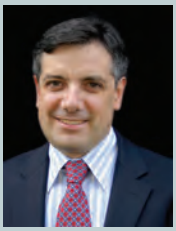
MARINE TECHNOLOGY REPORTER

October 2011 www.seadiscovery.com



5-minutes with
Rob Mecarini
President, Alpine Ocean Seismic Survey

Underwater Imaging

Assisting "Project Shiphunt" Students Unearth Treasures Past

Market Report
World UMS Market

Subsea Engineering
Cable Bury Equipment

View from St. John's
Pangeo Subsea

VideoRay

The Global Leader In MicroROV Technology

www.videoray.com

DETERMINED

VideoRay Remotely Operated Vehicles...

Rugged, reliable, and portable solutions available for underwater filming, inspection, location, and recovery. With more than 1,950 systems sold worldwide, VideoRay is the most trusted ROV on the market today. Learn how professionals just like you are using VideoRay products and services to operate safer while saving money. Visit **www.videoray.com**.

ABOVE: Shibuya Diving Industry (www.shibuya-diving.co.jp) is one of the best known and most innovative dive companies in Japan. Founded by renowned diving environmentalist Masanobu Shibuya, they are determined to repair the massive damage to ports from the recent Tsunami. Their newly-acquired VideoRay Pro 4 ROV System is a key part of their diving tools. Photo Credit: Mr. Masanobu Shibuya, President, SDI

www.videoray.com

580 Wall Street Phoenixville, PA 19460 USA

+1 610 458 3000 info@videoray.com

Piezoceramics - Transducers - Systems

CHANNEL TECHNOLOGIES GROUP

Since 1959

CHANNEL INDUSTRIES — Piezoelectric Ceramics

Since 1966

ITC — Transducers

Since 1973

SONATECH — Custom Acoustic Systems

Over 50 Years of World Class Quality

www.channeltechgroup.com

879 Ward Drive . Santa Barbara . CA . 93111 . USA . Tel. 805.683.1431

October 2011

contents

Marine Technology Reporter • Volume 54 • Number 8

Pictured on the Cover

is an image from the recent "Project Shiphunt," which utilized advanced imaging systems from Sony and Intel and included a group of high school students and global subsea leaders in a unique mission to discover and document historic shipwrecks in Lake Huron.
See story on page 18.

(Photo Credit: Mike Postons - Fourth Element/3deep)

Pictured in the background:
James Willett radios to a dive boat during the Project Shiphunt.

on the right path

Looking North for new ocean technology opportunities? Look to Newfoundland and Labrador, Canada first. Consider us your landmark location for research and development in cold ocean technologies and unmatched expertise in harsh environment operations. Our world-renowned ocean technology cluster has made its mark in the fields of ice engineering, marine simulation, navigation and communications technologies, and AUVs. The edge of the new frontier starts here. Make sure you're on the right path.

www.nlbusiness.ca/arctic

Newfoundland Labrador
CANADA

it's happening here.

Authors

Even Børhaug *received his MSc and PhD degree in Engineering Cybernetics from the Norwegian University of Science and Technology. He joined Kongsberg Maritime where he works as an R&D engineer in the AUV software department with a focus on the HUGIN AUV.*

See Story on page 48

Per Espen Hagen *received his MSc in Signal Processing from the Norwegian Institute of Technology. He joined the Norwegian Defence Research Establishment (FFI). In 2008, he joined Kongsberg Maritime, where he is in charge of System Architecture at the AUV R&D Department.*

See Story on page 48

Antoine Martin, *a business consultant and principal of Unmanned Vehicles Systems Consulting, LLC, previously worked as an ocean engineer developing UUV payloads. He can be reached at AMartin@marketintelgroup.com to answer questions related to maritime robotics. Antoine recently completed a comprehensive study of the world's evolving UMS technologies and markets; his research report is published by Market Intel Group LLC (MiG).*

See Story on page 24

MTREnews
MTR **publishes a twice weekly newsletter via e-mail. Subscribe for FREE at www.seadiscovery.com**
For banner advertisement info, contact Rob Howard at howard@marinelink.com

SUBSCRIBE
Subscribe to the print or electronic edition of *MTR* by visiting www.seadiscovery.com, or e-mail Kathleen Hickey at mtrcirc@marinelink.com

ADVERTISE
MTR **offers a number of print and electronic advertising packages. To see our editorial calendar and advertising rates, visit www.seadiscovery.com/mt/mtMagazine.aspx?mnl2=l2advertising**

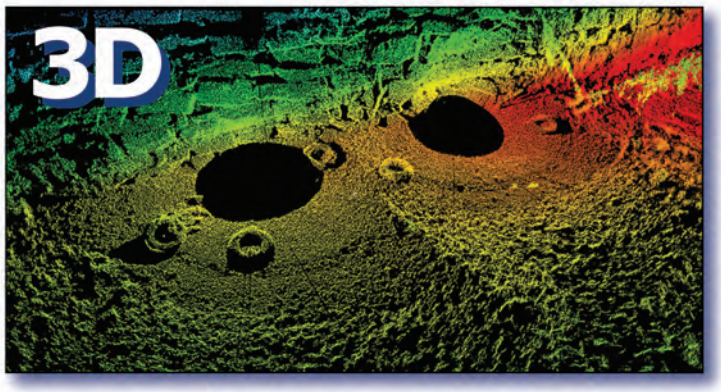
POST/SEARCH•JOBS
MTR JOBS **listings are updated weekly and help match employers with qualified employees. Post a position or keep abreast of new employment opportunities at www.seadiscovery.com/mt/mtJob.aspx**

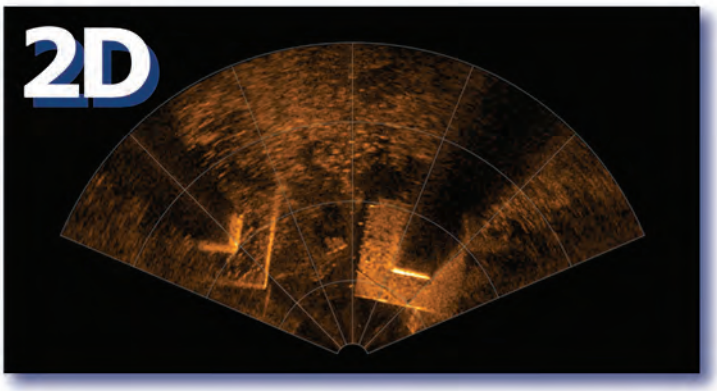
SUBMIT•EDITORIAL
MTR **invites you to submit company news and events for publication on-line and in print. Visit www.seadiscovery.com/mt/mtStories.aspx?PostStory=new**

SUBMIT VIDEO
MTR **invites you to submit interesting Subsea videos for broadcast. Contact trauthwein@marinelink.com for details.**

EVENTS•CALENDAR
MTR **maintains a list of upcoming industry events. Search an event or post information on your event at www.seadiscovery.com/mt/MTCalendar2.aspx**

Your Challenges, Our Solutions.





Compact Acoustic Systems

A world of high-resolution 3D mechanical scanners, configurable AUV gap-fill sensors, and real-time acoustic cameras for multiple applications.

BlueView TECHNOLOGIES

www.blueview.com

Photo Credit: Mike Postons - Fourth Element/3deep)

www.seadiscovery.com

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

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

PUBLISHER
John C. O'Malley
jomalley@marinelink.com

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

Contributing Editors
Capt. Edward Lundquist, USN (Ret.) • Steve Withrow
Claudio Paschoa • Andrew Safer

Production Manager
Irina Tabakina
tabakina@marinelink.com

Sales Administration & Office Manager
Rhoda Morgan
morgan@marinelink.com

Sales & Event Coordinator
Michelle Howard
mhoward@marinelink.com

Manager, Accounting Services
Rhoda Morgan
morgan@marinelink.com

Manager, Public Relations
Mark O'Malley
momalley@marinelink.com

Manager, Marketing
Jocelyn Redfern
jredfern@marinelink.com

Manager, Information Technology Services
Vladimir Bibik
bibik@marinelink.com

CIRCULATION
Kathleen Hickey
mtrcirc@marinelink.com

ADVERTISING

Vice President, Sales and Marketing
Rob Howard
howard@marinelink.com
Tel: (561) 732-4368 • Fax: (561) 732-6984

Advertising Sales Manager
Lucia M. Annunziata
annunziata@marinelink.com
Tel: (212) 477-6700 • Fax: (212) 254-6271

Mike Kozlowski
kozlowski@marinelink.com
Tel: (561) 733-2477 • Fax: (561) 732-9670

Japan
Katsuhiro Ishii • amskatsu@dream.com
Tel: +81 3 5691 3335 • Fax: + 81 3 5691 3336

For as complex, unique and technologically advanced as this industry is, it is similar to others in that it faces a number of challenges to ensure its long-term success. The technological challenges are somewhat obvious and numerous, centered on the ability to work more efficiently and effectively in one of the most hazardous and challenging spaces on earth, including the need for improved 'vision', communication and sustainability underwater. The non-technical challenges are similarly numerous and difficult, from increasing the education and interest of the younger generation to a life of science and engineering, to finding the means to grow the market to enhance the economies of scale, particularly as it relates to profitable creation, manufacture and production of highly technical products and systems in ever greater numbers.

That's why when I see something like "Project Shiphunt," illustrated on the cover with a corresponding article on page 18, it is personally exciting. I realize that it is but a minute microcosm of the industry and its potential, but "Project Shiphunt" wraps into one neat ball a glimpse of what could be on a larger scale. It combines the deep pockets and breadth of market that only corporations (Sony & Intel) can; it triggers the interest and creativity of youth, in this case five high school students from Michigan; it showcases impressive new technologies (3D filming and subsequent 3D computer modeling) that could be of benefit across the subsea technology landscape; and it includes the interest and expertise of leading organizations (NOAA & WHOI) from government and academia to lend direction, scope and credibility.

Reading further into this edition, specifically the Unmanned Maritime System market report starting on page 24 – a report that estimates the UMS market to be worth $7B between 2012 and 2020 – and you can start to see in part where these future talents and technologies could be put to work.

Gregory R. Trauthwein • trauthwein@marinelink.com • tel: 212-477-6700

MARINE TECHNOLOGY REPORTER
www.seadiscovery.com
Vol. 54 No. 8
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.

Publishers are not responsible for the safekeeping or return of editorial material. ©2011 New Wave Media.

Member
BPA WORLDWIDE BUSINESS

Subscription:
To subscribe please visit
www.seadiscovery.com/subscribe

WWII Mine Disposed of at Site of World's Largest Offshore Windfarm

Explosive Ordnance Disposal (EOD) specialist Ramora UK (www.ramorauk.com) reports that it has safely disposed of an unexploded World War II mine onsite at one of the world's largest offshore windfarm. The four-man Ramora UK team used a Remotely Operated Vehicle (ROV) to place a countermining charge next to the 1,500lb (680kg) mine which had been assessed as high-risk due to damage previously sustained to it. Throughout the procedure a 1,500m safety zone was maintained to protect other vessels in the area.

"The expansion of the offshore renewable energy sector is creating an increased requirement for rapid and safe disposal of the UXO that is very common in coastal waters," said David Welch MIExpE, Managing Director of Ramora UK. "This mine was particularly hazardous because of damage that had occurred to its booster release mechanism. We are very pleased that our experienced operators were able to deal efficiently with it."

A controlled explosion was then initiated from a safe distance, leaving an underwater crater 65 ft. (20m) wide by 13 ft. (4m) deep. The German, ship-laid, ground mine was detected in 115 ft. (35m) of water, 20 miles (33km) off Harwich in Eastern England, on the site of the Greater Gabbard Windfarm which will be the world's largest offshore windfarm when it is completed next year. Portsmouth-based Ramora UK was contracted by the prime contractor on the project, Fluor (www.fluor.com), which had first called in the company for another mine found at the site in 2009. Ramora UK used elements of the REODS suite of equipment to dispose of the mines. REODS reduces the human and commercial risks of EOD by removing the need for a diver. It is kept on 24/7 standby, is fully mobile, and can be rapidly deployed anywhere in the world transported in a 10 ft. container. If necessary it can move UXO to a safe location for disposal and it has already been used to dispose of many similar items.

SEAWEED: Wave Energy for Public Utilities

Newfoundland and Labrador company Grey Island Energy Inc., is moving forward with the SEAWEED, proprietary technology aimed at generating energy through the power of ocean waves. In-water tests of the system were successfully completed in the tow tank of NRC Institute for Ocean Technology. The tests were conducted to validate the configuration and design of the SEAWEED's energy coupling system, and durability of the device. During testing, the SEAWEED endured a wide range of wave spectrums that simulated regular and irregular waves. The results exceeded the company's expectations, indicating that the SEAWEED is an efficient and reliable generator of energy. As a result of testing, GIE will execute the next stage of the SEAWEED's development program. Daniel Hoyles, Chief Operating Officer of Grey Island Energy, said: "We are extremely pleased with the results of our testing in the tow tank. This test was a significant step towards designing an ocean wave technology that is more durable, efficient, and easier to maintain than competing technologies."

"We are extremely pleased with the results of our testing in the tow tank," said Daniel Hoyles, COO, Grey Island Energy.

For utilities and independent power producers, the SEAWEED provides a unique energy solution that is consistent, reliable, and cost effective. It is the innovative result of practical and scientific knowledge by Grey Island Energy and its research collaborators. The application of creative design has produced a more reliable and cost effective ocean wave energy design that is easily adjustable to customer needs. The device is designed to harness power generated by ocean surface waves by adjusting to varying wave conditions and utilizing a hydraulic takeoff system to transmit mechanical power. Grey Island Energy IE has been accepted into the Genesis Center at Memorial University and the Ocean Technology Enterprise Centre (OTEC) at the Institute for Ocean Technology. Both centres are incubation facilities with the Genesis Centerproviding business advice and guidance and OTEC providing technical advice and guidance. In addition, the fabrication of SEAWEED Validation Model was funded by the National Research Council's Industrial Research Assistance Program.

Long Island Offshore Wind Project: $2.7 to $4.7B

The Long Island–New York City Offshore Wind Collaborative filed a lease application with BOEMRE for a **proposed wind farm of up to 350 to 700 MW** is to be located 13 to 17 miles off the coast of the Rockaway Peninsula and Long Island, could create up to $2.7 billion in new economic activity, including 2,300 to 4,700 jobs during construction and 85 to 170 permanent jobs, depending on project size.

OceanServer Wins AUV Contracts

OceanServer Technology received AUV orders from NOAA and the University of Wisconsin for use in scientific research and mapping applications. The new order from NOAA represents the federal agency's second Iver2 vehicle purchase. NOAA's Chesapeake Bay Office is developing an operational capability to observe and monitor habitat restoration and quantify environmental conditions in restoration areas. The Iver AUV will play an important role in pre- and post-restoration assessments and ongoing surveys of benthic characteristics and 3D characterization of water properties and quality. The Iver EP35 will dramatically expand NOAA's survey capability in shallow water and enable AUV configurations including a variety of instrument packages.

Modular Mine Countermeasures System

ATLAS ELEKTRONIK has set a milestone in mine countermeasures (MCM) technology. With the C-IMCMS, the company has presented another first: a modular and platform-independent MCM system that operates exclusively with unmanned units. For the first time, the complete functional chain of unmanned mine countermeasures – both for mine-hunting and for influence sweeping – was demonstrated by means of remote-controlled or autonomous systems. The missions of all vehicles used were planned, monitored and evaluated from a container-based command and weapon control system. The C-IMCMS (Containerised Integrated Mine Countermeasures System) consists of a portable combat management system as well as the analysis software CLASSIPHI for post mission analysis of side-scan sonar data, the unmanned surface vessel (USV) FAST, the autonomous underwater vehicle (AUV) SeaOtter Mk II and the mine disposal system (ROV) SeaFox. The system was deployed from the shore; operations on board various ship types are also possible. Antoni Mazur, Managing Director of ATLAS ELEKTRONIK UK, said: "This demonstration once again underlines the technology leadership of ATLAS ELEKTRONIK, also in the field of mine countermeasures – leadership which ATLAS will continue to expand and extend over corporate locations and national borders."

Polarcus Alima Takes Northern Sea Route

One of the X-BOW vessels designed by ULSTEIN, the seismic vessel Polarcus Alim', recently transited to Asia-Pacific via the Northern Sea Route (NSR). This is the first known passage of a 3D seismic vessel along the Northern Sea Route. Her passage commenced on September 15 from Hammerfest in Norway after completion of seismic operations in the Barents Sea. After only nine days and 3,000 nautical miles the vessel reached Cape Dezhnev in the Bering Straits. She is presently continuing her onward passage to New Zealand to commence operations there. Polarcus Alima is an ultra-modern 12-streamer 3D seismic vessel of the SX134 design. Vessels making the passage are required to hold an ICE-1A or higher ice class. The expected time savings in transit between Norway and New Zealand compared to the traditional route through the Panama Canal amounts to some eight days. The savings versus the Suez Canal, a necessity for some larger seismic vessels, amounts to thirteen days.

Preparations for the voyage were carried out with Tschudi Arctic Transit AS through its Russian - Norwegian JV company Arctic Bulk AG, Atomflot, and the Northern Sea Route Administration in Moscow.

TECHNOLOGIES FOR A GREENER TOMORROW

Power Up!

Teledyne Marine provides the technology and experience you need for every phase of your marine energy application.

MEASURE
inland and coastal currents and offshore waves with Teledyne RD Instruments

SURVEY
the seabed for hazards to construction and sensitive habitats with Teledyne Odom and Teledyne Benthos

COMMUNICATE
wirelessly with your remote subsea sensors with Teledyne Benthos

CONNECT
power and network your subsea and surface instruments with Teledyne D.G. O'Brien and Teledyne ODI

WIND WAVE TIDAL

TELEDYNE MARINE

www.teledynemarine.com

BENTHOS • D.G. O'BRIEN • ODI • ODOM • RD INSTRUMENTS

Liquid Robotics & the

Pacific Crossing Grand Challenge

Liquid Robotics announced its Pacific Crossing (PacX) Challenge open to scientists around the world. During the PacX Challenge, four Wave Gliders will launch in the fall of 2011 off the coast of Northern California and attempt to travel the longest distance at sea by an unmanned marine vehicle. The robots will travel together to Hawaii and then take separate routes across the Pacific, one pair arriving in Japan and the other in Australia. While at sea, the Wave Gliders will be routed across regions never before remotely surveyed and will continuously transmit data on salinity and water temperature, waves, weather, fluorescence, and dissolved oxygen. This data will be made available in near real-time to anyone interested and who registers on www.liquidr.com/pacx.

