises. Offshore operations are complex and the stakes are high so customers demand high performance products moderated by reliable technology. This offers us the chance to leverage decades of real experience into products customers can count on delivered by a company with staying power. Our ROVs and subsea products have some of the best track records in the industry and we intend to tell the world about it, something we have not been very good at because we've been too busy working."

In your opinion, what have been the most dramatic changes in this business in the past 10 years?

Jones The dependence on remote technology to perform subsea operations that are directly on the critical path. Previously, remote operations were treated as contingency measures and the hardware was designed as such. Today, dependence on the ROV for critical tasks related directly to the success of the operation are routine. This has allowed dramatic changes to occur in equipment design, resulting in simpler designs that are more cost effective and reliable.

What do you count as the biggest CHALLENGES to running a successful subsea company today?

Jones Making sure you stay the course and deliver what the customer needs, not necessarily what he wants. It is true, customers are the source of all cash flow but what is the use if the flow is only short term? At Forum we want long term relationships with customers that are based upon sound technology backed by real operational experience. Today, many competitors offer products that on the surface are technologically sexy but are questioned by the people doing the real work offshore. The link to the field is the challenge, which is why we intend to continue investing in our large subsea services business unit. Currently, our services unit provides sale and rental of subsea hardware used for surface and subsea positioning,

bathymetric information gathering and supplying offshore personnel."

What is on the horizon – in terms of competition, legislation or technology – that you believe will change the way you do your business most in the coming five years?

Jones Recent events have affected offshore operations in certain markets in a way that will result in more reliance on subsea capabilities. The necessity of performing more complex remote operations combined with longer dives and reduced downtime are now a requirement, not an objective. We expect more imbedded technologies within the subsea hardware itself, some involving remote functionality that will drive our subsea business into new areas. Our business will be changed in the next five years by less reliance on expensive surface support and more reliance on dedicated subsea assets, with some of the changes driven by legislation and some by new technologies, especially those related to power delivery."

How is FET investing today?

Jones We are currently investing most heavily in our subsea business. Our 2011 capital expenditure plan is significantly above prior levels and the majority of that spending is in our subsea business. While the exact details are proprietary, I can say we are investing in new products and new markets both in terms of spending identified for growth and for maintenance objectives."

Perry branded ROVs from Subsea Vehicles, FET

Cura Joins Woods Hole Group

Woods Hole Group said that environmental scientist Jerry J. Cura will be joining Woods Hole Group in late March as a Senior Environmental Scientist. Cura comes to Woods Hole Group with his Ph.D. in Biological Oceanography from the University of Maine and over 20 years of experience in the field and as a principal in Menzie-Cura Associates.

McLellan Global Diving & Salvage.

Global Diving & Salvage, Inc. said that Nathan McLellan has joined the team as Contracts Administrator. He earned his Juris Doctor from Tulane University Law School in January, 2011 while receiving a certificate in Maritime Law and serving as a member of the Tulane Environmental Law Journal.

Northmore Joins Coastline Surveys

Coastline Surveys appointed Neil Northmore as Legal and Commercial Manager. He has experience in the marine industry including working for the Royal Yachting Association as Government Affairs Advisor and closely with the British Marine Federation, co-founding Dorade Law and later working at Michelmores Solicitors in a senior role in the Marine Department.

OceanWorks Signs Agreement with Velocious

OceanWorks announced the formation of a mutually supportive relationship with Velocious Australia Pty. Ltd. The agreement allows the companies to expand capabilities and resources through the global sharing of experience and complimentary opportunities, with both companies already enjoying formidable reputations as safe providers of high quality subsea solutions, intervention tooling and services. Velocious is a dynamic West Australian subsea engineering company that specializes in remote intervention technology for the Oil & Gas, Renewable Energy and Defense Industries.

OceanWorks' Subsea Flying Lead Orientation Tool

Email: marketing@oceanworks.com

S3 Acquires New ROVs

James Rae, S3 ROV Pilot Technician, adjusting the camera pan and tilt unit on an S3 ROV.

Specialist Subsea Services Ltd (S3) acquired two new ROV systems to expand its workclass fleet. The two Triton XLX 150hp ROV systems are advanced workclass units manufactured by Perry Slingsby Systems Ltd. S³'s Managing Director, Graeme Kidd, said: "We are particularly enthusiastic about the acquisition as it is new and exciting technology for S3. The XLX Workclass ROV's are top of the range systems which will help to further enhance our reputation as being a company of excellence in the support of offshore operations in the oil and gas and renewables markets on an international basis.

