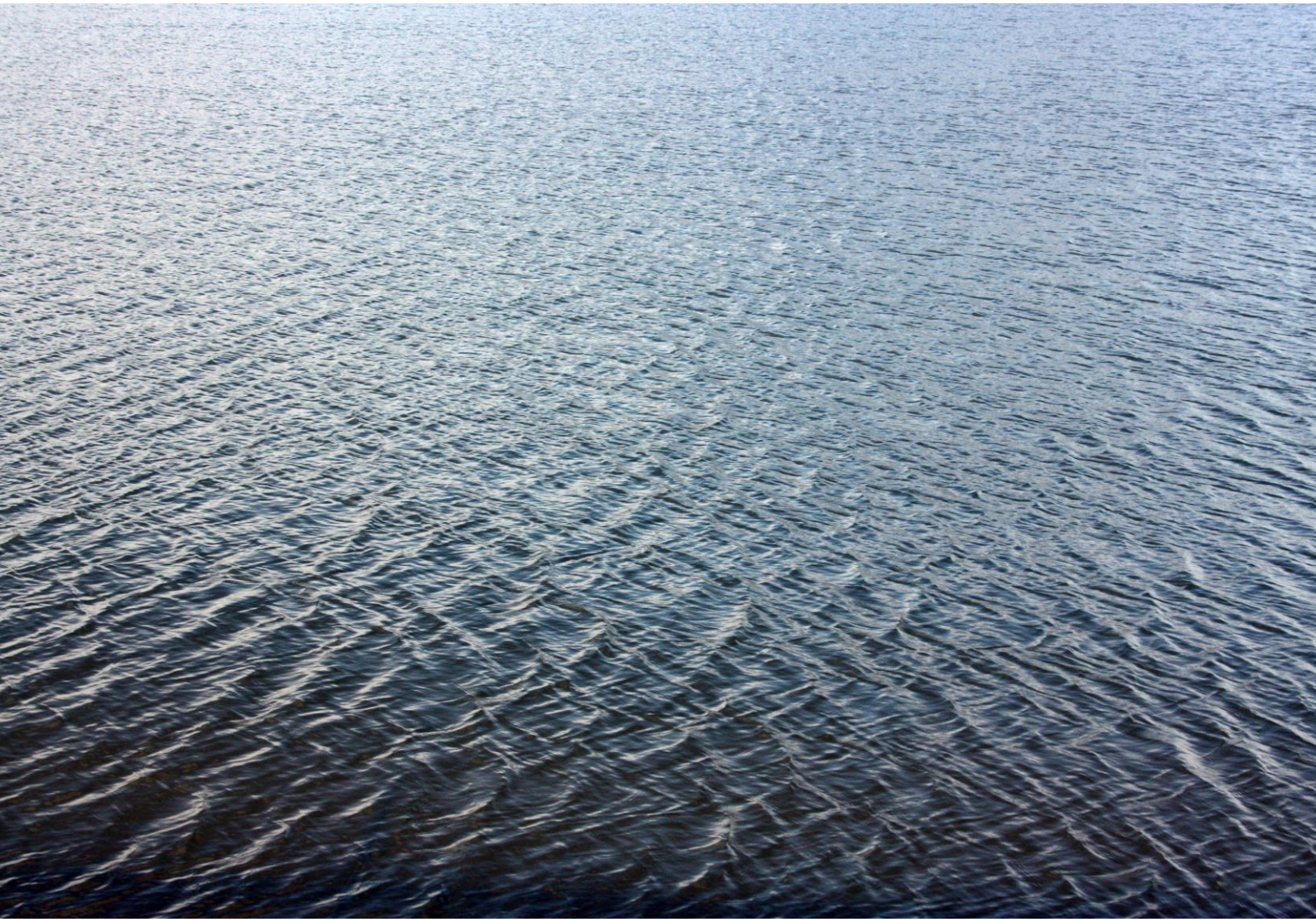
Subsea Springboard

Subsea Power, Survey and Control

12th November 2019

Subsea UK Office
30 Abercrombie Court
Prospect Road
Arnhall Business Park
Westhill
AB32 6FE