"Liquid Robotics invites scientists to embark on a grand challenge journey with us as we cross the Pacific on a voyage of scientific discovery," said Ed Lu, chief of innovative applications at Liquid Robotics. "These Wave Gliders are much like small 'spacecraft' that open up new opportunities for robotic exploration. I challenge all scientists who are interested in advancing ocean exploration to take advantage of this unique opportunity. What scientific questions can we address with this new and unique data set?"

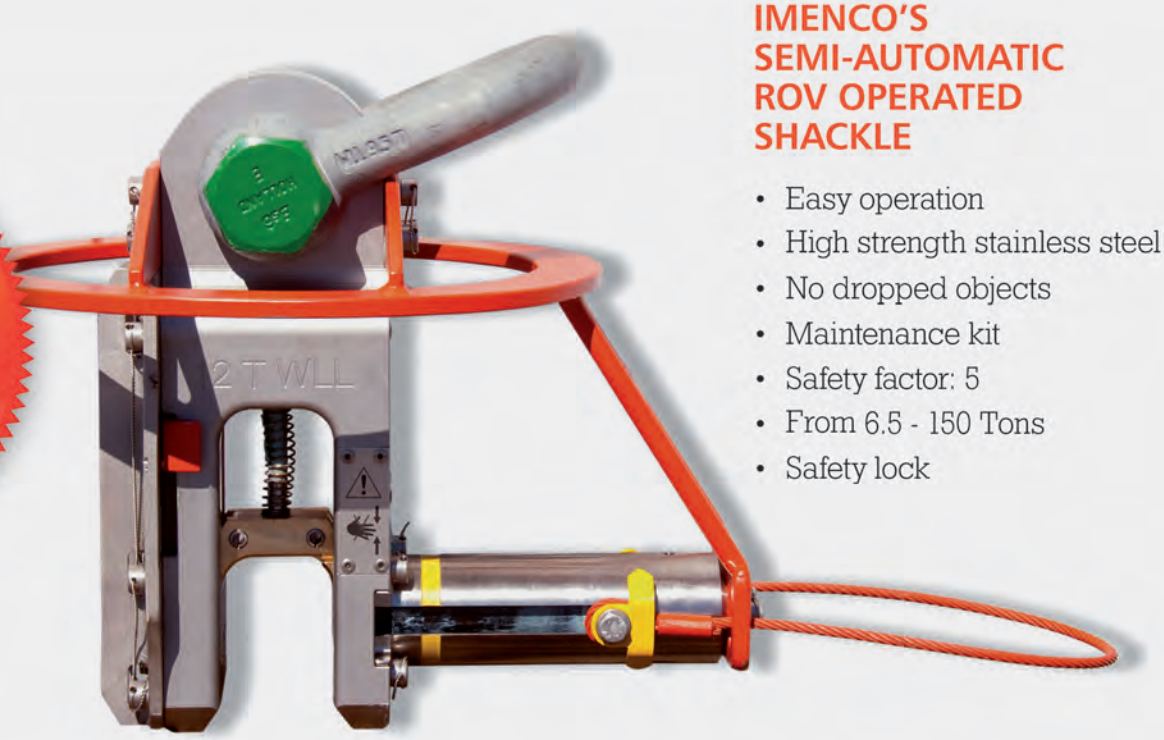
Those who wish to compete for the PacX Challenge prize are required to submit a one-page research abstract outlining their scientific intentions for the data collected during the Pacific crossing. The required one-page research abstract and PacX Challenge guidelines can be found on www.liquidr.com/pacx.

A distinguished science board of U.S. and international ocean scientists will evaluate the submissions and select one grand prize winner who best represents the daring spirit of exploration and discovery embodied by this journey. The grand prize winner will receive six months of free Wave Glider data services and will work with Liquid Robotics to chart the course and mission for the six month deployment, including sensor configuration. The PacX Wave Gliders will be equipped with a wide array of sensors including:

- **Seabird** GPCTD with Dissolved Oxygen Sensor – measures water conductivity, temperature, depth, and dissolved oxygen just below the float of the Wave Glider.
- **Datawell** MOSE-G Directional Wave Sensor – measures significant wave height, average period, peak period, and peak direction.
- **Airmar** PB200 WeatherStation – measures air temperature, barometric pressure, wind speed, wind gust speed, and wind direction one meter above the deck of the Wave Glider.
- **Turner Designs** C3 Submersible Fluorometer – measures chlorophyll-A and crude oil fluorescence, as well as turbidity and water temperature just below the float of the Wave Glider.

You don't have to drop anything to the ocean floor!

PROVEN THE BEST IN THE INDUSTRY



IMENCO'S SEMI-AUTOMATIC ROV OPERATED SHACKLE

- Easy operation
- High strength stainless steel
- No dropped objects
- Maintenance kit
- Safety factor: 5
- From 6.5 - 150 Tons
- Safety lock

Proven as the safest and best in the industry because there is no need to retrieve the shackle pin. The shackle can be used over and over again if cleaned in fresh water after use. Recommended by major operators worldwide for safe, efficient and user friendly subsea operation. The shackle's body and main parts are made from high strength stainless steel S165M equivalent to martensitic stainless steel 17/4PH. Standard or super shackle pin material, contact Imenco for more info. The Imenco Shackle is available in various sizes: 6.5, 12, 17, 25, 35, 55, 85 and 150 Tons. The shackle comes with a ILO Certificate and if needed, third party certification can be provided according to client's requirements. For more information please contact Al Cohen on **713 480 7777** or email **al.cohen@imenco.com** Imenco Houston, 16111 Park Entry Drive, Suite 100, Houston, Texas.

www.imenco.com

imenco
smart solutions

ULSTEIN Delivers Seismic RV

ULSTEIN delivered the seismic research vessel Oceanic Sirius to Eidesvik and CGGVeritas on October 3, 2011. Oceanic Sirius is designed and built in accordance with strict environmental standards and equipped with state-of-the-art technology for advanced seismic research operations. She is owned by a joint venture between Eidesvik and CGGVeritas. The vessel was named in a ceremony in Ulsteinvik on 1 October. Oceanic Sirius is sister vessel to the Oceanic Vega, delivered by ULSTEIN in July 2010.

"We are proud to deliver a vessel that features among the most advanced seismic research vessels in the world, and we are confident that she will stand the owners in good stead for many years to come, says managing director of Ulstein Verft, Karsten Sævik. Eidesvik is recognized for its focus on green solutions and dedication to the development of environmentally sound ships. CEO of Eidesvik, Jan Fredrik Meling, comments on their latest ship: "We are pleased to take delivery of another vessel of ULSTEIN quality; a vessel designed and built to minimise harmful emissions to the environment whilst offering the best possible working environment for our seafarers. This is the third X-BOW vessel we now own and based on the performance of the first two, Viking Poseidon and Oceanic Vega, we have great expectations for the Oceanic Sirius."

CGGVeritas is known as an innovative, responsible and high-end provider of geophysical technologies, services and equipment. Jean-Georges Malcor, CEO of CGGVeritas, says: "We look forward to the Oceanic Sirius matching the excellent seismic performance of her sister ship, the Oceanic Vega. She has been designed for optimum propulsion and seismic reliability to ensure minimum of operational downtime. Her outstanding qualities will make her a valuable addition to the CGGVeritas seismic fleet." Oceanic Sirius is the second of two vessels of the SX120 type designed by Ulstein Design & Solutions. She is a powerful seismic research vessel with a dynamic towing force of 140 tons. The vessel is ideally suited for acquisition of large 3D, 4D or high-resolution projects. The vessel´s 20 streamer winches are each capable of spooling 9 kilometres of streamers. Carrying an ICE-C classification, the Oceanic Sirius can operate in new frontier areas.

Oceanic Sirius is designed to stay permanently at sea with five-year docking intervals. There are enough engines

(Continued on page 17)

The largest global circulation available, reaching buyers and decision-makers in all market sectors

2012 Marine Technology Reporter Editorial Calendar

January / February — **Ad Closing: Jan 13**

Offshore Inspection, Repair & Maintenance

Market: Salvage & Recovery
Product: Scientific Deck Machinery
Directory: Umbilicals, Cables, Connectors & Power Supply

Bonus Distribution
AUVSI
Feb 7-9 Washington, DC
Underwater Intervention
Jan 24-26 New Orleans, LA

March — **Ad Closing: Feb 23**

Subsea Vehicle Report – Unmanned Underwater Systems

Product : Sonar Systems & Seafloor Mapping
Regional Report: Atlantic Canada
Preview: Oceanology International 2012 Technology Guide

Bonus Distribution
Subsea Tieback
Mar 6-8 Galveston, TX
Oceanology International
Mar 13-15 London, UK

April — **Ad Closing: Mar 22**

Global Offshore Deepwater Report

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

Bonus Distribution
Offshore Technology Conf.
Apr 30 - May 3 Houston, TX

May — **Ad Closing: Apr 19**

Hydrographic Survey

Market: Renewable Energy –Wind, Wave & Tidal Power Report
Product : Instrumentation: Measurement, Processing & Analysis
Preview: OceanTech Expo Preview & Show Guide

Bonus Distribution
OceanTechExpo
May 21-24 Newport, RI
UDT Europe
May 29-31 IFA, Spain

June — **Ad Closing: May 24**

AUV Arctic Operations

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

Bonus Distribution
EnergyOcean
Jun 19-21 Boston, MA

July / August — **Ad Closing: Jun 21**

MTR 100

The MTR 100 serves as an invaluable guide for companies, government agencies, municipalities, research institutions and universities seeking product and service providers throughout the year

September — **Ad Closing: Aug 23**

Subsea Defense: Protecting Port & Subsea

Market: ROV Technology: Workclass to Micro Vehicles
Products : Underwater Imaging: Lights, Cameras, Sonar
Special Report: Training & Education Institutions & Facilities

October — **Ad Closing: Sep 20**

Ocean Observation: Gliders, buoys & sub surface monitoring networks

Market: Marine & Subsea Engineering & Construction
Product : Offshore Inspection, Repair & Maintenance
Regional Report New England

Bonus Distribution
Oceans MTS/IEEE
Oct 14-16 Virginia Beach
SNAME
Oct 22-24 Providence, RI
MAST Americas
Nov 14-16 Washington, DC

November / December — **Ad Closing: Nov 22**

Fresh Water Monitoring & Sensors

Market: 2012 Market Planner
Product : Naval Underwater Warfare Technology
Special Edition: 2nd Annual Underwater Imaging Contest

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

(Continued from page 14)

and generator sets on board to conduct maintenance at sea and refueling is carried out by dedicated support vessels. The vessel is equipped with two CP (controllable pitch) propellers in a nozzle, each driven by two frequency converter-driven electric motors. This allows smooth speed control of around five knots during seismic acquisition. Two work boats will be used for maintenance of in-water equipment. Oceanic Sirius complies with the Clean Design demands as well as the redundant propulsion notation from DNV.

The vessel's redundant propulsion system ensures that propulsion and steering remain intact after failure in parts of the system. Diesel electric propulsion reduces fuel consumption and atmospheric emissions. In addition to modern systems for sludge, garbage and sewage handling, a complete ballast water treatment system has been installed on board.

The system prevents the spreading of marine organisms from one geographic area to another with the ballast water, a cause of potentially serious ecological, economical and health problems in the host environment.

The ship's instrument room, with its ergonomically designed interior, is located at the stern with large windows facing the sea. It is placed directly above the seismic area, with a direct view of the streamer deck. A storage area above the instrument room is served by a knuckle jib crane with a capacity of 10 tons at 20m outreach. The two offshore cranes placed on C-deck mid-ship have a capacity of 15 tons at 18m outreach and can be used to lift supplies on board from service vessels. Ulstein Power & Control has delivered a substantial amount of equipment for the vessel, including the information and communication system ULSTEIN COM, the navigation system ULSTEIN NAV, and the integrated automation system ULSTEIN IAS, which is equipped with integrated modules, among them PMS (power management system) and modules for monitoring of the helideck and the ballast water treatment system.

Project Shiphunt

Hauls in Two Shipwrecks

The M.F. Merrick shipwreck visualization was created by analyzing remote operated vehicle (ROV) footage taken during Project Shiphunt, combined with historical information researched from the 'Labadie Collection' at Thunder Bay library. Rough sketches of the wreck/site plan are then generated into a precise model using 3D software.

Project Shiphunt, developed by Sony and Intel Corp., began in May when five high school students from Arthur Hill High School in Saginaw, Mich., embarked on an adventure in the Thunder Bay National Marine Sanctuary. Their mission: hunt for a historically meaningful sunken ship, investigate its identity, and document the journey for future generations. Led by world-renowned nautical archaeologist, Dr. James Delgado, the student team worked side by side with scientists and historians from the National Oceanic and Atmospheric Administration (NOAA), Woods Hole Oceanographic Institute and NOAA's Great Lakes Environmental Research Laboratory.

The first web film "Shipwreck Alley" introduces the team and its objectives. The second film, "Discovering the M.F. Merrick", showcases their search successes.

On July 13, 2011, the Thunder Bay National Marine Sanctuary (NMS) announced the discovery of two Great Lakes shipwrecks.

The team located the 138-ft. schooner M.F. Merrick. In 1889, the schooner collided with a passing steamer in a dense fog. The Merrick sank immediately, and claimed the lives of five crew members, including a female cook. Today, the intact hull of the schooner rests upright on the bottom of Lake Huron.

The wreck of the steel freighter Etruria was also discovered and identified by the researchers. Launched in February 1902 at West Bay City, Michigan, the 414-foot long Etruria sank in 1905, after colliding with a steamer in thick fog. Today, the steamer sits upside down in deep water. The project represents the first time Thunder Bay area shipwrecks have been filmed in 3D, and the team is working to incorporate the new data into the exhibits at the sanctuary's Great Lakes Maritime Heritage Center.

According to sanctuary superintendent Jeff Gray, the discoveries are an exciting opportunity to better under-

stand the Great Lakes.

"This research will help us protect the Great Lakes and their rich history for future generations. It is also an extraordinary opportunity to inspire the next generation of explorers and introduce them to technology and experiences that could shape their futures," said Gray.

Great Lakes shipwrecks are among the best preserved in the world. Lake Huron's cold, freshwater has kept many Thunder Bay sites virtually unchanged for over 150 years. Through research, education and community involvement, the sanctuary works to protect our nation's historic shipwrecks for future generations, while providing access to recreational users. The sanctuary will con-

Project Shiphunt team on the foredeck of NOAA research vessel LAURENTIAN L to R: James Willett, Tiesha Anderson, Dr. James Delgado, Cody Frost, Tirrea Billings, Yer Vang.

Shiphunt team members deploy the large ROV for its deepwater mission. L to R: Cody Frost, Tiesha Anderson, Tirrea Billings.

tinue to investigate the new shipwrecks and will work with the State of Michigan to provide location information so divers can access the new sites.

WHOI Assists in Location of Thunder Bay Shipwrecks

When a group of five high school students embarked on Project Shiphunt, an expedition in search of lost shipwrecks, in May in Lake Huron, the Woods Hole Oceanographic Institution's Advanced Imaging and Visualization Lab (AIVL) was there, surveying and capturing 3D footage of the finds. The work was conducted as part of Project Shiphunt, an initiative developed by Sony and Intel Corp and led by National Oceanic and Atmospheric Association (NOAA).

"It was gratifying to be a part of a project that engages kids in the excitement of exploration and discovery," said Bill Lange, director of AIVL. Lange led a crew of videographers, divers and pilots of two remotely operated vehicles (ROV) during the expedition. "Our Sony cameras gave the students the ability to have that experience in real time and in some cases to direct the cameras to investigate specific features of the wreck. The high-definition footage we collected will be invaluable to scientists and marine archaeologists working to learn from the wrecks."

For the project, AIVL supplied five underwater Sony 3D HD stereoscopic imaging systems, two underwater 2D HD imaging systems; a large survey ROV capable of carrying up to five cameras of HD or better resolution and over 150000 lumens of LED light; a penetration ROV with 3D HD imaging capabilities and 24000 lumens of auxiliary lighting; additional high-powered underwater LED and HID lighting systems for diver cameras; and underwater communication systems for divers.

While in relatively shallow depth, the Thunder Bay wrecks were found in water deeper than the dive teams had been expecting, making the operations a little more challenging. It gave the divers less time in the water (which was a very cold 34 degrees F) and made greater demands on the camera's lighting systems as it was considerably darker and murkier at these depths.

Conducting their operations from the NOAA vessel the Laurentian, the AIVL team significantly modified two small ROVs to equip them with the necessary lighting and cameras for the mission. Four divers operating from a second vessel, the Interseas Explorer, used hand-held Sony 3D cameras to visually document and inspect the wrecks found in the deep water.

During the expedition, the NOAA team worked with the students to locate targets based on data from NOAA Thunder Bay National Marine Sanctuary and other maps generated by the ship's multibeam sonar. They used the historical record of ships known to have been lost in the area to develop criteria that would help them positively identify a wreck.

"There was a lot of excitement when we saw the first wreck come up in the monitors," said Evan Kovacs, AIVL director of 3D photography and stereographer on-site at Thunder Bay.

"It was pretty obviously not the ship they were originally looking for, so they quickly regrouped with the historians and came up with a whole list of objectives for the ROV pilots and dive team. The kids were calling the shots and they had us looking for damage in one section, checking for name plates on another part of the hull, checking for the cargo - they even had us looking for ship numbers scratched into the hold combings. It was quite a tall order on a 20-minute dive to 330 feet!"

The ROVs sent live 3D HD video

back to the students aboard the Laurentian, giving them the first glimpse of the ships since they met their untimely end.

The students even took turns piloting one of the ROVs — giving them the power to direct the visual inspection and perhaps sparking new directions in their future course of study.

"One of the kids actually decided he wanted a career as an ROV pilot," said Kovacs.

"The state-of-the-art Sony 2D and 3D cameras we used, coupled with the new Sony Vaio computers, made this an incredible immersive teaching experience for not only the students but for the scientists as well," added Lange.