Oceanwide Logs Order for SPHL

Oceanwide Safety at Sea announced the first order of a side-mating-Self Propelled Hyperbaric Lifeboat (SPHL). The side-mating configuration together with a launching system installed on a frame gives the possibility to use the SPHL in smaller portable systems, instead of using an HRC. This latest development therefore gives companies with mobile saturation systems the possibility to provide maximum safety for their divers.

The SPHL is equipped with two on-off-load lifting hooks and for recovery and ease of handling a single point lifting arrangement is installed.

Email: rob.bunders@oceanwidesafety.nl

NURC Upgrades Software

SeeByte provided the NATO Undersea Research Centre (NURC) with two upgraded licenses of its SeeTrack Military software. The upgrades to NURC's SeeTrack licenses will also include the latest versions of SeeByte's additional modules, comprising of the Computer-Aided Detection/Computer-Aided Classification (CAD/CAC) module, Navigation Post-Processing module

and the latest release from SeeByte, their Performance Analysis and Training Tool (PATT). Dr. Warren Fox, Principal Scientist at NURC said, "SeeByte's SeeTrack Military software can help us transition our world-class research in support of NATO's maritime operational and transformational requirements to NATO fleets. Its open architecture platform means that any new and innovative tools we develop for mine countermeasures to safely and efficiently find explosive ordnance can easily be made available to all existing NATO users of SeeTrack Military."

www.seebyte.com

SWATHE

Swathe Airborne Surveys is a new division within the Swathe Group bringing together aviation services, equipment manufacturers and 10-years hands on experience of bathymetric LiDAR surveying to provide a unique and cost effective solution to their clients allowing them to expand their survey operations into new and otherwise inaccessible areas of marine survey.

www.swathe-services.com

CDL Earns Military Contract

CDL won its first military contract for their TOGS-S unit. The purchase order of 12 TOGS Surface fibre optic gyro systems was placed by Marine Electronic Systems of Totton, England as part of their integrated bridge system solution to be installed on 12 Griffon hovercrafts bound for India. TOGS-S is a North seeking FOG with heading accuracy up to 0.2° with GPS aiding (0.5° unaided) designed for surface application including commercial shipping, military craft, yachts and land vehicles.

David Evans and Associates Purchases Two SeaBat 7125-SV2

David Evans and Associates Marine Services Division has purchased two of the new SeaBat 7125-SV2 systems. DEA's clients include private industry, local and regional municipalities, port authorities, the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration (NOAA). DEA is a long-time customer of RESON and was an early adopter of the SeaBat 7125. The upgraded 7125-SV2 system provides dramatically improved performance.

Global Marine Selects Predator ROV Distributor

Global Marine Systems announced that Great Eastern Group, an operational offshore company specializing in program management, environmental compliance, geophysical surveys, marine construction, and ship management & operations, will distribute its state-of-the art Inspection Class ROV system – Predator – in Rhode Island. Based in Florida, with offices and marine facilities in Rhode Island Great Eastern Group is the latest international distributor for Global Marine's Inspection Class ROV. Designed and built at its Portland facility in Dorset UK, the Predator uses the latest technology to ensure maximum operating efficiency for a number of marine operations.

DW Launches Deepwater Service

The new Deepwater Service has been launched by Douglas-Westwood. With quarterly updates, subscribers can keep up-to-date year round, with this dynamic and fast-moving industry. The research forecasts a massive 79% growth in capital expenditure compared to the last five years, with $206 billion to be spent on deepwater developments over the 2011-2015 period. "We expect African and Latin American developments to drive the forecast growth," said Steve Robertson, director. "African developments are largely concentrated on Angola and Nigeria. Latin America is likely to experience substantial growth, exceeding Africa's deepwater expenditure towards the end of the forecast period, driven by Petrobras' development of its Campos and Santos (pre-salt) fields off Brazil. There are some interesting prospects in North Africa but these may be hampered in the short-term by the present political uncertainties. A large cloud of political uncertainty also continues to sit stubbornly over the US Gulf of Mexico following the Macondo spill in 2010. Recovery is expected in the US Gulf over the next five years but at present activity levels are depressed and contractors continue to report that the region is difficult. The outlook for 2012 is poor with recovery expected from 2013 onwards. There is a risk that the present administration could limit deepwater activity in favour of development of unconventional onshore reserves instead.

http://www.dw-1.com/shop/shop-infopage.php?longref=695~0

‘Diving Bird’ Tech Tapped for Award

Kongsberg Seatex's 'eBird' Seismic Streamer Control System has been nominated for the prestigious Honors Award for Deisgn Excellence by the Norwegian Design Council (NDC). Kongsberg Seatex, Kongsberg Maritime's specialist in position reference systems, and attitude determination, is one of four companies to be nominated.With oil & gas exploration taking place in increasingly demanding environments, the offshore industry depends on new technology to overcome the challenges caused by working further from shore and in deeper waters. Kongsberg Seatex's eBird is one such piece of technology. It is a novel bird concept for lateral, vertical and roll streamer control in marine seismic acquisition that enables fault tolerant and efficient multi streamer steering by employing a wide range of innovative and patented technological solutions.

According to R&D Manager at Kongsberg Seatex, Arne Rinnan, the starting point for eBird was an idea from Kongsberg Seatex almost 20 years old: "Some ideas take longer to mature than others. Even though the idea has existed for a long time, it was not until we had a competitive concept that we took the first steps towards the product development of eBird."

In short-listing eBird for the design award, the NDC panel of judges recognizes the overall design and operational value of this unique system. A number of details also highlight eBird as an innovative design, including the titanium body for maximum tensile strength as well as extraordinary corrosion resistance. The smart design and construction ensures very low acoustic noise, and can be adapted to all types of streamer cables, whilst the innovative implementation utilizing connector-less power and signal transfer between body and wings makes eBird robust for all operational conditions.

eBird was launched at the Society of Exploration Geophysicists (SEG) annual meeting in Houston in October 2009.

www.kongsberg.com

MTNW: Adamac Deal

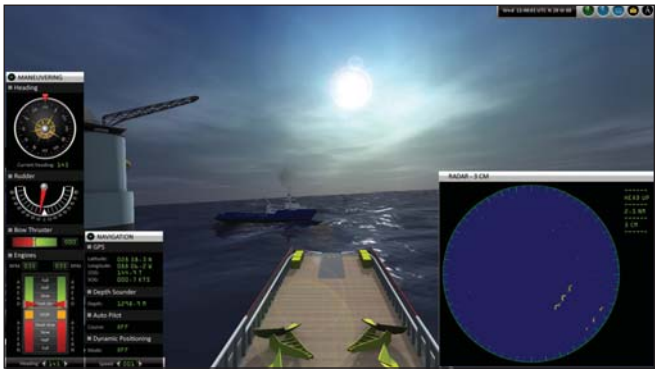
(Photo Courtesy Measurement Technology NorthWest (MTNW))

Measurement Technology NorthWest (MTNW) announced an award from Adamac, a Nigerian Oil & Gas Services company, for a project that called for nine running line tensiometers, displays, and software to monitor the anchor winch lines for a pipe-laying barge. "The Gulf of Guinea off of Nigeria is one of the fastest growing new oil patches. It is becoming as criss-crossed with sub-sea pipes as any ocean in the world," said Tom Rezanka, Managing Director of MTNW. "Oil companies operating in sub-sea environments have to be very careful about where they place their anchors for mooring. They need to know immediately if one of their anchors is slipping and could potentially pull through other nearby pipelines, or disrupt the laying of their own pipe." Kehinde Onibokun, Assistant General Manager of Adamac's Pipelines Unit agrees with Rezanka, stating: "Adamac is a fast growing Oil & Gas Services firm, working with the largest energy producers in the world. Part of our responsibility for personnel, equipment and environmental safety is to ensure that our own pipeline laying equipment is outfitted with the latest technology for monitoring." Kehinde went on to explain the reason Adamac chose to work with MTNW: "MTNW's anchor winch monitoring technology provides instant feedback to the vessel operators for immediate decision-making and also has data-logging for long-term, after-action review and analysis."