Sony and Intel's Project Shiphunt team announced the discovery of shipwrecks the schooner M.F. Merrick and the steel freighter Etruria.

The AIVL team is experienced in visually documenting undersea features, having developed their camera systems for scientific exploration of natural formations on the seafloor as well as exploration of historic wrecks, like the Brittanic, the Titanic, and the USS Arizona.

"Our goal is to take the tools we've developed here over 20 years and make them useful for marine archaeology and marine forensics," said Lange.

"Sometimes a diver can damage an archaeological site; other times it is too deep to send a diver. Our imaging systems, whether in the hands of divers or mounted on a vehicle of choice, can save researchers a lot of time, money, and man-power and still allow them to collect valuable data. "One of the most beneficial aspects of 3D surveys with our systems is that you can easily view deterioration or changes on a wreck site over time. The "byproduct" is that the 3D footage is truly immersive and if viewed properly it will capture minds and imaginations like no other tool available today," said Kovacs.

And viewing historic wrecks in 3D brings these seafloor time capsules to life in ways that haven't been seen — or perhaps imagined — before.

PanGeo Subsea

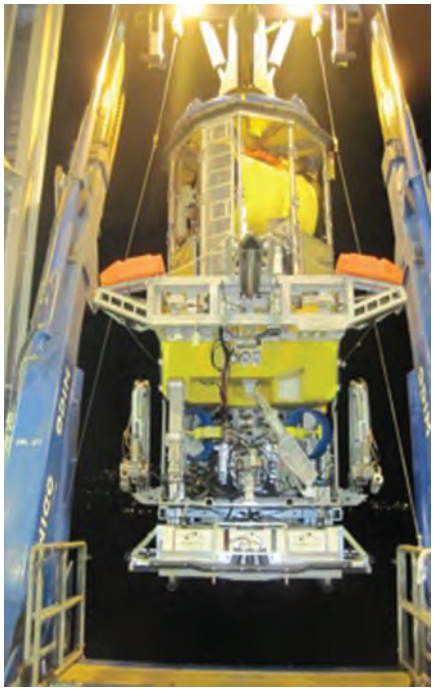
Locating N. Sea Buried Pipelines

By Andrew Safer

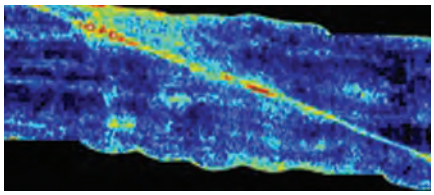
In a decommissioning project in the North Sea in May, St. John's-based PanGeo Subsea's Sub-Bottom Imager (SBI) detected a buried pipeline at depths as great as 4.5 meters beneath the seabed. "This was well beyond the ability to image pipelines using any other technology," said Gary Dinn, PanGeo's vice president of technology development, comparing it to a magnetometer which typically has a maximum range of two meters.

The SBI is an acoustic survey tool that utilizes an array of five hydrophones with 40 channels to create a 5-metre deep by 5-metre wide volumetric image of the area beneath the seafloor. The tool detects variations in acoustic impedance in the sedimentary layers. Whereas the SBI doesn't directly differentiate between compact sands, a boulder, or an object, PanGeo interprets the data by taking into account additional geological, geometric, and survey information.

The tool's inaugural application on a pipeline decommissioning project took place on a site that had been in use for 30 years, located 200 miles southwest of Stavanger between the Norwegian and UK sectors of the Ekofisk field, the oldest field in the North Sea. Operator ConocoPhillips had established a requirement that the sub-seabed be cleared of all man-made objects to a depth of 2 meters, in preparation for the installation of a new platform.



SBI on DOF ROV during deployment.



70cm pipeline buried 3m.

PanGeo's team of three staff from the St. John's office and one staff from their Aberdeen office deployed the SBI, mounted on a Hercules work-class ROV, from a pipelay vessel to a depth of 80 meters. The SBI flew 3.5 meters above the seafloor, imaging the sub-seabed. The debris removal operation included a 200-meter length of 30-inch concrete clad pipe and a 200-meter length of two 4.5-inch bundled pipes (10 inches in total width) in the 250 meter-by-250-meter area that was surveyed.

The 30-inch pipe was located using existing maps, but the 4.5-inch bundled pipes were not located where the as-given coordinates indicated they would be. It is assumed that this positional inaccuracy was due to the historical database not being updated as performance and repeatability of surface and subsurface positioning systems continually developed over the years since the pipe was laid. When PanGeo's team flew the SBI along the as-given route they didn't detect the bundled pipe, but when they reviewed the data they saw that the SBI had imaged a section of the pipe that had crossed the original survey line. This showed up in a mosaic they created from the survey gridlines which had been set 4 meters apart.

"We found the entire length of 4.5-in. bundled pipe in the next pass," said Jody Pynn, PanGeo senior systems engineer, who attributed this to the SBI's ability to create a 3D image of a given area. "We were getting immediate feedback from the excavation crew that they found what we said was going to be there," said Gary Dinn. "That was proof of the success." The pipe was located as far as

12 meters away from the as-given coordinates, and was buried up to 4.5 meters beneath the seabed—3.5 meters deeper than indicated on the map. Remarking on the pipe's distance from the as-given location, Dinn said, "You could spend a lot of vessel time trying to look for things in that sort of distance. The dredging tool causes a lot of seabed disturbance so you can't see what you're doing until the soil settles." He figures the SBI saved several days of vessel time at a cost between £100,000 and £160,000 pounds per day.

As the SBI flies over a given area, an 8-meter-wide swath of the sub-seabed is coarse rendered in real time, and then in post-processing, PanGeo renders the data to a 5 by 5 by 5 centimeter meter image composed of voxels roughly 1/3 the size. This fine rendering enables the detection of smaller objects. Using this process, PanGeo was able to detect a 7.5 centimeter electrical cable with a smaller steel cable attached to it 1.5 meters beneath the seabed.

The operator had also requested that PanGeo attempt to locate a life-of-field seismic array with 19- and 35-mm diameter cables linked together with hydrophones that had been buried beneath the seafloor. "It was highly unlikely that we could see the cables (with the SBI)," said Alex Fleming, PanGeo vice president global operations, "but the hydrophones were of sufficient size. We knew where it was laid, so when we flew over a small test section, we didn't see it in real time, but we saw the hydrophones in post-processing. The client was extremely happy with the operation."

The Sub-Bottom Imager utilizes three technologies — non-linear acoustics, near-field coherent array processing (multichannel arrays), and synthetic aperture sonar — to image the sub-seabed in 3D. The non-linear acoustics component was developed by Dr. Jacques Guigné in Paradise, Newfoundland in the early 1990s. Its first application was in an underwater probe the Department of Fisheries and Oceans used to gauge the effects of trawling on fish habitats on the seafloor offshore Newfoundland. The technology was also used to detect mines and unexploded ordnances in the seabed. The SBI, the next iteration of Guigné's acoustics technology, was developed after PanGeo Subsea was founded in 2006 following the merger of Guigné International Limited and Pan Maritime Energy. In demonstration projects, the SBI has imaged through a rock dump covering a pipeline in the North Sea and detected a 13-cm buried cable between Norway and the Netherlands. Following repair work, it verified the cable had been buried at approximately 1 meter. PanGeo's vice president, technology development said that the SBI worked successfully both when the cable was energized and when it was not energized. He noted that a magnetometer isn't operable when the cable is live.

The SBI is also suited for pre-engineering route surveys for buried pipelines and arctic applications requiring pipeline burial due to ice scour, including determining the depth at which the pipeline must be buried, said Dinn.

World UMS Market

Big Challenges, Big Opportunities

By Antoine Martin, Unmanned Vehicles Systems Consulting

The UMS defense market is forecasted to exceed a cumulative $7B between 2012 and 2020, whereas the UMS security market is expected to surpass a cumulative $600m between 2012 and 2020.

SeaGlider UUV by iRobot.

The unmanned maritime systems (UMS) market is coming of age, rapidly evolving under the combined impact of changing economies, operational and technological advances, and maritime threats. The UMS defense market is forecasted to exceed a cumulative $7 billion between 2012 and 2020, whereas the UMS security market is expected to surpass a cumulative $600 million between 2012 and 2020. Although the UMS security market remains considerably smaller than the defense market, the growth rate of the security market is forecasted to be much more robust than that of the defense market. It is quite obvious that although the unmanned maritime market is still emerging, the number of stakeholders is very small compared to unmanned aerial vehicle markets, and challenges abound - with each challenge so abound opportunities for those who know what to pick up and how to execute.

Many factors are leading the surge of interest in UMS. Here are a few below:

- Maritime Security on the increase and changing: terrorists' attack on the USS Cole in 2000, increasing maritime piracy despite attempts to curb it, the rising threat of Iran in the Middle East, territorial disputes in Eastern Asia, asymmetric warfare on the rise - all contribute to nations' need to better secure littorals, ports, estuaries, channels, and bodies of water. UMS offer improved response capabilities to the new maritime security threats - better than traditional equipment that has not changed in nature since the sixties.
- Evolving Technologies: The transition from large and expensive vessels to multi-mission frigates results in the introduction of a number of new vessels, some already in operation and others just conceptual. These new designs are meant to undertake a number of missions, from mine countermeasure to surface warfare. These ships, less capable than multiple dedicated ships, rely on UMS to perform specific missions. UMS offer to increase both power and capabilities.
- Military Budget Pressures: Economic pressures are forcing many nations to reduce their military budget. Homeland and security budgets are already strained, inadequately funded, and suffer even more. This means that fleet of vessels are insufficient and delayed. The trend to have fewer but more capable ships is now resulting in a lesser naval force. Cruisers and destroyers are giving way to cheaper multi-mission frigates. Ships are used past their recommended operational life. More importantly, as manpower remains the most expensive

element of military budgets, UMS may help reduce manpower demands, while keeping, even augmenting, capabilities.

- USV Technical Maturity: A number of Unmanned Surface Vehicles and associated sub-systems have been tested, improved, their concept of operations developed, and they have attained a degree of maturity such that they will move from research and development to procurement. In addition, new designs are broadening their field of applications.
- Unmanned Aerial and Ground Systems: Remotely Piloted Aircrafts have shown their value and limits in real conflict scenarios; Unmanned Ground Vehicles (UGV) have saved countless lives in Improved Explosive Devices mitigation roles. A number of countries are already using unmanned systems, so their operations, procurement, and use is better known amongst the armed forces, and is transitioning now to security communities. Government administrations are now integrating unmanned systems as part of their overall operational planning.
- UUVs: Unmanned Underwater Vehicles demonstrated their worth over and over again in mine countermeasures operations and are ready to transition to other uses.

Evolving Threats

Along with the evolution of technologies, there is a significant evolution in the nature, scope and magnitude of maritime threats. Terrorists are expressing clear intentions (and often actually carrying out or trying to carry out their threats) to attack oil tankers, cruise ships, natural gas plants, offshore platforms and place bombs in harbors and among public gathering events. States and non-state actors threaten to block congested waterways, damage underwater pipelines, and in general harm sea-borne commerce. Pirates are taking dozens of ships and their crews hostage for ransom; undocumented migrants flood maritime borders, illegal drugs smugglers seek increasingly innovative maritime paths, including submerged and semi-submerged vehicles (in addition to super-fast surface boats), people, and arms smugglers – all these are challenging the capacity and capabilities of the world's maritime border defense and security operators.

Submarines are very powerful naval vessels, with a tempting capacity to project threats and power across vast distances. Many nations are adding submarines to their navies for the first time, and making effective use of these new capabilities in local and global geopolitical maneuvering, including in sensitive regions such as the Middle East and the Persian Gulf.

Small speed boats pose a threat near littorals; even very capable ships find them a challenge. The world's navies still do not have an effective response answer to counter such threats.

For each of the above threats, UMS are poised to offer the right counter-threat tools. UMVs (the actual moving vehicle as opposed to the entire system including the command and control station) are nimble, can operate in environments where traditional vessels dare not go, separate personnel from potentially harmful situations, enable autonomous piloting, are stealthy, and economic. In essence, they are part of the desired response for naval and maritime threats of the 21st century – from an operational, economic and technological perspective.

Evolving Solutions

A close scrutiny of the broad UMS market sector reveals several potential evolutionary paths:

- USV adoption is much faster and reaches more users than the adoption of UUV, mostly because of the possibility to remotely control USVs, receive high bandwidth real time feedback from the vehicle, and reuse many of the sensors and standards developed for Unmanned Aerial Ssystems
- The security market for USV will surpass the security AUV market by 2015
- The arms race from the cold war is transforming to an all-domain unmanned systems race over the next two decades
- The mixed used of UMS for environmental remote sensing, security, and defense will continue to increase and present opportunities for small and low-cost platforms
- USVs will marginally be used for anti-piracy roles in the near term
- Oil & Gas stakeholders will be the first private users of USV for security and defense roles (or they will force governments to protect their private interests). Note that the oil & gas industry has been the largest user of UUVs for private and commercial purposes
- Organized groups, terrorists, pirates, smugglers (of humans, drugs, arms) will increasingly merge and use technology. UMS and networked data have an enormous potential to fight their activities
- The main obstacle to the sales of USVs lies in the navies' realization of the capabilities of unmanned maritime systems. Adoption of technology has been slow. Once the capabilities and potential are recognized, the hurdle is not technological but rests in operating the system: how to use the USV with existing equipment, effect functional launch and recovery, calculate the life costs and operational costs of using USVs, manpower required to operate USVs, developing funding for this new equipment at the expense of other, and an old acquisition process that does not suit asymmetric warfare pace.

Get This Report

"Unmanned Maritime Systems - Defense & Security UUV & USV – Markets, Technologies & Opportunities Outlook – 2012-2020" includes 530-pages, 292 Figures and 223 Tables. You can find more information and order the report at

http://marketintelgroup.com/unmanned-maritime-systems-umv-usv-uuv-defense-security-markets

Future UMS Uses

There are far too many UMS future uses to list in this article. I present here three representative future uses for UMSs. It is important to note that each use presents multiple business opportunities for operators, innovators, components & parts manufacturers, systems integrators, private and government contractors.

Environmental Monitoring

The BP Oil disaster in the Gulf of Mexico had a dramatic impact on several economies, from fishing to energy. A number of countries will want to deploy long endurance UUV "gliders" to constantly monitor the seas and exclusive economic zones. Data about the ocean will also increasingly be gathered in the Arctic, where climate changes are quite visible. Persistent operations are too costly to be performed by manned operations, and only unmanned equipment can perform them in a cost effective manner. Extreme environments such as the poles, and access to remote and dangerous locations — which often yield the more insightful data — is much better suited to

UMS. In addition, there is significant interest from defense and security governments to gather environmental data and create models, make predictions, and assess operational environments.

This is especially true for special operations, expeditionary warfare, and anti-submarine warfare.

Countering Underwater IED

UMS can significantly mitigate the threat of underwater IED attached to piers, walls, docks, and ships' hulls. It is reasonable to assume that UMVs will be increasingly deployed in ports and harbors for a variety of security and defense missions. ROVs already scan ships' hulls to search for bombs and even cracks in the structure, doubling as security and safety enhancers - increasing system availability while being 5-10 times quicker than divers. USVs will routinely patrol harbors, detect underwater "intruders", and detect suspicious activity. UUVs will swim in tankers' oil to detect if a bomb was hidden among the crude oil.

Protecting Infrastructure

Refineries, desalination plants, and offshore oil rigs are threatened assets that organized groups are known to target. USVs and UUVs are the most natural solutions from both a technical and an economic perspective; they will provide persistent, cost-effective services with increasing spectrum (from monitoring, and detection to possible active defense).

Such systems can be the solution for needs like those expressed by the Australian Petroleum Production & Exploration Association, who has stated their concern to protect their assets so they can satisfy the growing natural gas extraction and processing. Equally, such autonomous systems can provide the security required to maintain the integrity of undersea cables for communication which are vital to economies since we rely on information and its communication for most of our activities.

Furthermore, USVs and UUVs can actively participate in the protection and assessment of bridges, dams, canals and harbors and other sensitive structures that need to be checked regularly.

As we have seen, the autonomous maritime domain offers almost unlimited possibilities, yet it is not monitored or understood well. As threats, budgets, technologies and strategies evolve, so should our ability to explore, analyze and forecast UMSs' rapid evolution.

Reasoned insight and foresight will vastly improve the ability of researchers, developers, vendors and users to make the most, operationally and economically, out of this new wave.

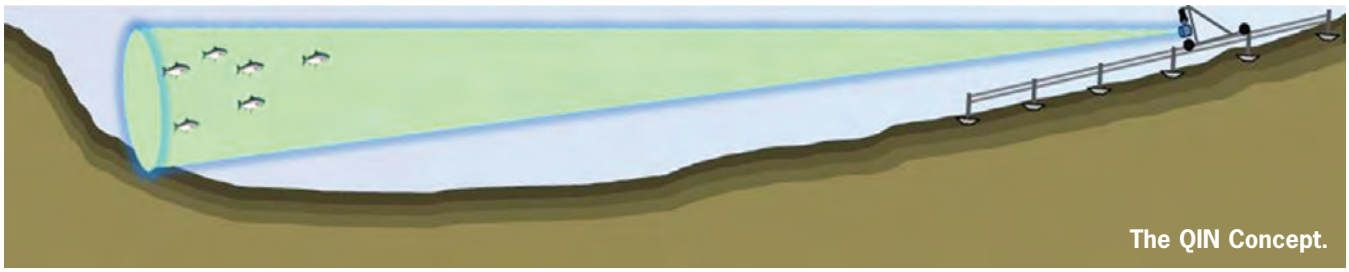
U-Ranger USV by Calzoni.

... One Small Step for the

Sockeye ... One Giant Step for Hydroacoustics

Quinault River System is First of its Kind Sockeye Salmon Counter

Fisheries managers at the Quinault Indian Nation (QIN) have a long history working with BioSonics on management of the salmon resources of the Quinault River. Since the early 1980's, BioSonics has assisted tribal biologists in developing systems and procedures to enumerate adult salmon in Lake Quinault.



The QIN Concept.