Rezanka explained that having technology continuously monitor anchor winch tension trends and historical peak loads locally at the winch station, in the control room, and remotely through the PC increases the safety factor beyond other currently available systems. With historical data-logging of tension loads that MTNW's WinchDAC software provides, vessel owner and managers have the capability to demonstrate and certify performance to their customers. "We have placed anchor winch mooring systems in the North Sea, Dubai, Venezuela, Singapore and now Nigeria," said Matt Mostad, VP of Sales at MTNW. "We are pleased to see growing recognition in the importance of mooring monitoring and data-logging for end-customers and for rig managers."

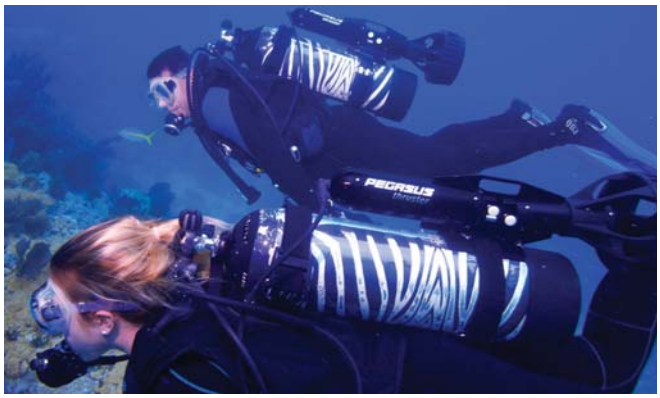
www.mtnw-usa.com

vSHIP: New Ship Simulator for Offshore Industry



Marine Simulation released its latest product, vSHIP, which is designed to train and prepare shipboard personnel for the ever growing roles and responsibilities they face in support of the offshore industry. Available as a desktop PC based simulator, vSHIP is designed to interface with marine electronics and navigation software via industry standard interfaces, as well as with other vSHIP and ROVsim Pro installations, providing a real world, coordinated operation simulation. Potential training applications include: offshore mooring and support operations, coordinated bridge / ROV team operations, naval mine and ordnance sweeping and clearance, as well as complex mission rehearsal.

http://www.marinesimulation.com



Pegasus Thrusters

Pegasus Thruster has, since 2002 built a leading position in fixed-mounted, high-performance, hands-free underwater diver propulsion vehicles (DPVs). With a complete line of thrusters tailored to both professional and recreational divers, Pegasus Thrusters are becoming a staple for the underwater professional. Current users who are reaping the benefits of the lightweight, easy to use device include municipalities, explorers, search & rescue teams and TV production crews. Pegasus Thrusters are patented unique systems powered by a NiMH battery that delivers significant propulsion power with relatively no maintenance. The major difference between the Pegasus and competing DPVs, is the way the thruster is fixed to the diver's air tank with a simple but secure mounting bracket, leaving the user's hand's free for tasks like filming, photography, spear guns and other equipment. With speeds up to 170 feet-per-minute and pressure tested to 250-feet, the Pegasus Thrusters expand diving boundaries and significantly reduce fatigue.

www.pegasusthruster.com

Underwater Hemispheric Camera

Ocean Presence Technologies (OPT) announced its first 360-degree hemispheric camera. The model OPT-09 has been designed for monitoring and recording of the entire area. Ideally suited for small aquariums or pools, the camera can be mounted on the bottom, supported upside down from the surface or from the side of a pool, a wall or pier piling. The OceanCam-OPT-09 provides hemispheric recording and captures a 360-degree view without any moving parts. A virtual Pan-Tilt-Zoom (PTZ) function allows the camera to be controlled and viewed over the Internet. The Internet-ready camera supports MxPEG and Motion-JPEG and delivers excellent VGA picture quality at 30 fps. This imaging system uses a ½-in. CMOS sensor and has a maximum image resolution of 3.1 million pixels (2048 x 1536) with an 8x digital zoom. With hemispheric, single- or double-panorama or simultaneous quad views, the camera can cover a wide monitoring area with great efficiency. Even when using the zoom function, the camera always records the entire image. The full image can optionally be saved for later research purposes. The recorded images can be later analyzed from different perspectives using virtual PTZ. The camera also features an internal DVR (digital video recorder) with a maximum memory capacity of 32 GB; recording over 30 hours of video. The OPT-09 OceanCam joins the lineup of real-time underwater camera systems. The system features an optically clear 55% hyper-hemisphere glass dome and is rated to 180 ft. (55m). Ultra-deep models are also available. The system comes complete with 50 feet of underwater Power-over-Ethernet cable, power supply and recording software. **Email: Robert.Aston@oceanpresence.com**