Salmon are a main staple of income and subsistence for the Quinaults. While the river supports several viable runs, the blueback sockeye, a highly prized delicacy, represent the most culturally significant salmon run in the river. Accurate and timely measure of salmon escapement is foundational to a successful sockeye harvest management strategy. Historically, sockeye escapement has been estimated by counting adult salmon in Lake Quinault using a BioSonics mobile scientific echosounder. Tribal harvest managers have expressed concerns about using estimates from lake surveys because of an apparent relationship between distribution (depth) of the fish and precision of the estimates, the potential for overestimation due to resident fish, and due to lag between the time fish enter the river and the time they enter the sampled population in Lake Quinault. QIN harvest managers therefore sought a more timely and precise index of salmon counts to properly manage their fisheries resources. It was widely believed that such an index would most likely be obtained from sampling in the lower river.

The Need for Timely Estimates of Escapement

The need for accurate estimates of salmon escapement has long been recognized. The QIN membership realized that wise stewardship of their salmon runs and achieving the maximum sustainable yield was dependent on access to the number of fish entering the river as soon as possible. In 2009 BioSonics completed an evaluation study to determine if a suitable site exists for counting salmon with sonar. Several candidate sites were evaluated by personnel from the QIN and BioSonics and an ideal site was identified. In 2010 QIN contracted with BioSonics, Inc. to study the feasibility of establishing an automated, real-time fish counting station in the lower river.

Defining the Vision of an Automated Salmon Counting System

Existing methods for counting salmon in rivers vary widely in complexity and scale. Counting salmon via visual observation, weirs, fish traps, and conventional sonar systems are all relatively common. Such operations can be labor intensive however, and are often manned 24/7 or require frequent visits for maintenance, analyzing data, and reporting of results. BioSonics and QIN envisioned an automated acoustic system that could collect and analyze data in real time, with a communications network that received daily fish counts from a remote station on the river and published results to a web page "dashboard". BioSonics scientists believed such a system with a high degree of automation would provide data to the most people in the shortest amount of time, and have the highest degree of scientific and legal defensibility.

In recent years, BioSonics has pioneered the advancement of Automated Hydroacoustic Monitoring Systems centered around their digital DT-X split beam technology which allows for the detection, sizing, and 3-D tracking of targets at ranges in excess of 200 meters. BioSonics software systems provide watchdog functionality that monitor and communicate system status parameters to project managers in real-time. BioSonics data processing software uses advanced algorithms to automatically generate fish tracks and create fish count reports. The QIN's desire for a remote, riverine fish counting system was an ideal opportunity to leverage BioSonics latest technology and create a completely autonomous fish counting system that operates 24 hours a day with minimal manpower and transmits fish count information in real time.

Innovation to Overcome Challenges

Once an ideal location was selected, engineering of the automated counting system began in earnest and several logistic issues were quickly identified. First of all, the location for installing the salmon counting station is on a remote stretch of the river with no available power source or communication link. This meant that a reliable autonomous power source would be needed. Custom power modules were engineered to provide continuous electricity. Two heavy duty trailers were configured each with a bank of deep cycle batteries and an integrated inverter/charger. By rotating the trailers every 3-4 days for recharging, the system could be continuously powered with relatively little effort and at low cost. The entire sys-

Installing the track (left) and the transducer (right).

tem had to be extremely robust to withstand river flow and long term exposure to the elements, yet also be easily removable to avoid extreme high flows in the fall and winter when water levels rise and inundate the entire location. Therefore, all surface electronics and components were housed on trailers for quick and easy demobilization. Lastly, an adjustable mount for the transducer was necessary to accommodate water levels in the river that fluctuate several feet depending on precipitation and runoff rates. To facilitate transducer positioning, a track and trolley system was designed to allow for adjustment of the split beam transducer. A mechanical rotator was integrated to provide additional fine adjustment capability and ensure accurate transducer aiming.

SeaDiscovery.com

underwater tech and ocean science news

July 6 - Nov. 10, 2011

MARINE TECHNOLOGY REPORTER

Subsea Photo Contest

Your photo could be on the front cover of MTR

Share your experiences in the underwater world - your entry will be seen by thousands of your colleagues. All contest winners will be published in a special section of the Nov/Dec issue, with one winner featured on the cover. Go to:

http://photos.seadiscovery.com

to submit your best underwater images. Complete rules and terms can be found on the website, or go to:

http://photos.seadiscovery.com/rules-and-terms.asp

Contest Sponsored By:

GLOBAL Diving & Salvage, Inc.

KONGSBERG

SEACON®

In May 2011, the automated salmon counting system utilizing BioSonics scientific sonar was deployed in a remote stretch of the Quinault River in Grays Harbor County, Washington. The system consists of 120 kHz split beam transducer and ROS PT 25 rotator mounted to an adjustable track trolley system custom fabricated from anodized aluminum. The track was gravity mounted with cement pier blocks for minimal bank disturbance and easy demobilization. A DT-X echosounder and control computer were housed in a mobile office trailer with a satellite modem for communication. The system operated for several months during which time, data was collected and processed for algorithm refinement and tuning for site-specific conditions. By the end of the deployment phase, the system was automatically transmitting daily salmon count reports to project managers. BioSonics President Tim Acker expressed the significance of the project; "This pilot stage deployment was monumental. To our knowledge, there is nothing else like this in the world. Completely autonomous, completely automatic fish counting represents a shift in the way fisheries managers work. Imagine sitting at your desk and receiving a fish count report from an unmanned monitoring station twenty miles away."

About the Quinault Indian Nation

The Quinault Indian Nation (QIN) consists of the Quinault and Queets tribes and descendants of five other affiliated tribes: Quileute, Hoh, Chehalis, Chinook, and Cowlitz. The QIN is a sovereign nation with the inherent right to govern itself and deal with other tribes and nations on a government-to-government basis. Tribal operations include: Administration, Natural Resources, Community Services, Health and Social Services and several commercial enterprises. The QIN Reservation is located on the southwestern corner of the Olympic Peninsula in Washington State and encompasses over 208,150 acres, including some of the most productive conifer forest lands in the United States, and 37 kilometers of unspoiled Pacific coastline. Nearly 700 people are employed by QIN and its enterprises, making it one of the largest employers in Grays Harbor County.

Taking the Helm

MTR interviews Rob Mecarini, who this summer took over as President, Alpine Ocean Seismic Survey.

By Greg Trauthwein, editor

Please tell us a bit about yourself, and specifically how you got into the maritime business?

My first job out of college was in non-profit fundraising, but it didn't take me long to discover I didn't want to be stuck behind a desk! I asked my father, Gino Mecarini, for a temporary job in order to clear my head. He shipped me off as a deck hand on one of Alpine's vessels, and I have never looked back. In my 20 years with the company, I've traveled all over the world, and have done just about every job we have. This summer, my father decided to step back on his day-to-day responsibilities, and I took over his role as President.

Tell us about Alpine Ocean Seismic Survey.

Alpine provides a full range of marine surveying and data collection services, including geophysical, hydrographic, oceanographic, geotechnical, environmental, and positioning. We've worked on thousands of projects for oil and gas, civil engineering, cable, submarine, shoreline protection, and — more recently — offshore renewable energy. Alpine has been around since 1957 and my father purchased the company 25 years ago. In 2009 we sold a controlling share to another family-owned company – the Gardline Group, which is based in the UK and is the largest privately owned survey company in the world. We consider family ownership a strength, as it enables us to take the long-term view rather than focusing on quarterly profits. We have about 20 employees here in the States, and we can draw on the 1,000 employees of Gardline as well as many long-term partners.

What do you count as the company's primary strengths?

We have the resources of a very large company, but we offer very personalized service. We are great at delivering a turnkey package – if our team doesn't offer the service, we can find the right subcontractors, manage the job, and integrate the entire process. We make it easy for our customers. We also have global expertise – while we know the US very well, we have more than 50 years of international experience and global assets, which has been strengthened by our relationship with Gardline. In the States, we are particularly well-positioned on the eastern seaboard and in the Gulf of Mexico with our new vessel, the R/V Shearwater. It is a 110' x 40' aluminum twin hull that sleeps 20, and provides great positioning and line-keeping capabilities. The vessel is outfitted with two moon pools, A-frames, and a crane, giving us the ability to deploy a variety of specialized equipment for any job, near-shore and offshore. We launched the Shearwater this year, and have already done jobs on the East Coast and the Gulf Coast. Clients love the spacious quarters, the onboard laboratory, as well as the flexibility it provides for undertaking their projects.

We understand that you have an interesting capability for shallow/freshwater survey.

We introduced a new line of camera technology to the States, developed by Gardline, including a freshwater lens system. It's specially designed to capture clear images in highly turbid conditions, which are common in both shal-

Alpine launched R/V Shearwater earlier this year. The 110 x 40-ft. aluminum twin hull that sleeps 20, and provides great positioning and line-keeping capabilities. It is outfitted with two moon pools, A-frames, and a crane, giving us the ability to deploy a variety of specialized equipment for any job, near-shore and offshore.

low ocean and fresh-water environments. It uses a distilled water lens and adjustable lighting, and opens up many areas where traditional underwater video and photography just don't work. The Shearwater is also a great asset for these environments. The hydraulic propulsion system offers excellent maneuverability essential in rivers and shallow waters, and its shallow draft allows us to access areas off limits to other vessels its size.

Looking at the marine data collection market today, where do you see opportunity and why?

One of the big areas of opportunity is in energy redistribution, which requires the installation of submarine cables to carry energy from the area of generation to the area of power use. Alpine has been a key player in the majority of major HV cable projects recently completed in the US. Down the road, renewables in the Northeast is going to be a big factor. We also are looking to expand our environmental and geotechnical services by bringing to the US market Gardline's unique capabilities. Regionally, our growth is the strongest on the eastern seaboard, but we see a lot of potential for us in the Gulf of Mexico and West Coast. We also do a lot of work in the Mediterranean, since we have an office in Italy, and we've found the Israeli market to be particularly active for us in that region.

What do you count as the most important technological advances that have allowed you to conduct your operations more safely and efficiently?

This will really date me, but GPS has been a game changer in terms of efficiency and safety. Before GPS, you had to set up networks of ranging equipment to get precise positioning. It was time consuming and not very reliable. GPS made positioning so much more reliable, efficient, and — ultimately — accurate. Alpine was one of the first companies to use GPS for offshore survey work and we've never looked back. ***Another advance has been the digitization of data. When I started, everything was on paper, with fix numbers that correlated to data collected with your nav system. You had to extrapolate everything by hand. Now all the data is geo-referenced in real-time – it is so much quicker.*** Forty years ago, we had two whole buildings devoted to data reduction and mapmaking – now, because of digitized data and powerful processing software, we have one large room. From a safety standpoint, there has been a huge increase in awareness of the importance of health and safety procedures. When people know, respect, and follow the procedures, you have a much safer and more efficient operation.

What technologies do you see on the horizon that hold the most promise to make this business more efficient?

I think that autonomous underwater vehicles (AUVs) hold a lot of promise in certain environments, particularly in engineering survey work. Right now, the cost of these systems is high and availability is scarce, so they tend to be used in deeper waters. As the technology develops and economies of scale are achieved in the manufacturing process, prices will come down -and their increased use will likely make the industry more efficient. Other innovations include the ongoing improvement in the data collection and processing equipment we have at our disposal. The speed at which you can capture, process, and parse the data is increasing geometrically. That reduces costs – the faster you can collect data, and the more efficiently you can process it, the lower your expenses.

How has Alpine invested in the past year (or coming year) to enhance its services?

The R/V Shearwater was a big investment for Alpine, but we feel it brings the company to a new level. We don't think there is another commercial vessel like it on the eastern seaboard, and we believe it will be in high demand. ***We also have started to invest in very high-resolution multi-channel equipment to service offshore renewables foundation design.*** This equipment is particularly important on the eastern seaboard because the combination of water and turbine foundation depths, as well as local geology, results in multiples in the data. These multiples make it hard to see subtle changes in the geology. The only way to solve the problem is by collecting multi-channel data, which allows you to process out most of the multiples.

We also continue to invest in data processing and presentation software. One of our latest initiatives is GIS software used to build updatable databases for storing and viewing, in a myriad of ways, project data sets over time. This is a very useful tool for any project that has a long life span (cables, pipelines, wind farms, etc.) and where ongoing monitoring and maintenance is critical. We are also investing in rolling out new services we can provide through Gardline – it has a very strong environmental data collection program and is the second largest offshore geotechnical services company in the world.

What do you consider to be the biggest challenge to running your company today?

I think probably anyone in business today would say the biggest challenge is the volatility and uncertainty in the market. For oil- and gas-related work, when prices go up,

We introduced a new line of camera technology to the States, developed by Gardline, including a freshwater lens system. It's specially designed to capture clear images in highly turbid conditions, which are common in both shallow ocean and fresh-water environments.

Rob Mecarini, President,
Alpine Ocean Seismic Survey

we get more work. When they go down, we slow down. Renewables work is based on whether or not a project can attract investors, and can demonstrate clear demand for its output, so the condition of the economy, the clarity of permitting routes, and the long-term energy policy of the country have a large impact on how projects progress. I think it's clear that the offshore renewables market will not truly take off until there is a clear legislative path for permitting and a long-term energy policy with bankable incentives and production goals that will attract investors. The power cable market is similar -- projects are backed by investors, and need demonstrated demand. It is really challenging for us to determine how to staff up for the long term, because it is hard to predict the market and its needs. This is a very capital-intensive business, so it can be hard to make long-term projections on equipment needs. We go through some dramatic swings, but we are lucky to have a parent company willing to support us through the lean times. That really helps us focus on a long-term plan.

What do you see on the Legislative front, either nationally or locally, that you believe holds the biggest promise to help your business in the coming years (i.e. the proliferation of offshore windfarms?)

I'd turn that question around – one of the biggest threats that the industry faces is that our country has no clear long-term energy policy. This impacts investment, particularly in the renewables market, in two ways: investors don't like uncertainty, and they need the financial incentives and clear power-generation goals this type of policy will provide. A clear commitment and a long-term roadmap would be a plus for our industry. Another issue, especially in the renewable sector, is regulatory permitting, which needs to be streamlined and in some cases

One of the biggest threats that the industry faces is that our country has no clear long-term energy policy.

Rob Mecarini, President, Alpine Ocean Seismic Survey

clarified. Our ability to work on projects is based on developers getting permits. We also would like to see both state and federal government invest in more infrastructure projects such as bridges, tunnels, seawalls, and beach reconstruction. In some cases, there is federal money for projects, but the states can't afford the matching funds.

Can you share with our readers one or two case studies that you feel best exemplify Alpine's capabilities?

One example is the TransBay cable project in California. It was multidisciplinary, required us to manage a number of subcontractors, and we worked on it from end to end. We started with the desktop study, which is where we conduct research to find out as much as possible in advance about the geology, the permits, and other issues so that the design of the final route is as informed as possible. We did the survey work and sediment sampling. We coordinated with everyone from land surveyors to diver operations. We provided the positioning for the barges and coordinated the data for the cable installation. It was a very challenging site – the river merged with the bay, so we had both fresh water and salt water, strong currents, and a complicated tidal regime that required us to develop specific tidal models.

Even though the installation is complete, we're still involved: we do the yearly inspections of the cable, and are working with the client to develop an interactive database that they can update as the years go on. That is a great example of our capabilities – we worked on that project from design, through installation, and to ongoing maintenance and caretaking. Working on a project from end to end is one of our strengths.

Another project that highlights our capabilities are the two Fishermen's Energy wind farms, located off of the coast of New Jersey. Alpine did the survey work for the meteorological tower for its offshore site that was subject to BOEMRE regulations, and also performed the survey for the demonstration site that was subject to state regulations. Because of the lack of clarity in some of the survey requirements for permitting, Alpine had to work closely with Fishermen's to provide them with what they needed. We were one of the first contractors to conduct multi-channel data collection for an offshore wind project, and worked with an equipment manufacturer to provide them with feedback on their new high-resolution system. We are very proud of the commitment and support we showed the project through its ups and downs. Now, we are supporting the developers in pre-construction, and hope to continue with them for a long time.

Burial Equipment

How to choose it for Offshore Wind Inter-Array Cable

By Phil Walker and Cliff McDougall, Pharos Offshore Group Ltd.

Remember the last time you dug through the toolbox looking for a specific tool? Having the right tool for the job makes all the difference, while using the wrong one can create more work and increase the odds of making mistakes.

While the scale of the project may change, the principle still holds true. And this is certainly the case when choosing the right subsea technology to bury power cable—using the equipment best suited for the job based on a number of variables can make all the difference.

This paper explores the key criteria to consider when selecting subsea equipment for burying and protecting the power cable that connects the turbines of an offshore wind farm (OWF).

OWF technology might be considered relatively new, but undersea cable has been around for quite some time. The first successful trans-Atlantic subsea cable was laid in 1866 and carried telegraph signals. Burying subsea cable and pipe to protect it has become much more common in the last four decades. Many tools have been engineered and used successfully to install and maintain telecommunications (telecom), oil and gas (O&G) pipe and power transmission cables.

Likewise, many methods and products have been developed for subsea cable protection, tailored for a range of scenarios. These types of protection measures are all generally much more costly than cable burial and are beyond the scope of this paper. Given the enormous distances that protection efforts entail, the most cost-effective approach is likely to use burial equipment, which is detailed in this paper. The OWF industry is growing rapidly, but is still new compared to telecom and Oil & Gas (O&G). While some subsea installation practices and procedures are transferable to the newer OWF industry, many are not. The inter turbine array cable, or infield cable, requires unique procedures because of the multiple runs of cable within a confined, precisely planned area of the turbine foundation array.

General Lay and Burial Methods

Here we will outline the pros and cons specific to offshore wind farms. Please note that different pros and cons can apply for other applications like O&G pipe and telecom cable. Circumstances can even change significantly between wind farm locations. Since there are many possible vehicles that could theoretically bury inter-array (IA) power cable, it is important to consult with experienced installers and fully examine the positives and negatives of any given system relative to a specific project.

Inter-array power cable connects all the turbines to the substation or substations. Once consolidated at the substations, the power travels through "export" cables as HVAC or HVDC to the shore station. The cable plan will optimize the orientation of the cables from turbine-to-turbine and turbine-to-substation. The two main methods for laying and burying power cable within an OWF array are:

Ploughing

Simultaneous lay and burial of the cable from point A to point B in one pass. A plough uses a mechanical share to cut a trench that the product cable is depressed into. The seabed falls back on top of the cable to provide instant protection once the plough passes. For long-distance burial, the plough is the most economical method – when it can be used.

Right:
SMD Nereus, Telecom Cable Maintenance Trenching ROV.

Trenching

First, the cable is laid between two points. At some point after the lay, a trench is then created by a self-propelled trencher that allows the cable to fall into a trough in the seabed. The seafloor material is fluidized by powerful water jets or mechanically cut with a chain or wheel equipped with hardened bits. This is commonly referred to as PLIB – Post Lay Inspection and Burial.

General Plough vs. Trencher Pros and Cons (relative to OWF Inter-Array Cable)

Plough Pros

- Can be completed in one process
- Generally faster rates than trenching
- Generally good burial
- Can penetrate harder sea beds
- More economical over longer distances
- Instant cable burial and protection

Plough Cons

- Must be completed properly in one pass
- Difficult to monitor product cable tension
- Can cause cable damaging tension spikes
- Difficult to maneuver and position near foundations
- More difficult to steer as it is towed
- Requires tow cable catenary management
- Requires umbilical management
- Risk of mechanical impact/abrasion/stress on product cable
- Higher risk in the vicinity of adjacent cables
- Plough "grade-in" and "grade-out" at each end of span or a recovery leaves exposed cable requiring BLIB
- Can't "cut & grip" damaged cable
- Requires bigger ship and more crew

Trencher Pros

- Self-propelled control
- Maneuverable to optimal cable position
- Can work adjacent to vessel and foundation
- Multiple pass option to improve burial
- More deploy/recover operation flexibility
- Mobilization layout flexibility – stern or side launch
- Generally single man launch capable
- Wider operating weather window
- Can remain working for long periods
- Can perform cable/foundation inspections
- Can "cut and grip" damaged cable
- Can conduct cable and scour surveys
- Can assist with messenger lines in the cable "pull-in" process
- Scheduling flexibility – lay then bury

Trencher Cons

- Generally slower than a plough
- Less effective in harder sea beds
- Post-lay burial – two-part process
- Generally requires returning after the lay to then trench
- Requires more power from the ship for cutting or jetting

General Mechanical Cutting vs. Jetting Pros and Cons

Trenchers are self-propelled, and use either a mechanical cutting or water jetting technology for penetrating the seabed. Since the pros and cons regarding maneuverability are similar, we will look further at the pros and cons of the soil cutting technology when water jetting is compared to mechanical cutting.

Mechanical Cutting Pros

- Can cut harder sea beds
- Control of cutting rate
- Completed in one pass

Mechanical Cutting Cons

- Cable is at greater risk of mechanical damage
- Extreme caution needed around cable
- Bigger machines 75T+
- Cable needs to be "loaded" into a protective cable highway on the vehicle
- Must be done in one pass
- Difficult to bury cable with slack, bends or loops
- Generally slow to very slow rate of progress
- Generally more expensive to buy/lease a system
- Generally more expensive to operate and maintain

Jetting Pros

- Risk to cable minimized
- Control of cutting force/rate
- Can run multiple passes to improve burial
- Jetting arms deploy over cable to capture
- Can bury cable with slack, bends and loops
- Adjustable nozzles and arm configurations to accommodate varying seabed conditions
- Generally less expensive to buy/lease system
- Generally less expensive to operate and maintain
- Generally smaller in size using smaller ships

EB Sea Stallion III - 3-Meter Cable Plough.

Jetting Cons

- Limited to lower seabed soil strength than mechanical cutting
- May require more than one pass

Both burial methods have been used with varying results. Each must be utilized with unique considerations to the environment, vehicle specifications and operator experience.

A plough installation generally requires a larger cable ship with more operational personnel all charged at a higher day-rate. A wider variety of vessels are suitable for trenching ROV mobilization. With enough deck space to accommodate the ROV, LARS and associated containers, the ship only requires proper stability, dynamic positioning navigation (DP2) and adequate crew facilities.

As you can see, each method and technology has a diverse list of pros and cons that would further depend on actual equipment design. Unfortunately, there is no one solution that will accommodate every possible combination of OWF project characteristics. The ideal solution for a given project is debatable and usually can have multiple solutions. Project owners and installers must weigh all the variables and pick the optimum solution.

Wind Farm Operational Considerations

Power cable must be laid under a minimum tension to prevent the cable from "hockling" — forming a loop under torsion when there is insufficient tension. Cable must be laid though a plough under tension, this causes suspensions, especially at the towers where the cable exits the J-tube. Cable under tension here cannot be buried later. It is preferable to lay the cable with slack and PLIB it afterwards. Controlling the plow operations within a wind farm can be challenging. In addition to the plough tow cable and product cable, there is also a plow umbilical cable. If this is an armored cable, it also requires floats with extra people to put them on and take them off. All these moving parts are difficult to control especially in high currents usually found at OWFs. Alternatively, a trenching ROV will usually have it's umbilical integral to the lifting cable requiring only one cable to manage dur-

ing operations and less people required for operations.

Over the course of a project, it is difficult to avoid some periodic recovery of underwater equipment for maintenance or adjustment purposes. If a plough needs to be recovered between towers, it will leave exposed cable or else the entire cable section may need to be recovered and ploughed in again, starting all over, requiring more time cable handling personnel. Any "plough-ups" or anomalies not corrected at the time will require PLIB by a trenching ROV. A trenching ROV, on the other hand, can be quickly recovered — usually by a single man if needed. This makes it easier to repair or adjust nozzles or jetting arms in mid-operations. The arms of a jetting trencher do not need to be "loaded". The product cable can then be recaptured by lining up and lowering the jetting arms around the cable.

It's probable that every wind farm plough job will need some form of PLIB to remedy these unburied situations. Exposed cable, slack, bends and loops are best buried with a jetting ROV while a mechanical cutting ROV would introduce too much risk of damaging the cable.

Older Equipment

While older systems may provide some advantages (low acquisition cost, etc.), the age can present some major limitations. For example, vehicles built for deeper telecom work are typically rated for 2500 to 3000 meters of seawater depth. They are designed to work with smaller diameter cable and can be vastly underpowered for dealing with the larger diameter and heavier power cable. Also, their larger flotation profile creates problems in the high-current, shallow waters typical of wind farm sites.

In addition to the limitations of their technology and design, one-off and older legacy systems can also present a myriad of potential operational problems. Finding experienced operators familiar with the operating system may be highly difficult or even impossible. Outdated procedures and unique system idiosyncrasies become an issue. Plus, spare parts can be expensive to procure, and difficult to source. With the well-defined unique cable burial equipment requirements of inter-array cable, it is clear that new systems must be designed to meet the technical and capacity requirement demands unique to the OWF industry.

New Equipment

When a vehicle is specifically designed and purpose-built, certain design consideration and economies can be leveraged to reduce the overall acquisition, lease and operating costs. Here we outline some specific areas that an operator should consider when selecting a trenching vehicle or tool specifically for the installation, trenching, burial, surveying and future maintenance of power cables within the OWF market.

Maneuverability

Typically, wind farm sites are located in relatively shallow, high current, windy and rough waters, with a limited or seasonal weather window for installation and maintenance. Weather downtime caused by adverse conditions can run as high as 40% at the height of the season. These challenging environments can bring a project to a standstill until they improve. Being able to expand the weather window has huge implications to the project's bottom line. Holding up an expensive ship and crew operation because of vehicle limitations can cause expensive delays. If these delays add up, they can domino to other even more expensive turbine installation vessel activity in the broader schedule.

Tracks

Sea bottom conditions can even vary within the space of a single wind farm. Though some ROV's are made to free fly by adding buoyancy, trenchers can actually benefit from negative buoyancy that allows jetting forces to cut into the sea floor. Larger capable tracks will allow the trencher to traverse undersea terrain ranging from softer muddy bottoms to steep inclines, as well as being better able to negotiate obstacles.

Alternatively, trackless ploughs use skids that can have a tendency to "run away" when aimed down a seabed incline. As the seabed gets harder, ploughs are also increasingly difficult to steer. It becomes critical to manage any sea floor slope and maneuver around problematic bottom terrain.

Thus, the ideal IA vehicle would be a powerful tracked vehicle that can be maneuvered even during high currents. A low and wide profile aids in stability and can allow the vehicle to continue to work longer in adverse tidal or current flows.

Commercial-Off-The-Shelf Parts – COTS

Burial equipment manufacturers tend to incorporate proprietary parts into the construction of their vehicles. These unique parts can cost more to replace, as they are not mass-produced. This can also cause long lead times when ordering spares from the original equipment manufacturer (OEM). There is also a risk that the part will not be available when necessary. The problem of discontinued

parts can be crippling, especially with some electronics components. For example, replacement control boards are costly and hard to find if the technology is obsolete.

Using off-the-shelf parts can increase versatility and be a key component in reducing overall operating costs.

Jetting

For soil conditions from 5Kpa to 120kpa, the optimal method of burying a cable is to jet water into the sea bottom to "cut" a trench for the cable to settle into. Because the sea floor can be studied from the pre-project surveys, this process should be pre-planned to utilize the best jetting swords and nozzles for the soil conditions.

Mechanical cutting (as discussed above) with a chain or wheel is another method utilized when the sea bottom conditions are too hard for jetting. However, this mechanical cutting has other intrinsic problems ranging from clogging, fouling and maintenance down time, to a higher risk of accidental damage to the product cable itself.

The ability to control the jetting force is very important. Some jetting systems are either "on" or "off," and in the case of jetter power, bigger is not always better. Too much power can result in cable trenches that are too wide and therefore self-defeating. If the resulting trench ends up being simply a large ditch, the product cable can still be exposed to anchors, fishing nets and other hazards.

One method that has proven effective in gaining control over the jetting force is to employ a variable speed motor that drives the water pumps supplying the jetting force. Varying the driver (and therefore the jetting force) allows the operators to "fine-tune" the process to compensate for variances in soil conditions.

Versatility

A versatile trenching vehicle can also be used for "multi-tasking" while expensive vessels are deployed. An OWF installation involves many ships that are performing inter-dependent operations. One ship can easily be delayed by having to wait for another ship to complete its activities. Therefore, it is highly beneficial if the ROV host ship can convert any "down time" to productive work while it is waiting for another ship to finish its work. Some other tasks that a trenching ROV can also perform are: Post Lay Inspection & Burial (PLIB), Pre Lay Surveys (PLS), Touch Down Monitoring (TDM), foundation scour surveys and cable maintenance.

Often, PLIB work will be required after a plough is used to bury cable. The "plough up" and "plough down" operations will leave sections of the cable exposed at each end of the run and at any cable crossings. Returning with a jetting trencher at some point may be the only way to complete the burial. Fortunately, the final "as built" survey data could also be collected at this time as well.

A trenching ROV can also be used to perform various other operations if fitted with the correct equipment. With its robotic arm, the ROV operator could assist with feeding the cable pull-in at the J-tube. Special tooling is also used to perform and "cut and grab" that allows the vessel to pull up and retrieve problematic cable.

Power

Nameplate data does not always translate to available power for specific operations. When considering the trencher power, calculate the resulting power that is actually available to power the tracks, water jets and ancillary equipment. In surface fed units where the water pressure is actually generated on the surface, the power available for water jetting on the sea floor is inversely proportional to the water depth. In addition to the extra piping losses, you will generally loose 1 bar (15 psi) per 10m (30 feet) of water depth. Attempting to do work too deep will be slow or fruitless.

Operating Depth

As most wind farms today are sited in 10 to 40 m of water, a long expensive umbilical is not needed. Often, repurposed systems will have existing umbilical capable of 2500m water depth operations. Longer umbilicals can even impair shallow water operations, as the remaining wound umbilical can actually heat up on the winch reel.

Conclusion

Due to unique physical constraints of OWF arrays and the sensitive nature of the power cable, as well as the repetitive nature of multiple turbine connections, the favored method for inter-array cable burial is PLIB trenching with a tracked vehicle. Additionally, when seabed conditions allow, water-jetting technology is preferred over the potentially more dangerous mechanical cutting. Our research shows that many burial vehicles will be needed as OWF build rates increase to meet industry projections. If burial equipment is available, its owners will probably be using it in their bid proposals for upcoming jobs. It will be the responsibility of the hiring company to perform sufficient due diligence to ensure that the equipment proposed is the best suited for the job.

Email: info@pharos-offshore.com
www.pharosoffshoregroup.com

MREC

The New England Marine Renewable Energy Center (MREC) will host is 3rd annual technical conference in Boston on November 7-8, 2011.

By Maggie L. Merrill, Marine Marketing Services

The New England Marine Renewable Energy Center (MREC) will host is third annual technical conference in Boston on November 7-8, 2011. MREC has been bringing people together to discuss the many aspects of making ocean energy a reality in the U.S. since 2007. Creating a network of technology developers, regulators, funding and financing groups, local and national stakeholders, MREC is building a foundation for the introduction of ocean energy devices. The theme running through all five of MREC's stakeholder and technical conferences has been a blending of real world experience transferred directly from European leaders to their U.S. counterparts.

What makes this year's 3rd Annual MREC Technical Conference special are the key note speakers, the breadth of topics to be covered and the fact that it has grown to take place over two full days. This year there will be more than 35 presentations and 10 technical posters; 15 will be presented by graduate students from the U.S. and abroad. These professionals will share their research results on topics related to wave energy and tidal energy systems, numerical modeling, environmental assessment and offshore wind. International perspectives will be addressed by speakers from Ecuador, Scotland, Ireland, UK, Germany, and Norway.

Keynotes will be given by industry leaders who will talk about the lessons they have learned by being among the first to put "steel into the water." Peter Fraenkel, Chief Technology Officer of Marine Current Turbines will provide insights about where the ocean energy industry is today and what can be done to accelerate the industry. Hans-Joachim Stietzel, Director of Cuxhaven Harbor Development Company, will share his perspective on how coastal regions in Germany have benefited from offshore wind energy. Mark Sinclair, of Clean Energy Group will talk about his effort to link ocean energy states and organizations to leverage their resources to bring energy from oceans and rivers ashore sooner rather than later. Patrick Cloney, Executive Director of the Massachusetts Clean Energy Center will talk the importance of taking a long term view toward fostering clean tech and clean energy companies and research organizations in Massachusetts to enable them to better compete in the renewable energy race. Starting with the first annual Ocean Energy for New England conference, held at the Advanced Technology and Manufacturing Center, Fall River, MA, (2008) the focus was on how the U.S. can create a regulatory framework that would enable marine hydrokinetic systems to be tested; environmental impacts to be monitored and stakeholders to be involved in the process. The US Minerals Management Service and the Federal Electric Regulatory Commission were just beginning to clarify their roles in permitting, regulating and monitoring the introductions of offshore wind systems as well as wave, tide, and current test devices. Additionally, experts with in-the-water experience from the University of Edinburgh and the European Marine Energy Center in Scotland provided detailed accounts of lessons learned in terms of what to expect when designing, testing, scaling, launching, operating and maintaining ocean energy devices. The 2nd Annual Ocean Energy for New England conference that took place in Hyannis, Mass., addressed topics related to how ocean energy systems might fit locally in New England coastal waters. That is when the Massachusetts Ocean Management Planning process was picking up speed and was looking at the Rhode Island Special Area Management Plan process as a road map for

MREC 2011 Keynote speaker Peter Fraenkel of Marine Current Turbines, Ltd.

delineating appropriate spots in state waters for offshore wind and other renewables that would avoid conflicts with other users.

At that conference we also felt it was necessary to address topics such as maximizing benefits to local communities, workforce readiness and grid infrastructure development. Creating a culture of open communication with all stakeholders including; property owners, view shed advocates, tribal interests, finance organizations, municipalities, fisher men and women, marine transportation operations, and recreational boaters is crucial to a project's ultimate success. A Maine-based company, Ocean Renewable Power Corporation has reported great success with testing and integrating its Tidal Generation Unit. Early on they made the strategic decision to consult with the locals before moving too fast. Hiring local marine trades people to assist with running the boats, installing moorings, and building their special purpose barge helped lay the foundation for ORPC to achieve success. ORPC has quelled the skeptics by creating jobs for local employees and by demonstrating that electritiy can be produced from their system.

A conference devoted to engineering and technologies was needed. So, MREC's University Research Consortium launched the first in a series of technical conferences in October 2009. A formal call for abstracts was issued with reviews resulting in 20 technical presentations and seven technical posters being on hand for over 200 attendees to absorb.

The second annual technical conference took place a year ago in Cambridge, Mass., and was coupled with the 6th Conference on Clean Energy. As with any new industry, it is important to provide a venue for professionals to meet one another, exchange ideas and figure out the many possibilities and challenges of bringing power from tides, waves, currents, thermal gradients in ocean water and offshore wind to our homes, schools and offices. MREC is doing its part to collaborate with others in the industry to bring the best minds together.

www.mrec.umassd.edu

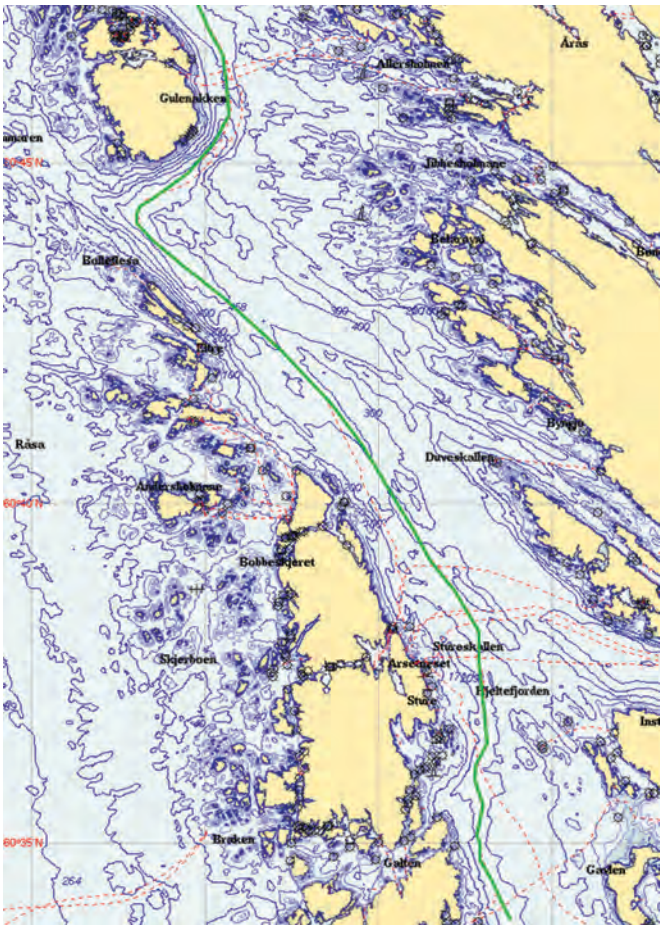
AUV Pipeline Inspection Using the AUVs

Hugin & Remus

By Even Børhaug & Per Espen Hagen

Kongsberg Maritime has completed the world's longest multi-sensor AUV pipeline survey using one of its HUGIN 1000 Autonomous Underwater Vehicles (AUV). The pipeline inspection took place February 9–11, 2011, in the Hjelte fjord near Bergen, Norway and the HUGIN 1000 was operated from the Royal Norwegian Navy vessel HNoMS Malty.