L-3 Klein Introduces UUV 3500 SSS

L-3 Klein Associates debuted its UUV 3500 high-resolution side scan sonar for Unmanned Underwater Vehicles (UUVs). The UUV 3500 was developed as a side scan sonar with the unprecedented benefit of an advanced bathymetry payload for the growing Autonomous Underwater Vehicle (AUV), Remotely Operated Underwater Vehicle (ROV) and UUV markets. L-3's UUV 3500 product line leverages powerful multi-channel processing electronics, offering both photo-quality side scan imagery and swath bathymetry that together exceed the performance of standard multi-beam echo sounders. In addition, the new system utilizes L-3 Klein's proprietary wideband technology for unmatched range and resolution while operating at lower power to deliver superior capability at a highly affordable price.

www.L-3com.com/Klein

C-FINS for Real-Time Mapping of C3 Submersible Fluorometer Data

Turner Designs introduces C-FINS (Fluorometric Integrated Nautical Mapping System), integrating the C3 Submersible Fluorometer's digital output with GPS data for data mapping. A simple software module enables C-FINS and ArcGIS to work together allowing for real-time mapping of fluorescence, temperature, depth, and turbidity. The ability to capture and integrate these data reliably using the C-FINS package is an enhancement to its C3 product line.

E-Mail: sales@turnerdesigns.com • www.turnerdesigns.com

C3 installed in C-ray Deployment Body, part of the C-FINS package.

OSIL to Supply Specialist Multi-Corer

OSIL's (Ocean Scientific International Ltd.) range of Multiple Corers help collect an undisturbed sediment sample from the seabed. Each of the four corers, Mega, Maxi, Midi and Mini, provide a simple and reliable way of collecting the most accurate sample possible. The corers use a unique hydrostatically damped coring mechanism (penetration rate ~1 cm/s) to attain the undisturbed sample. The hydrostatically damped head allows a true representative sample that has not been disturbed by the bow waves seen in front of traditional corers. In order to fully maximize its use, the modified corer has been extended to provide a longer core tube length of 800 mm (standard length 600 mm), which will result in an increased sample for work/study. The corers collect the undisturbed sediment sample together with overlying supernatant water, which provides a unique insight into the sediment water interface. The frame of the corers is made of 316 stainless steel and the core tubing itself of acrylic.

With a deployment rate of approximately 1m per second on the descent coupled with a retrieval rate at winch speed the corers are ideal for rapid assessment work. OSIL's corers are currently used worldwide by companies such as IAEA, Petrobras, Altima, NOC, BP and The University of Aberdeen.

www.oceanscientific.com

Launch of Bathy DataBASE 3.1

CARIS released Bathy DataBASE 3.1, a move which the company claims continues to solve the demands for robust and scaleable data management for the storage and analysis of ever-expanding volumes of sonar and LiDAR data. Bathy DataBASE now works with Oracle Spatial 11g utilizing the GeoRaster and geo point cloud data structures for storage. Oracle Spatial has been specifically designed to meet the needs of advanced geographic information system applications. This latest release of Bathy DataBASE expands the database system options available to clients following last year's release of Bathy DataBASE 3.0, which offered the open source PostgreSQL database for backend storage.

www.caris.com/products/bathydatabase

Hydrophones for Unique Use

Sensor Technology Ltd. received a repeat order for hydrophones custom-designed for a unique application in fire hydrants. "Most of our hydrophones are used in marine applications, where designing for survival in sea water is the standard. For this project, the hydrophones are used in pipes carrying drinking water to millions of people, so finding suitable, food safe materials was our major challenge." said Harvey Ng, production manager at SensorTech. The fire hydrants, by Hinni AG of Switzerland, use hydrophones to detect leaks in the piping network. The sensors take sound measurements at predefined intervals and compare them to reference values. Significant deviations from the reference indicate a leak.

www.sensortech.ca

MARINE TECHNOLOGY REPORTER

The international authority for business news and information from the marine technology and ocean science community.

Marine Technology Reporter 2011 Editorial Calendar

JANUARY / FEBRUARY — **AD CLOSE DATE: JANUARY 22**

FEATURE: Marine Salvage & Recovery

MARKET: Naval Underwater Warfare
PRODUCT / DIRECTORY: Commercial Diving Equipment & Services

BONUS DISTRIBUTION:
Underwater Intervention
February 22-24

MARCH — **AD CLOSE DATE: FEBRUARY 12**

FEATURE: Subsea Vehicles: AUV, ROV, UUV Annual

MARKET: Sonar Systems & Seafloor Mapping Solutions
PRODUCT / DIRECTORY: Ocean Business 2011 Exhibitor Guide

BONUS DISTRIBUTION:
Ocean Business - April 5-7

APRIL — **AD CLOSE DATE: MARCH 12**

FEATURE: Oil & Gas SubSea Monitoring

MARKET: Seafloor Engineering
PRODUCT / DIRECTORY: Deck Machinery, Winches & Cranes

BONUS DISTRIBUTION:
OTC
Offshore Technology Conference-
May 2-5

MAY — **AD CLOSE DATE: APRIL 16**

FEATURE: Subsea Defense Edition

MARKET: Renewable Energy: Wind, Wave & Tidal Power
PRODUCT / DIRECTORY: OceanTech Expo

BONUS DISTRIBUTION:
OceanTech Expo - May 17-19
UDT - June 7-9

JUNE — **AD CLOSE DATE: MAY 14**

FEATURE: Hydrographic Survey

MARKET: Communications, Telemetry, Data Processing
PRODUCT / DIRECTORY: Instrumentation: Measurement, Process, Analysis

JULY / AUGUST — **AD CLOSE DATE: JULY 23**

FEATURE: MTR100 Edition

MARKET: Work Class ROV & Auxiliary Systems
PRODUCT / DIRECTORY: Umbilicals, Cables, Connectors & Power Supply

BONUS DISTRIBUTION:
Offshore Europe - Sept. 6-8

SEPTEMBER — **AD CLOSE DATE: AUGUST 13**

FEATURE: Ocean Observation

MARKET: Environmental Monitoring & Pollution Control
PRODUCT / DIRECTORY: Training & Education Institutions and Facilities

BONUS DISTRIBUTION:
Oceans 2011 MTS/IEEE
September 18-23
OTC Brazil - Oct. 4-6

OCTOBER — **AD CLOSE DATE: SEPTEMBER 10**

FEATURE: Ocean Engineering & Design

MARKET: Underwater Imaging
PRODUCT / DIRECTORY: Scientific Deck Machinery

BONUS DISTRIBUTION:
MAST Americas - Nov. 14-16

NOVEMBER / DECEMBER — **AD CLOSE DATE: NOVEMBER 19**

FEATURE: Fresh Water Monitoring and Sensors
(lakes, rivers, reservoirs)
MARKET: 2012 Market Planner
PRODUCT / DIRECTORY: Shallow Water Survey

CONTACT US @ SEADISCOVERY.COM OR EMAIL US AT INFO@MARINELINK.COM

Log onto SeaDiscovery.com to explore these new job openings.

MARINE POLLUTION CONTROL OFFICER

Job Location: United Arab Emirates, Dubai
(Marine Pollution Control Officer)
Environment Department of Dubai Municipality (http://www.environment.gov.ae) is looking to hire a Marine Pollution Control Officer to work with Marine Environment and Wildlife Section. The Pollution Control Officer will be based in Dubai and will serve under the direction of the Head of Section. The successful candidate will work under a biannually renewable contract with Dubai Municipality.
Marine Pollution Control Officer
Responsibilities include:
•Implement Maritime laws & regulations.
•Ensure compliance with all applicable International, regional & national environmental regulations, permitted conditions and corporate policies.
•Investigates marine oil & other hazardous materials spill incidents, implement response plans, and provide reports.
•Routinely conduct safety/pollution control audits of facilities and operations to ensure compliance with applicable regulatory requirements
•Monitor operations performed by vessel owners for compliance with established environmental regulatory requirements
•Develop contingency plan, assist in oil spill clean ups and be able to produce records and documents necessary for availing penalty/compensation.
•Conduct investigations into accidents, incidents, and environmental abuse for identification of root cause and corrective action to prevent recurrence.
•Investigates opportunities to prevent pollution.
•Prepare and present audit and inspection reports for management review
•Coordinate with other International, regional, and national agencies associated with Marine pollution.
•Ensure environmental enforcement with all local and federal regulatory requirements or permitted conditions
•Perform other duties as assigned by Environmental Manager
Qualifications, skills and experience
The Prospective candidate should be a male with: Either a bachelor/master degree qualification in applied and/or environmental science, engineering, A Master Mariner Certificate from an Internationally recognized governmental body, or in another field related to environment management, or appropriate experience in industry, environmental monitoring and enforcement
The ability to develop promotional materials such as posters, manuals, website design, videos
Minimum of 5 years of experience in regards to Health and Safety or environmental experience.
Must possess leadership qualities and have ability to work in a high pace environment