The subject of the inspection was two subsea pipelines going to the Mongstad oil refinery. The HUGIN 1000 AUV was equipped with a an advanced suite of KONGSBERG imaging equipment including the HISAS 1030 synthetic aperture sonar, EM3002 multibeam echo sounder and an optical camera with LED lighting. The instruments were used to inspect around 30 km of subsea pipeline in an 8-hour, two-pass mission.



In the first pass, side-scan data from the HISAS 1030 sonar was used to detect and track the pipelines in real-time, using PipeTracker software for pipeline detection and tracking extracted pipe-like features in the sonar images, with a high degree of robustness towards false detections.

The PipeTracker software, which was developed in a collaborative effort with the Norwegian Defence Research Establishment (FFI) in a project funded by the Norwegian Research Council, runs as a plug-in module in the standard HUGIN payload system. The HUGIN 1000 control system in turn uses the identified pipeline tracks to position the vehicle at an optimal range for HISAS imaging. The whole process is fully automated inside the AUV and requires no operator intervention.

In the second pass, HUGIN followed the pipeline tracks identified in the first pass at low altitude and inspected the

Figure 1 (left): The first 8-hour mission (green line)

Figure 2: A single 3 Megapixel camera image. Altitude 4.6 m. Resolution 2x2 mm.

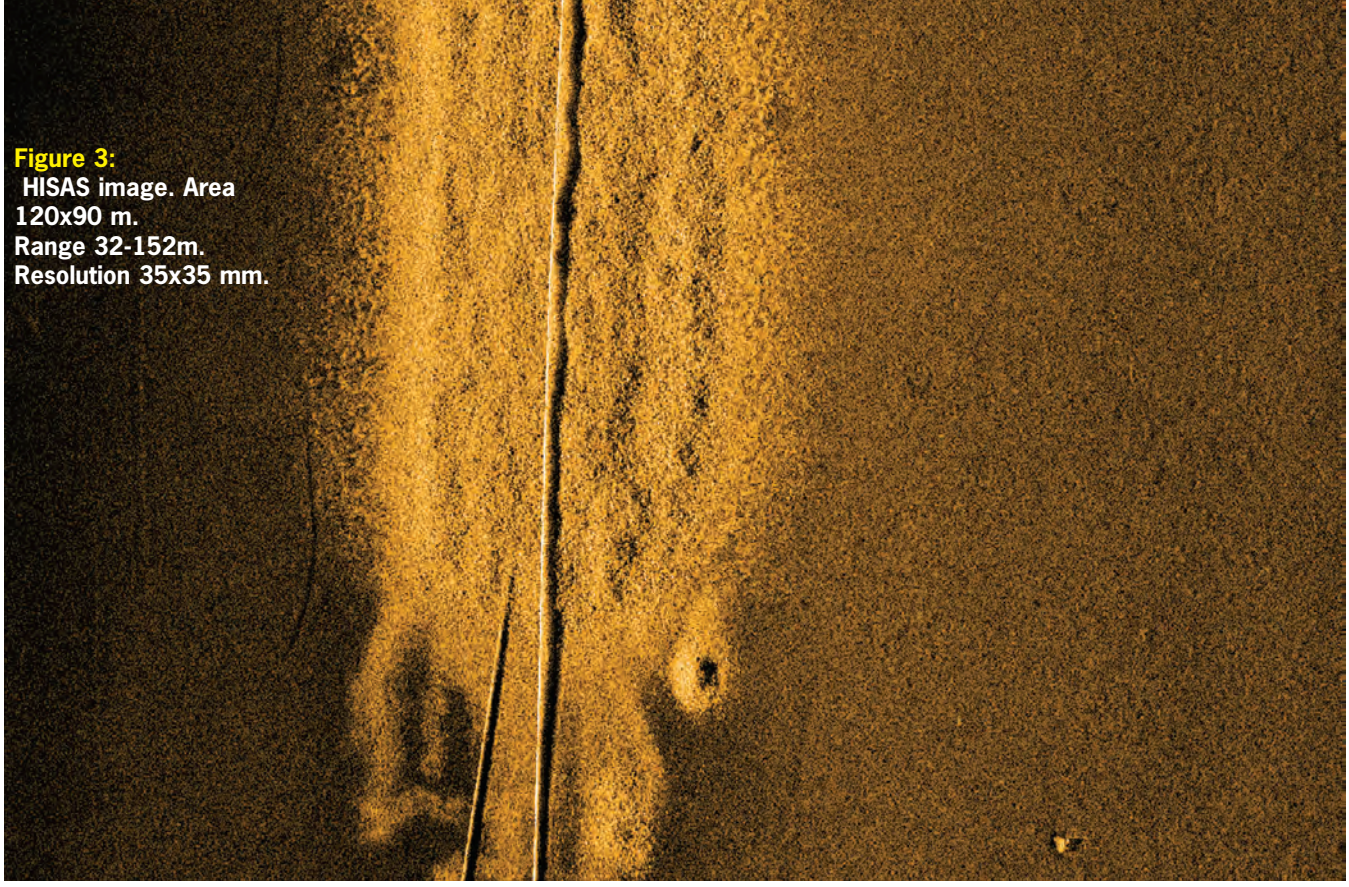


Figure 3:
HISAS image. Area 120x90 m.
Range 32-152m.
Resolution 35x35 mm.

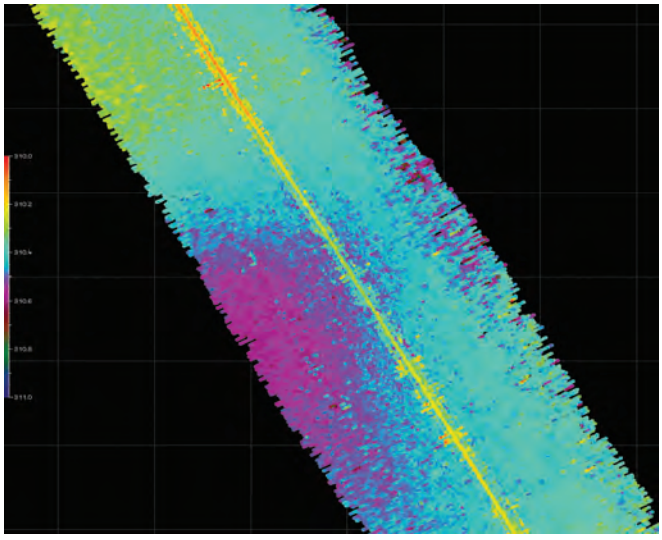
pipelines using the EM 3002 multibeam and the optical camera. After the mission, the recorded HISAS 1030 data was post-processed into high-resolution (4x4 cm) sonar images and bathymetry maps of the pipeline. Together with the optical images and the multi-beam data recorded in the second pass, this gave a detailed view of the pipeline surroundings and the pipeline itself. The complete procedure was repeated the next day over the second pipeline in a new 8-hour, two-pass mission.

Both pipelines were surveyed at a constant speed of 4 knots and at 4-25m altitude, depending on the sensor in use. Water depth was 180-560m. The greater speed of the HUGIN 1000 compared to that of a ROV meant that 60km of pipeline could be inspected in a little over 16 hours during the two passes. Furthermore, the stability of the HUGIN platform and the ability to simultaneously operate both at high speed and at low altitude resulted in an efficient survey with crystal clear images from the onboard optical camera.

Kongsberg's REMUS family of Autonomous Underwater Vehicles (AUVs) built by Hydroid can also perform visual pipeline inspections and pipeline surveys when equipped with high-frequency sidescan sonar, a multi-beam and camera. Hydroid's REMUS 100 AUV, used for deployment in shallow waters and the REMUS 600, used for operation in greater depth, boast the same capabilities as the HUGIN 1000, allowing the vehicles to succeed in pipeline inspections.

Kongsberg Maritime and subsidiary Hydroid offer 'Full Picture' HUGIN and REMUS AUV solutions, where the vehicles themselves and required instruments can be supplied by Kongsberg Maritime, ensuring users have a single company to co-operate with for any kind of survey. The company is aligning the two product lines, providing users operational synergies and a strengthened technology base, suitable for all underwater survey applications. The PipeTracker software module has been developed in a collaborative effort with the Norwegian Defence Research Establishment (FFI) in project funded by the Norwegian Research Council (the FORNY-program).

Figure 4: Raw bathymetry from EM3002. Area shown 120x120 m.



MTS Elects Four to Board of Directors

Zande, Toll, Kocak, and Manley Elected as Vice Presidents

The Marine Technology Society (MTS) announced the results of its recent elections for positions on its Board of Directors. The following Vice Presidents were elected: Jill Zande, Education and Research; Ray Toll, Industry and Technology; Donna Kocak, Publications; and Justin Manley, Government and Public Affairs. Election results were announced at the Society's Annual Meeting during OCEANS'11.

Zande is the Associate Director and ROV Competition Coordinator for the Marine Advanced Technology Education (MATE) Center. "Each year over 400 schools, middle through university, participate in MATE ROV competitions. I have developed strong working partnerships with many businesses, research institutions, government agencies and professional societies, and am well-experienced in fostering working partnerships among diversified groups. I look forward to bringing this experience and expertise to continuing the growth of MTS' already robust student-focused educational programs and opportunities."

Toll works for NOAA'S National Data Buoy Center (NDBC) on an SAIC contract. "Part of my responsibilities as Vice President will be to foster increased relationships for MTS with industry and relevant associations. My background encompasses a wide range of experiences, including the Navy as a user and provider, as well as private industry. I believe strongly that we need a national infrastructure for ocean observation to advance our country's priorities to address catastrophic events, marine spatial planning, and others. I will be working to pull together the extraordinary expertise available within our membership to present MTS as a venue that is program/agency neutral which can focus on operational systems nationwide and globally."

Kocak serves as an advanced program engineer with HARRIS CapRock. "Having developed an extensive publications list of my own, I am well-accustomed to working with editors. As well, I recognize the critical nature of information and research in our profession, and will work to leverage this background to develop a strategy that not only delivers timely and impartial information, but also delivers this information to the marine community and our government leaders to both solve problems and assist in better decision-making."

Manley is the Senior Director of Business Development for Teledyne Benthos. "MTS has raised its profile with government agencies and legislators as an impartial voice of marine science and technology expertise. In my second term in this position, I plan to continue to improve our public affairs efforts, increase MTS' visibility among media outlets, and seek opportunities to educate the public about the vital contributions of marine science and technology."

MTS Announces Annual Award Winners

MTS announced the honors and recognitions it awarded at its Annual Meeting held at OCEANS'11 in Hawaii. The highest accolade a member can receive within the Society is to be designated an MTS Fellow. Three individuals were honored at the MTS Annual Meeting, joining the 114 honored with this recognition since its inception. These were **Benton F. Baugh** and **Peter Fougere**, both of Houston, Texas, and **Brock Rosenthal** of La Jolla, California. Baugh is president of Radoil, Inc., a registered professional engineer, author of numerous technical papers, and holder of more than 200 patents. Fougere is well-known for helping achieve Dynamic Positioning reliability, and made valuable contributions to the 2010 DP Operations Guidance and the DP Vessel Design Guidelines documents. Rosenthal was a co-founder of Deep Sea Power and Light, and later joined Ocean Innovations with a special focus on underwater equipment. He has been active in the Society, and is best known for his willingness to share his time and technical expertise.

Among other top awards, the Lockheed Martin Award for Ocean Sciences and Engineering was presented to Howard Shatto for his extensive technical achievements in marine science, engineering and technology.

Kvaerner Appoints Allen Executive VP

Kvaerner appointed Tony Allen as Executive Vice President for its International business area. Allen has more than 30 years of industry experience and has been part of the corporate management with several of the leading EPC contractors for the oil and gas industry, including SNC-Lavalin Inc., Humphries & Glasgow and Earl and Wright. He also worked as a Project Manager and Technical Director for Kvaerner in the 1990s.

Eyles, Walters Appointed at 2H Offshore

Eyles

Walters

2H Offshore announced two new appointments. Tim Eyles becomes the managing director of the 2H Offshore group of companies. He will also continue to share the running of 2H Offshore's engineering office in Woking, UK. At the same time, David Walters, joint leader of the company's Houston, USA, office, has been added to the 2H Offshore global management team as a principal director. Eyles and Walters joined 2H Offshore in 1998 and 1997 respectively, both directly after graduating from the University of Surrey, UK.

Gosling Joins Liquid Robotics

Liquid Robotics, developer of the Wave Glider unmanned ocean vehicle, and cloud-based data service provider, announced that James Gosling, formerly of Google, has joined the company as chief software architect. The addition of Gosling comes at a time when the company is experiencing rapid growth in its customer base, adding strategic new hires, and expanding company operations. In June, Liquid Robotics closed a Series D $22 million financing round led by VantagePoint Capital Partners, the company's first institutional investor, together with participation by oilfield services provider Schlumberger.

"Liquid Robotics tackles a rocket science problem that does good for the world and is incurably cool," said James Gosling. "Liquid Robotics can totally change the way we look at oceans. We'll be able to get a wide variety of detailed data more cheaply and pervasively than any other way. It involves a large data problem and a large-scale control problem, both of which are fascinating to me and have been passions of mine for years." Gosling is best known as the developer of the Java programming language.

Febo Joins CTG-Sonatech Division

CTG-Sonatech division announced the hiring of its new Director of Business Development, Brent Febo. In this capacity, Febo will be responsible for organizing, implementing, and accounting for all of Sonatech's business development initiatives and activities. He will be based in Washington, DC, and will continue to make that his center of operations.

Febo joins CTG from ITT (formerly EDO Electro-Ceramic Products), in Salt Lake City where as Director of Business Development he was responsible for the strategic planning, and the implementation of those plans with respect to business generation, forecasting, establishing and maintaining good customer relationships.

Management Changes at Aker Solutions' Subsea

Alan Brunnen and Tove Røskaft will both take a seat at the executive management team of Aker Solutions following a restructuring of the company's business area Subsea. Mads Andersen who has headed Subsea leaves the company after eight years in the same executive team. Alan Brunnen has headed up Aker Solutions' regional subsea business in Aberdeen and the Controls segment since early 2009. He joined Aker Solutions in 2006 and has nearly 30 years experience from the oil and gas industry. He will now step up to head the new Subsea business area.

In his new role, Brunnen will also be responsible for the Brazilian subsea operations of Aker Solutions, which reported significant quality issues related to its deliveries in the second quarter this year. An experienced task force headed by Chief Operating Officer Per Harald Kongelf has been mobilized to support him and the newly appointed Brazil Subsea manager Egil Bøyum in evaluating and addressing these issues. This work is still ongoing.

The change in organizational structure means that the Umbilicals segment, which represents approximately 20 percent of the former Subsea business area, becomes a business area in its own right. Tove Røskaft has

headed Umbilicals since 2009 and will continue to do so in her new role. She has been with Aker Solutions since 1996.

Underwater Center Honored

The Underwater Center has picked up a top award at the inaugural Energy North Awards Ceremony held in Inverness, Thursday, September 29, 2011. The Center triumphed in the Best Oil and Gas Industry Service Supplier category, which recognizes companies that are involved in the oil and gas industry in the HIE region. The Underwater Center says it is the only training center in the world that offers the full range of Health and Safety Executive (HSE) commercial diving qualifications in air and mixed gas diver training, from HSE SCUBA to HSE Closed Bell diving.

FMC Wins $135m BG Norge Deal

FMC Technologies won a contract by BG Norge, a subsidiary of BG Group, for the manufacture and supply of subsea production equipment to support the Knarr oil and gas field. The contract has a value of approximately $135m in revenue to FMC Technologies. The Knarr field, formerly known as Jordbaer, is located in Norwegian block 34/3 of the North Sea in water depths of approximately 1,320 ft. (400m). FMC's scope of supply includes three each of subsea production trees and water injection trees. The company will also provide six subsea control modules, five wellheads, two manifolds and other related equipment and controls. Deliveries will commence in the spring of 2013.

"This is the first call-off order under the new multi-year frame agreement," said Tore Halvorsen, FMC's Senior Vice President, Global Subsea Production Systems. "We recently completed a detailed engineering study for the project, and we are eager to now support the field with our subsea systems."

IEEE OES Presents Awards at Oceans '11

IEEE OES announced its annual award recipients at OCEANS '11. The Distinguished Technical Achievement Award recipient Christopher von Alt was recognized for his significant accomplishments in oceanic engineering. He is a leader in the development and use of autonomous underwater vehicles in oceanography, underwater acoustics, and ocean engineering. The Distinguished Service Award recipient James T. Barbera was honored for outstanding contributions towards the objectives of the Oceanic Engineering Society. He has been active in the management of IEEE OES for many years serving on the Administrative Committee for 12 of those years. Also honored at the Awards luncheon was Donald E. Barrick. He was named IEEE Fellow, Class of 2011. His recent research has involved use of HF-radar surface current data for improving ocean circulation models and use of normal modes to extend and improve nowcast maps of HF radar data in bays and estuaries.