Prefer experience with the following:
Minimum of 10 years services as an Officer on board tankers of international shipping companies, 4 years of which should be post the Master's qualification, Marine/naval vessels or shipyards
Experience with Microsoft Office software (i.e. Word, Excel, PowerPoint, etc.)
Must have basic knowledge of OSHA, DEQ, Coast Guard regulations

The person:
Essential
• Good scientific understanding of the Marine Environment
• Strong analytical and decision making skills.
• Strong oral and written communication skills in Arabic and English.
• IT literate

Desirable
• Enthusiasm for the marine environment and a desire to help build an expert regulatory body.
• Marine Environment related further education qualification.
• At least 2 years experience either within the academic community or within industry.

How to apply
Please send your resume in word format to marabdulla@dm.gov.ae
Applications for this position must be received at an earliest. Applicants are encouraged to describe how their knowledge and skills fulfill the requirements of the position. Total Salary (AED 8,000- 13,000/pm) is commensurate with experience. Air tickets as per Human Resources law, annual leave (22) working days after passing 12 months of service. Three months probation period.
Mohammed Abdul Rahman Hassan Abdulla
Dubai Municipality
Marine Enironment & Wildlife Section
Environment Department
P.O Box 67
Dubai,
United Arab Emirates
Phone: 0097146066819
Email: marabdulla@dm.gov.ae
WEB: http://www.environment.gov.ae

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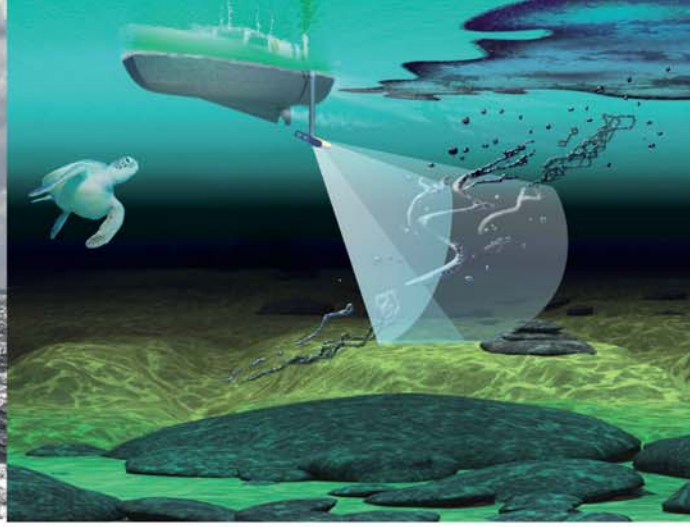
In St. John's, developing a New Arctic Ship and Offshore Structures

Design Toolset of the Future

Pictured is Dr. Claude Daley and the small double-pendulum ice impact apparatus. Developing tools to design ships and offshore structures for year-round Arctic operations is the focus of a $7.2 million five-year applied R&D project at Memorial University of Newfoundland in St. John's, Newfoundland and Labrador, Canada. Husky Energy, Inc., American Bureau of Shipping (ABS), Samsung Heavy Industries Co. Ltd, Rolls-Royce Marine, and BMT Fleet Technology are the industry partners in the Sustainable Technology for Polar Ships and Structures (STePS2) project. The National Research Council's Institute for Ocean Technology (IOT-NRC) is a key technical partner in the project. This story is featured in the April 2011 edition of *Maritime Reporter & Engineering News*, sister-publicaiton to MTR. To read Andrew Safer's article in full, visit www.marinelink.com and click the "magazine" link.