SeaZone Expands Data Coverage

SeaZone is expanding the data available in its products, both in terms of geographical coverage and data features. Data from hydrographic offices, research institutions, private companies and NGOs throughout the world is being incorporated into the SeaZone suite of products. SeaZone sources datasets from definitive data providers, ensuring only official and accurate information is used in its products. SeaZone's flagship product, HydroSpatial, an off-the-shelf authoritative digital marine map, is undergoing a revamp.

http://www.seazone.com

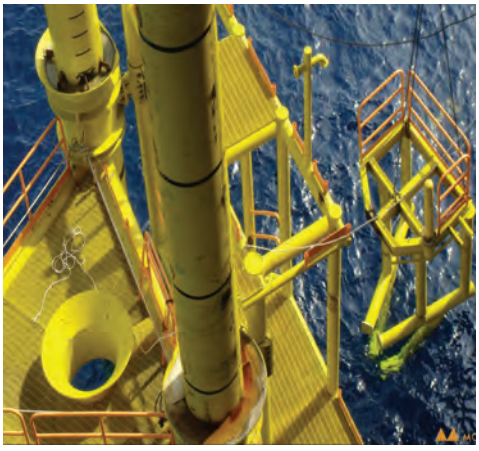
FPSO OSX-1 Mooring System Enroute to Brazil

The disconnectable buoy that comprises the mooring system of the FPSO OSX-1 (floating production, storage and offloading unit for oil and gas) belonging to OSX, an EBX Group company, arrived in Rio de Janeiro in September. It will be used for producing the first oil by OGX at Waimea in the Campos Basin. This is a large scale piece of equipment, with a height of approximately 17m, a diameter of 14m and weighing more than 700 tons. The buoy will be responsible for interconnecting the OSX-1 to well OGX-26 via flexible piping and umbilicals. Production estimates for this well is for up to 20,000 barrels of oil per day already

in 2011. The mooring chain, piles and steel wire rope of the FPSO OSX-1 are already in Brazil.The prior installation of this mooring system in Rio de Janeiro will allow for quick connection of the unit, reducing the time required between the arrival of the OSX-1 and the start of its operation.

www.osx.com.br

Momentum Completes Offshore Install for PCPP



Momentum completed the offshore installation of the DANA LWS (Light Weight Structure) for PCPP. PCPP is a joint venture between Petronas Carigalli, PetroVietnam and Pertamina of Indonesia. Momentum loaded the structure on to a Barge and installed the structure using a Jackup drilling rig. Traditionally, the installations of these structures are done using a Derrick Barge at a far greater expense to the client. "Momentum continually seeks innovative and cost effective solutions for their clients", stated Jimmy Larsen, Deputy Managing Director. The combined weight of the unit (jacket, platform, boat landing) was 300 tons which was installed in 50 meter of water depth and the project was completed on time under budget and with ZERO incidents.

www.momentumdubai.com

Bluefin Robotics Acquires Hawkes Remotes

David Kelly, President & CEO, Bluefin Robotics

Graham Hawkes

Bluefin Robotics acquired the assets of Hawkes Remotes, Inc (HRI), a spinoff from Hawkes Ocean Technologies (HOT), that develops advanced Remotely Operated Vehicles (ROVs). Bluefin plans to leverage their AUV autonomy and subsea vehicle experience to add hybrid capabilities to the Hawkes ROVs and offer them as an extension of their current product line to the oil and gas industry.

"We are thrilled to be working with Bluefin Robotics to take this technology to market," said Graham Hawkes, Co-Founder and CTO of Hawkes Remotes, Inc. and President and CTO of Hawkes Ocean Technologies. "Thanks to many years of experience and an extensive track record of designing and building AUVs, they're a perfect fit to carry on the HRI vision of combining new and existing technologies to rethink the core designs of unmanned underwater vehicles."

Bluefin's decision to acquire the HRI designs stems from their mission to develop highly capable platforms for subsea survey and inspection-related tasks for the oil and gas industries. The Hawkes technology and design approach stood out among the crowd because it challenges the economics of deep ocean access via a ROV. The designs offer scalable, modular solutions including a thin, armored fiber-optic tether and on-board high-energy density batteries that will reduce the total cost of ownership/operating costs while simultaneously outperforming existing ROV technology.

"When we first considered purchasing HRI's assets, we discovered that the companies shared many of the same philosophies and innovation goals," said David P. Kelly, President and CEO of Bluefin Robotics. "… vehicle modularity, on-board power, very deepwater ops, an efficient and cost-effective op tempo, rapid response deployments, for example."

As part of the acquisition, Bluefin and Hawkes Ocean Technologies entered into a strategic relationship to bring the HRI ROV technology to market, but also to continuously advance the design and development of ROV platforms and technology.

SMIT Expands Global ROV Fleet

Schilling Robotics announced an order for two Heavy-Duty (HD) ROV systems from SMIT. The HD systems will be rated for 4,000m and will be supplied with tether management systems (TMS), control vans, and launch and recovery systems (LARS). SMIT will install the HD ROV systems onboard its subsea diving support vessels in support of the company's expanding global subsea operations. The systems will be delivered first quarter of 2012. Dennis M. Stolk, manager operations for SMIT Subsea, said "These work-class ROVs will be outfitted with a comprehensive range of survey and tooling equipment to support subsea construction and IRM operations therewith increasing the versatility of our dive support vessels."

Reson Welcomes Distinguished Guest

First Sea Lord and Chief of the Naval Staff Admiral Sir Mark Stanhope GCB OBE ADC met with RESON's Business Development Manager John Fraser, Business Development Manager Tommy Sturesson and André De Schipper. During the DSEi (Defence & Security Equipment International) exhibition the September 13-16, 2011, RESON was featured as exhibitor in the hall area and as a supplier of underwater acoustic solutions demonstrating equipment in the adjoining dockside. RESON showcased a live demonstration of a diver detection solution with SeaBat 7128 as the turn-key system for diver detection. The meeting between RESON and Admiral Sir Mark Stanhope, First Sea Lord and Chief of the Naval Staff, was with a common interest for securing harbor and coastal assets as well as mobile force protection.

HATLAPA Acquires Triplex AS, Extends Portfolio

Hamburg-based manufacturer HATLAPA Marine Equipment has purchased a majority shareholding in the Norwegian deck machinery company Triplex AS. In doing so HATLAPA's traditional product portfolio of compressors, steering gear and winches has now been significantly expanded to include all components of a typical deck machinery package for supply vessels and AHTs.

Rapp Hydema Buys Hydra Pro

Rapp Marine Group acquired Hydra Pro Seattle, a crane manufacturing firm. Possessing both American Petroleum Institute (API) Spec 2C and ISO 9001: 2008 certifications, Rapp Hydra Pro is a rarity in the crane community. Hydra Pro also manufactures A-Frames, cylinders and other associated machinery. Hydra Pro's clientele includes customers the offshore oil industry, the U.S. military, and various other marine subsectors, including ROV-handling. Kurt Manchester is the new Hydra Pro President. Johann Sigurjonsson, President of Rapp Hydema U.S., is impressed by the operation's functionality and said that he is planning to replicate some of these practices at the original 4433 27th Avenue facility. Closely involved in all aspects of the acquisition process, Sigurjonsson called Hydra Pro "a most important addition to the Rapp family" which includes existing facilities in Dutch Harbor, AK, Seattle, WA (two sites), and the Houston sales office.

N-Sea

A New Era for Noordhoek

Noordhoek has emerged after a turbulent period as a reinvigorated company, ready to capitalize on its strengths, expand its business and build a brand synonymous with excellence. "This rejuvenation is a testament to our dedicated workforce, who, with the support of our ambitious partner Value Enhancement Partners, has created a more dynamic and entrepreneurial company. The launch of our new name N-Sea is just the beginning,', said Commercial Director Cees Noordhoek. The letter 'N' is a prominent part of the name. In the 'N', Noordhoek, the name in which the company has invested more than 50 years, lives on. Thanks to the impressive work over 50 years the name Noordhoek continues to open many doors. In addition, the new name refers to the North Sea Standards, which means quality and also refers to N-Sea's home base. Moreover, the new name N-Sea presents a more powerful, international and customer-focused company. N-Sea is the name, followed by the names of the divisions underneath: Offshore (N-Sea Offshore), Survey (N-Sea Survey), Seatec (N-Seatec), and inshore (N-Shore).

Bob, Sergio and Cees have N-Sea pointed for success.

Otto Candies' Turns to Rapp Hydema for Winch Retrofit

Rapp technicians recently completed a winch drive retrofit for Otto Candies. An existing Rapp hydraulic winch was converted to electric, making use of Rapp's Active Heave Compensation (AHC) package. "Active Heave Compensation is important for our future vessel operations in Brazilian waters, and the Rapp package has shown well with other customers," said Brant Folse, Project Manager and Marine Engineer at Otto Candies. Rapp's package includes an award-winning motor, recognized as a new innovative technology at the 2010 Offshore Technology Conference (OTC) Spotlight on Technology ceremony. The Rapp design features liquid cooling—despite the fact that the R&D team at the outset considered myriad air-cooled designs before opting for liquid-cooling. The Rapp motor is designed to provide more kW per kilogram of weight than comparable air-cooled designs. Owing to favorable acknowledgement in the industry, Rapp patented the design. The motors are mounted on Rapp's own

in-house manufactured gearbox, that it developed long ago for its hydraulic winch lines. Since completion of the first retrofit, Otto Candies has now ordered a second, with work now underway. The winch retrofits are part of wave of electric winch contracts for Rapp, including customers in government survey, fisheries, and offshore oil sectors. Other than enabling deepwater operations to a maximum working depth of 2500m, the electric package provides reliability and reduced maintenance requirements compared to hydraulic. After completion, Rapp's TWS-35060 winch achieves 79.2 tons line pull at 35 meters per minute speed (bare drum), and 30 tons at 92 meters per minute (top layer).

Extra-Long Seismic Multipurpose Davits

Vestdavit was contracted by Mitsubishi Heavy Industry on behalf of Petroleum Geo-Services (PGS) to design and supply extra-long outreach workboat/lifeboat/FRC davits for **PGS's 5th generation Ramform new building seismic vessels**. The two davits for each of the two vessels building at MHI for 2013 delivery will have an extra-long outswing to be capable of launching and recovering 20 man tender boats safely in seas states 5 – 6. Vestdavit designed a special Vestdavit H – 10000S dual point hydraulic davit with a dual winch system for the application. Atle Kalve, development manager, Vestdavit, said, "These davits will make deployment and retrieval safer for PGS' crews. The tender boats will normally be used in relatively calm sea states, but are constructed to handle safely even in sea state 6." The boats and davits also have the function as lifeboats and Fast Rescue Craft in an emergency. A key benefit of these davits is the simplicity of use, which reduces crew training needs. The characteristic Ramform design seismic survey vessel has only a short flat parallel ship side for the boat to lie against. To overcome this Vestdavit will supply a painter boom travelling 12m, the longest ever supplied by Vestdavit. Both boom and davits are computer controlled with inbuilt auto tension.

DMS-500 Motion Sensor

The DMS 500 range of motion sensors has been launched by Teledyne TSS to meet the needs of users who require a conservatively priced, top-quality motion sensor with Ethernet connectivity, but without the high integrity subsea housings that typify Teledyne TSS products. The newest addition to the range is the DMS-500H. It can be used to measure heave and has important applications such as in support of crane and winch control and helideck operations. The DMS-500RP was launched earlier in the year and has been developed to measure roll and pitch to meet the needs of dynamic positioning (DP) system builders or any application that needs to provide high dynamic accuracy during vessel turns or extreme sea conditions. The DMS-500 label will ultimately be applied to a complete range of conservatively-priced sensors that incorporate a number of advanced and innovative features for applications such as dynamic positioning, wave height monitoring and structural stress monitoring. The versatile design means that the range will be available in various accuracies so that models are suitable for a wide range of bespoke applications.

New Approaches to Offshore Mooring

Measurement Technology NW (MTNW) implemented its running line tensiometer (RLT) technology with a Samson synthetic rope in an offshore mooring monitoring project engineered by Delmar Systems. This implementation is MTNW's first use of tension measurement technology with 2"+ synthetic ropes.

Recently, Delmar Systems was contracted to moor an offshore supply vessel (OSV) to a major offshore platform in the Gulf of Mexico. The OSV is using a three-point mooring system consisting of two stern hawser lines attached to the platform and a bow mooring line attached to a preset suction pile foundation in 2,900 ft. of water. The mooring system had to be as robust as possible while still maintaining ease of handling and rigging by the vessel crew.

To achieve a higher Maximum Breaking Load on the OSV bow mooring line while maintaining deck maneuverability, Delmar chose

Samson's AmSteel-Blue HMPE rope made of high modulus polypropylene (HMPE) as the bow winch line. An MTNW RL-20175K running line tensiometer provided tension measurement for the bow line. During the design phase of the project, MTNW thoroughly tested and calibrated the RLT using the specified 2¼" AmSteel-Blue rope.

"This is MTNWs first use of an RLT to measure tension in a major synthetic mooring line of this large diameter," said Tom Rezanka, managing director of MTNW.

IMENCO's ROV Shackle

Imenco's semi-automatic ROV Shackle is inherently safe as there is no need to retrieve the shackle pin. The shackle can be used as many times you like as long as you clean it with fresh water after operation. The shackle's body and most part is made from high tensile stainless steel S165M equivalent to Martensitic Stainless steel 17/4PH The pin is standard shackle pin. The Imenco Shackle comes in various sizes 6.5T – 12T – 17T – 25T- 25T- 35T – 55T – 85T – 150Tons. Safety factor is 5. For the bigger shackles clients often request a transportation basket which also can be certified. For more detail information please contact:

Email: al.cohen@imenco.com

www.imenco.com

Full Ocean Depth Multibeam Imaging Sonar

BlueView Technologies has been commissioned to develop the first full ocean depth (11,000m), multibeam imaging sonar systems for historic exploration projects by Virgin Oceanic and film director & National Geographic Explorer in Residence James Cameron. The new imaging sonar systems will be integrated onto manned and unmanned submersibles destined for the deepest locations on earth, including the Mariana Trench in the Pacific Ocean. At more than 6 miles deep the BlueView imaging sonar will withstand immense pressure, more than 8 tons per square inch. Using hundreds of razor-thin acoustic beams the 2D imaging sonar system will aid real-time navigation, object detection and tracking, and monitor biologic activity by delivering and recording high resolution sonar imagery and data in an environment absent of visible light. Explorer Chris Welsh approached BlueView Technologies to develop the unique multibeam system to support the Five Dives Expedition sponsored by Virgin Oceanic. World renowned film director/producer James Cameron will also use the system to explore the Mariana Trench in a separate expedition to film this unique location in 3D and uncover its mysteries.

www.blueview.com

Ruggedized Flash Drive Protects Data

Fischer Connectors introduces the Fischer Rugged Flash Drive; a flash drive specially designed for safe transportation and storage of sensitive data in harsh environments. The Fischer Rugged Flash Drive memory module is securely mounted within a rugged aluminum casing designed to provide full protection against extreme environmental conditions. Sealed IP 68/69K even unmated, the USB flash drive is waterproof down to 120 meters. The Fischer Rugged Flash Drive is resistant to extreme operating temperatures (-40°C to +85°C). In addition, it is protected from shock and vibration damage (withstands a min. 26 x 1.5-meters drop). The USB flash drive is equipped with a rugged protection cap.

www.fischerconnectors.ch

NEW ROS Spectator 36:1 Camera

Remote Ocean Systems (ROS) has introduced the Spectator 36:1 Color Zoom Camera that offers a 36:1 optical zoom with autofocus. This latest technology camera has an outstanding 88° Field of View capability in water. The Spectator 36:1 has a 6AL4V Titanium housing and is depth rated to 4000 meters.

Email: sales@rosys.com

Angel Shark Green Laser Underwater

Imenco's Angel Shark Green Laser Underwater is intended for ROV use only where measurements are needed from video images. The green light ensures good visibility even at long distances due to less absorption of green light in water. By paralleling two lasers, calibrated at set distance, accurate measurements from video images is possible. The 150 mW, 532 nm Green Laser is built into a stainless steel housing with a depth rating to 3000m.

Email: al.cohen@imenco.com • www.imenco.com

Birns Aquila Articulating Helmet Mount

BIRNS introduced the BIRNS Aquila Articulating Helmet Mount. This lightweight, adjustable mount is tailored for one of the of the company's most popular lighting families—for the BIRNS Aquila, BIRNS Aquila-LED and BIRNS Aquila-UV. Designed by Jeff Kirby, BIRNS' Mechanical Design Engineer (and eldest son of Bob Kirby, of Kirby Morgan helmets) it's designed with exceptional safety and performance attributes, and tailored to fit on the faceplates of the entire line of Kirby Morgan DSI helmets. The design allows for articulated movement of any BIRNS Aquila to swivel in all directions.

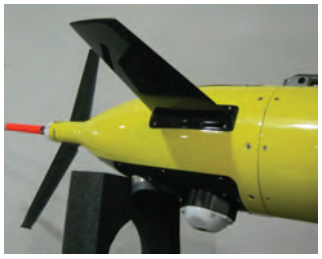
www.birns.com

Longer Range Underwater Inspection

2G Robotics expanded its line of underwater laser scanners with the development of the ULS-500. This longer range higher power underwater laser scanner is designed for scanning over larger areas reducing the number of setups required to obtain complete coverage. Based on the same principles of operation as the ULS-100, the ULS-500 uses higher power lasers and is a physically larger system. 2G Robotics ALF technology allows the system to operate in a wide range of environments. Maximum data capture rate of more than 250,000 points per second. The class 4 laser system is capable of scanning at 3 to 5m and will cut through and filter out a moderate level of silt in the water.

www.2grobotics.com

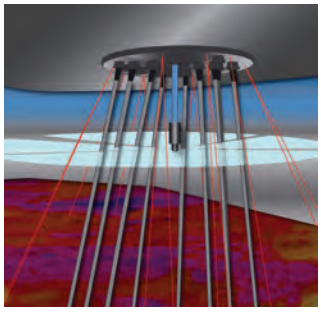
Nortek: ADCP for iRobot Seaglider



Nortek collaborated with iRobot to develop a modified compact Acoustic Doppler Current Profiler (CP) for the iRobot 1KA Seaglider Unmanned Underwater Vehicle (UUV). The development, which took place over the course of the past year, has resulted in the testing of a small, light weight and low-power consuming CP with the Seaglider platform. The project is an important milestone for Nortek, and it complements the work done in the past on measuring turbulence with Nortek high resolution current profilers from open ocean moorings and from moored profilers. The iRobot Seaglider accommodates a variety of sensors and is designed for missions lasting many months and covering thousands of miles. With Nortek's CP sensor, Seaglider could continuously profile currents throughout the water column during long-range missions. These long-range missions are important because they allow for very cost-effective operations.

www.nortekusa.com

RAMS for FPSOs



Tritech developed a system for the real-time integrity monitoring of mooring lines, umbilicals and risers on Floating Production Storage and Offloading Units (FPSOs). RAMS (Riser and Anchor Monitoring System) is a 360 degree riser and anchor chain monitoring system for FPSOs that is deployed beneath the vessel and monitors the presence, integrity and position of mooring lines and risers 24/7 from a single sonar head. RAMS has been tested and the accuracy of the system has shown to be 100% effective in its current deployment on Teekay's Petrojarl Foinaven FPSO, operating on a BP deepwater oil field, within the UKCS (UK Continental Shelf), located approximately 190km (118mi) off the West Coast of Shetland. The RAMS technology builds on the leading proprietary multibeam sonar technology developed by SRD prior to its acquisition by Tritech (a Halma company).