(Photo: Memorial University of Newfoundland)





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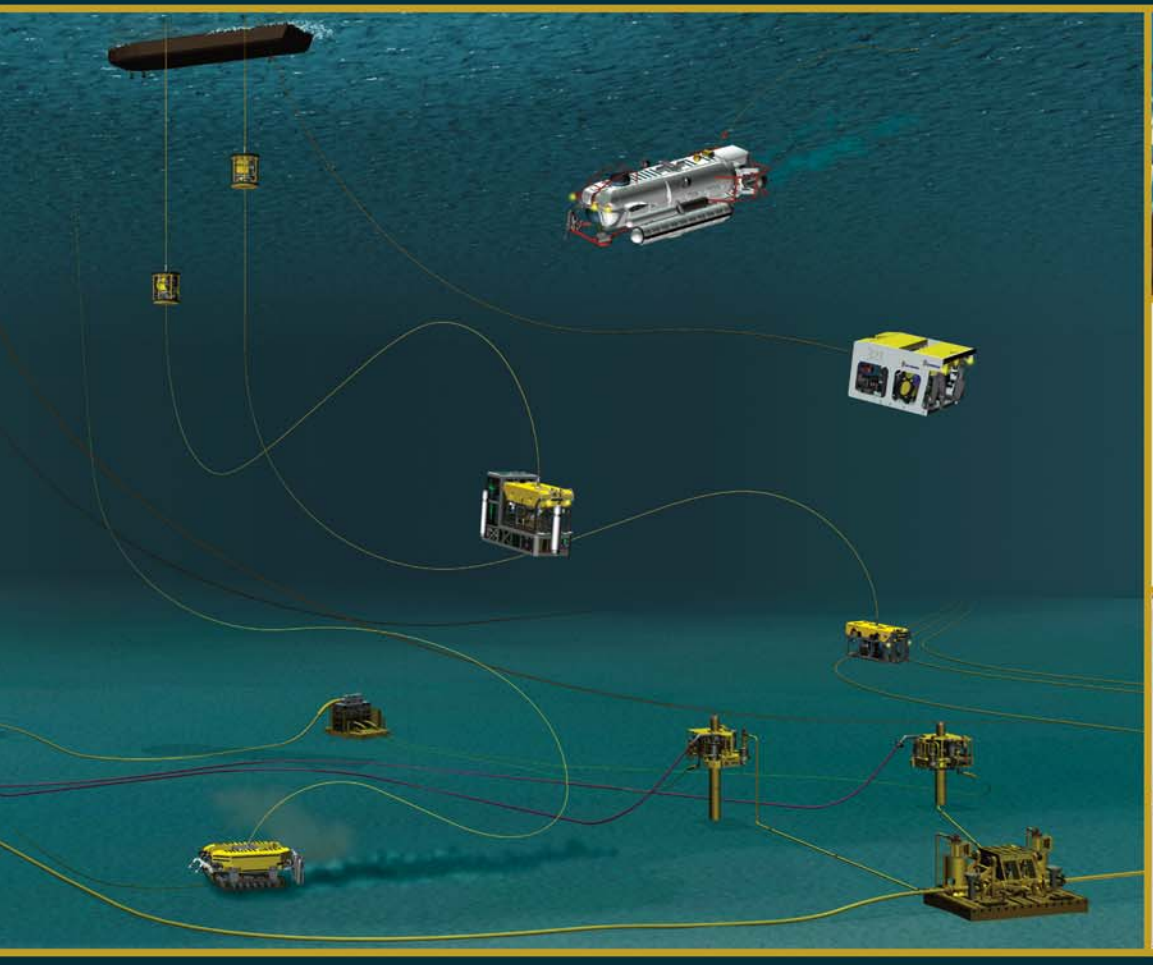

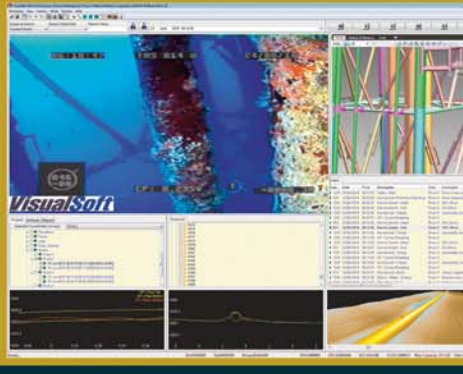

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