AIRINS: Faster Surveys for France

iXSea installed and commissioned complete georeferencing systems for all of the aircraft operated by the Institut Géographique National (IGN), France's national authority for reference geographic information. The project work scope included providing AIRINS inertial navigation systems, a flight management system, an interface with a gyro-stabilized platform, data logging and processing and all equipment installation, cabling and commissioning.

IGN's main objective is to establish and maintain national reference geographic databases. When the organization was seeking to accelerate database production, it selected the AIRINS high-grade IMU/GPS designed by iXSea. The system is based on 0.01°/hr FOG gyroscopes and will integrate with any kind of GPS and any type of camera or lidar.

www.ixsea.com

Editor's Note: The profile of SEA CON in the July/August 2011 edition contained errors. The correct version is published here.

SEA CON
1700 Gillespie Way, El Cajon, CA 92020
Tel: 619-526-7071
E-mail: contactus@ seaconworldwide.com
Website: www.seaconworldwide.com
President: Mr. Patrick G. Simar
Executive Vice President: Mr. Denton Seilhan

Testing Capabilities:
- Pressure cycling up to 20,000 psi.
- 19 Pressure vessels with varying inner dimensions ranging between 2.125 to 39 inches and lengths ranging from 2.5 to 144 inches.
- Electrical, optical, accelerated life, gas leak, cold water, sand and silt, full mechanical, environmental, vibration and tensile strength testing.


MINI-CON Fibre Optic

Company Profile: After almost 45 years in the subsea industry, the SEA CON Group has become a leader in the manufacture of electrical, optical and hybrid subsea systems and connector solutions for the Oil & Gas, Defense, Oceanographic, Renewable Energy and many other harsh environmental markets. Since the beginning with the manufacture of the Marsh & Marine connector range, SEA CON has always undertaken the challenge of not only providing what the markets require today, but also tomorrow and achieves this by identifying and providing solutions for technology gaps within a market. An example of this is SEA CON's commitment to supporting the use of fiber optics within the Oil & Gas industry through the development of dry-mate optical products, including the MINI-CON and OPTI-CON connector series, the highly successful underwater mateable HYDRALIGHT connector and even the down-hole multi channel fiber optic G3 connector series. To achieve this broad spectrum of product supply and service, the SEA CON group has six globally located manufacturing facilities, each staffed with experienced design/development teams. SEA CON maintains multiple CNC machining departments, routinely manufacturing electrical contacts from 28 AWG to components weighing hundreds of pounds. SEA CON also has several molding departments with a wide variety of composites/elastomers and an in-house glass to metal sealing facility. To complement its design and manufacturing capabilities, SEA CON has extensive in-house testing capabilities that includes, electrical, optical, dimensional, pressure, shock, vibration, axial pull equipment all with experienced staff. To support its product in the field SEA CON provides a 24/7 field service support through its many highly trained field service teams.

Technology Profile: SEA CON has been providing products and services to many harsh environmental markets over the years and has been proud to provide some of the most leading edge solutions available in the market.

This focus on technology has always run deep within SEA CON and can be traced back many years through products like the ALL-WET connector series. These connectors not only provided the market with the ability to mate electrical connectors 'wet', but gave the flexibility of connecting multiple individual instruments, lights, etc into a single interface connection point on a control pod with the further development of the 'Split' ALL-WET connector range. As markets change SEA CON has been able to adapt existing products to meet market needs. The Metal Shell Series (MSS) has been one of the main product lines for SEA CON, providing high contact density and a variety of power and signal configurations. This series has also provided SEA CON with the ability to meet the requirements of API-16D standards with the inclusion of 'test ports' at seal interfaces, critical in today's offshore drilling industry. SEA CON understands the importance of not only developing technology but also ensuring that the technology is qualified in accordance with the appropriate specifications for the applicable markets. This understanding and experience has been gained through many Technology Qualification Programs (TQP's) conducted by SEA CON for products including, but not limited to the MINI-CON and the HYDRALIGHT connectors as well as the SEA CON Precision Hose system to name but a few.

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

UNDERWATER ACOUSTIC ENGINEER

Job Location: USA, NC McLeansville
Underwater Acoustic Engineer – McLeansville, NC (27844BR)

Specific Responsibilities:
Work with a team to conduct sonar system analysis to assess system performance and validate requirements, develop analysis methodologies and software tools for acoustic performance modeling, system planning, and sonar signal processing approaches, conduct trade studies and sonar system analyses to provide recommendations for system requirements, design, development and application, consult with development teams throughout the design cycle and provide technical guidance, support development programs, engineering studies, and new business proposals, prepare test plans for at-sea sonar system testing, process and analyze acoustic data from at-sea tests, prepare technical reports, memos, and presentations, participate and present technical results at reviews and working group meetings. Requires occasional travel to support meetings and at-sea test events.

Basic Qualifications:

Master degree in Engineering or Physics or a Bachelors degree in Engineering or Physics with a minimum of 2 years related experience. Experience in one or more of the following areas: sonar system design and development, acoustic system performance modeling, oceanographic surveys, GIS tools, sonar signal processing, anti-submarine warfare operations, and software development (including Matlab).

Due to the nature of work performed at our facilities, U.S. citizenship and the ability to obtain a secret clearance is required.

Required Key Skills:

Design Verification
MS Office
Requirements Analysis
Requirements Based Testing
Requirements Decomposition
Requirements Traceability
System Performance Analysis
Systems Analysis
Systems Engineering
Test and Evaluation

Distinguishing Features:

MS in Engineering or related discipline preferred. Relevant experience related to high reliability undersea communications systems, at sea hardware deployment, and high power – long haul optical transmission desired.

Preferred Key Skills:

Concept Development
Design Verification
Hardware Design
Mechanical Design
Telelogic DOORS
Telelogic System Architect

If you have interest in being considered for this position, please send your resume and contact information to Erika Chamblin. Contact information below.

e r i k a | c h a m b l i n

Staffing | Recruiting
703 663-9300
Erika.chamblin@gd-ais.com
www.gd-ais.com/careers

Erika Chamblin
General Dynamics Advanced Information Systems
5440 Millstream Road
McLeansville, NC 27301
USA

Phone: 703 663-9300
Email: erika.chamblin@gd-ais.com
WEB: http://www.gd-ais.com

Advertiser's Index

For Fast, Free Information from Advertisers visit www.maritimeequipment.com/mt

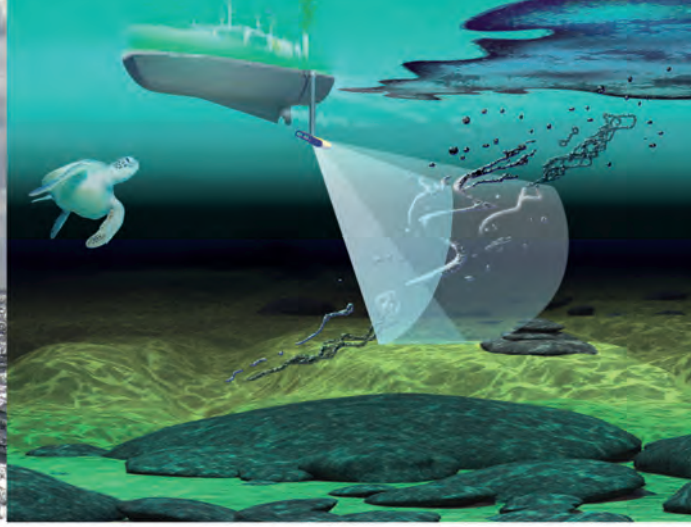
Page	Company	Website	Phone#
27	Balmoral Offshore Engineering	www.balmoraloffshore.com	44 (0) 1224 859000
9	Birns, Inc.	www.birns.com	1.888.Birns.88
5	BlueView Technologies, Inc.	www.blueview.com	Please visit us online
9	Cavidyne LLC	www.caviblaster.com	(352) 275-5319
1	Channel Technologies Group	www.channeltechgroup.com	(805) 683-1431
21	Evans Capacitor	www.evanscap.com/deepwater_products.html	(401) 435-3555
7	Fisher Connectors Switzerland	www.fisherconnectors.com	41(0) 21 800 95 95
C4	Forum Energy Technologies	www.f-e-t.com	Please visit us online
3	Government of Newfoundland and Labrador	www.nlbusiness.ca/arctic	Please visit us online
19	Hydroid	www.hydroid.com	(508) 563-6565
13	Imenco AS	www.imenco.com	(713) 480-7777
33	JW Fishers Mfg Inc.	www.jwfishers.com	(508) 822-7330
15	LinkQuest, Inc.	www.link-quest.com	(858) 623-9900
4	LYYN AB	www.lyyn.com/craig	Please visit us online
17	MacArtney A/S	www.macartney.com/deep	Please visit us online
54	MAST Americas	www.mastamericas.com	Please visit us online
25	Moog Components Group	www.moog.com/marine	(902) 468-2263
26	OceanServer Technology, Inc.	www.ocean-server.com	(508) 678-0550
39	Rapp Hydema AS	www.rappmarine.com	(206) 286-8162
C3	Reson A/S	www.reson.com	(805) 964-6260
15	Seacon	www.seaconworldwide.com	Please visit us online
4	Sensor Technology Ltd	www.sensortech.ca	(705) 444-1440
12	Shark Marine Technologies Inc.	www.sharkmarine.com	(905) 687-6672
23	Silicon Sensing Systems Ltd	www.siliconsensing.com	44 (0) 1752 723330
29	Sound Metrics Technologies, Inc.	www.soundmetrics.com	Please visit us online
31	Specialty Devices, Inc.	www.specialtydevices.com	(972) 429-7240
32	Subsea Photo Contest	http://photos.seadiscovery.com/rules-and-terms.asp	Please visit us online
11	Teledyne Marine C/O	www.teledynemarine.com	Please visit us online
31	Think Sensor Research Inc	www.thinksensor.com	(778) 895-2201
C2	VideoRay LLC	www.videoray.com	(610) 458-3000

Project Shiphunt

Developed by Sony and Intel Corp., began in May when five high school students from Arthur Hill High School in Saginaw, Mich., embarked on an adventure in the Thunder Bay National Marine Sanctuary. Their mission: hunt for a historically meaningful sunken ship, investigate its identity, and document the journey for future generations. Led by world-renowned nautical archaeologist, Dr. James Delgado, the student team worked side by side with scientists and historians from the National Oceanic and Atmospheric Administration (NOAA), Woods Hole Oceanographic Institute and NOAA's Great Lakes Environmental Research Laboratory.

See Full Story starting on page 18.





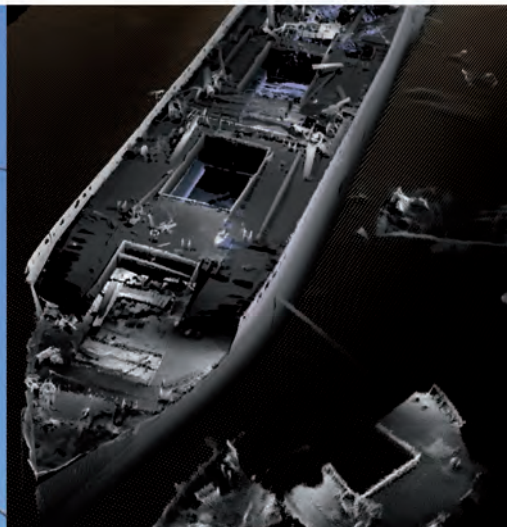
RESON Hydrophones and Sonar Systems

Marine Research - mammal monitoring
Environmental surveys - noise condition monitoring
Windfarm surveys - pre-site surveys before dredging and construction
Marine construction - inspection and maintenance of windturbine base
Oil Detection - from ship wreck oil leakage or oil rig accidents
Cable inspection - AUV and surface vessel mounted sonars
Online monitoring - of wave and current turbines
...and much more. Tell use what your underwater measurement challenges are:

US: +1 805 964 6260 | DK: +45 4738 0022 | NL: +31 (0)10 245 15 00
UK: +44 1224 709 900 | Singapore: +65 6725 9851

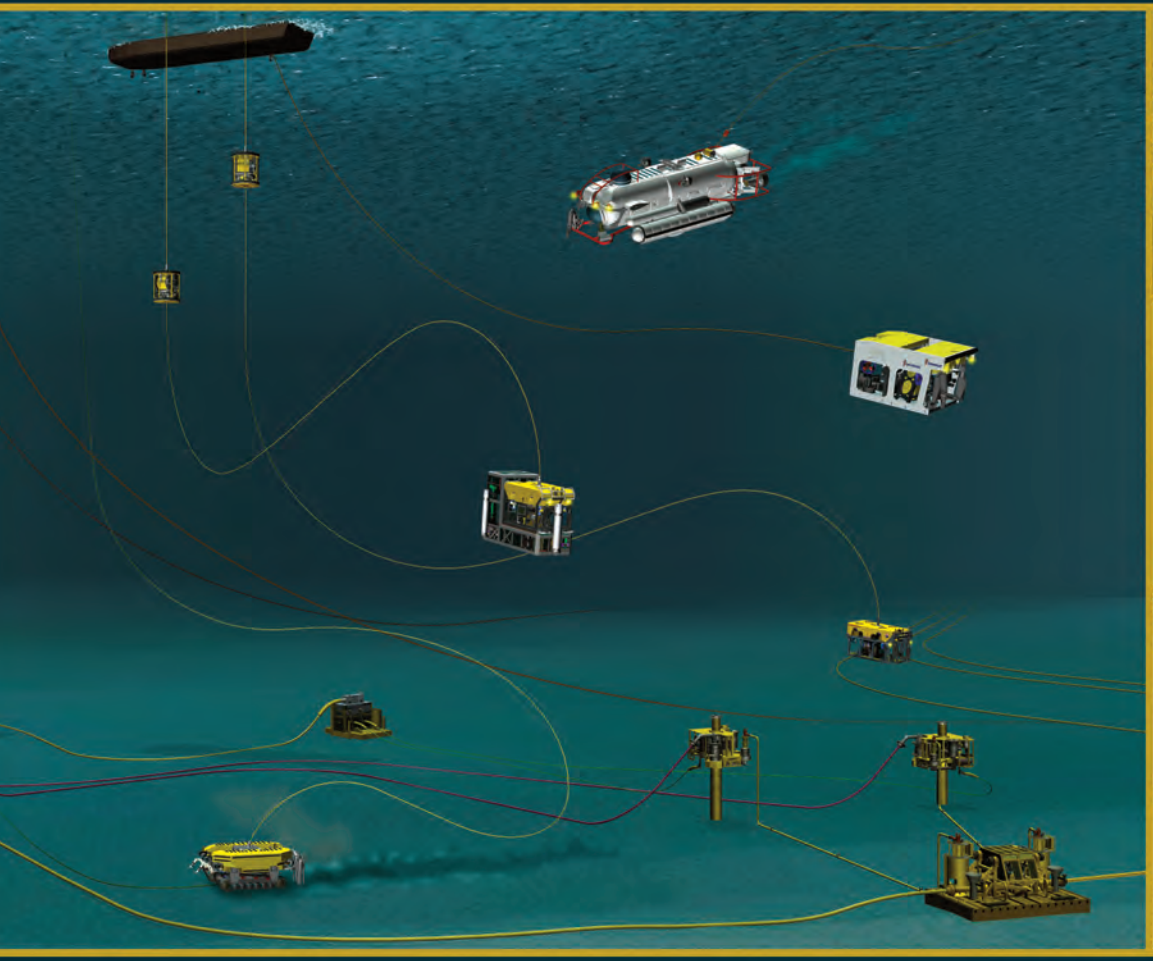
RESON

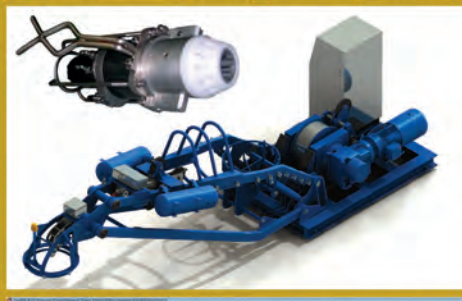
Array picture with courtesy of David Beales
AUV picture with courtesy of ECA Group and SHOM | Breda picture with courtecy of ADUS

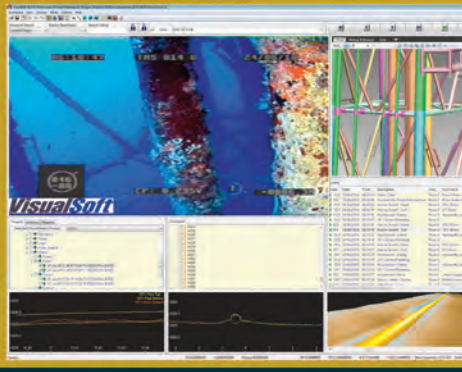



FORUM™
ENERGY TECHNOLOGIES

Complete Subsea Capability







Turn to Forum's Subsea Group when you need state-of-the-art technology and experienced personnel for your next subsea project.

Forum's products include purpose built remotely operated vehicles (ROVs), ROV and custom intervention tooling, control systems and integrated system solutions. Our services include rental of ROVs, tools and positioning systems as well as personnel and training services, seabed coring, geoscience project management and subsea pipeline joint coating. Forum's pioneering Rovdrill® drilling system and VMAX™ simulation software are providing innovative ways to drill smarter and deeper. **To take your next subsea project to a new level visit: www.f-e-t.com**

Perry
sub-Atlantic
DPS OFFSHORE
UKPS OFFSHORE
OJS OFFSHORE JOINT SERVICES
GEOSCIENCE EARTH & MARINE SERVICES, INC. GEMS
VisualSoft
ROVDRILL®