NSRI
National Subsea Research Initiative

SUBSEA UK™

07:30 Coffee and Bacon Roll

08:00 Introduction

Neil Gordon
CEO
Subsea UK

Neil initially studied business in Aberdeen then trained as a commercial diver spending eight years carrying out numerous diving assignments in the UK and Norwegian waters involving new construction projects, pipeline surveys, welding and inspection. He has over 25 years' management experience in director and business development roles, combined with over 15 years in the subsea industry.

Prior to joining Subsea UK, he spent four years managing the National Hyperbaric Centre which included project-managing saturation diving operations and hyperbaric weld trials. He more recently developed the subsea safety training and consultancy aspect of the business, where he regularly lectured to subsea engineers and delivered a range of training courses both in the UK and overseas.

He has experience working in India, Middle-east, Africa and Brazil and has worked with the Oil and Gas Producers diving operations sub-committee on client representative training and competency for subsea projects. He was also an active member of the IMCA diving safety, medical, technical and training committee.

08:05 Umbilical-less Systems

Neil Robertson
Director
Crondall Energy

Technology now exists to make umbilical-less systems a reality soon.

These systems will use local power sources to operate the subsea wells. Power may be generated locally by renewable devices or provided by installed stored power which is either re-charged or replaced when depleted.

The only link to the control room will be a communications link, nominally wireless, although thru-pipe wall has been looked at.

Chemical provision is provided by local chemical storage and local chemical injection pumps power by the local power source.

Much of these technologies are being developed in isolation by different companies.

Crondall have completed a study into umbilical-less systems and have identified interesting system related issues such as:

- Power demand and consumption
- Hydraulic vs. all-electric systems
- Transfer of costs from CAPEX to OPEX

NSRI National Subsea Research Initiative

SUBSEA UK™

- Inapplicability of Industry Standards

This presentation will highlight some of these and make the case that system engineering currently lags technology development and will be a key enabler for adoption.

Neil has 17 years' experience with a leading equipment supplier in Aberdeen, Scotland and Houston, Texas at both the manufacturer and system supplier level and subsequently 10 years working as a subsea and reliability consultant.

Neil has extensive experience in the design and operation of subsea wellhead and production equipment, including deepwater systems for the Gulf of Mexico and West Africa. He also has experience of HIPPS design.

Neil has considerable experience of applying functional reliability techniques to subsea equipment design including concept screening and equipment comparison and evaluation.

08:20 Large-Scale Subsea Power

Dr. Thomas Valdez
Manager, Chemical Engineering Group
Teledyne Marine

Teledyne has developed a fuel cell-based subsea power node that can enable the large-scale delivery of subsea electrical power. It is envisioned that this subsea power node could be used to power recharging and communication docks to enhance the endurance of unmanned underwater vehicles (UUVs) and resident remote operated vehicles (ROVs). This system could also provide back-up power to subsea oil fields and data centers. The subsea power node is designed to be buoyant negative fuelled and buoyant positive spent; this allows the system to be installed and retrieved through the use of an integrated retrieval system. The subsea power node has been deployed dockside to perform ship husbandry exercises. In these exercises, a resident ROV would traverse a dock and inspect ship hulls. The subsea power node is capable of delivering either 8 or 25 kW per module. This system can be hybridised with a battery to provide 100's of kW while maintaining the described subsea recharging capability. Smaller units in the range of 50 to 100 W are also being developed to support the ocean sensor community.

This presentation will introduce the subsea power node and discuss the capabilities it can enable.

Dr. Thomas I. Valdez is the Chemical Engineering Group Manager at Teledyne Energy Systems Incorporated, Hunt Valley Maryland. He manages the development of advanced chemical and electrochemical engineering systems. These projects include advanced electrolysis for the generation of hydrogen and oxygen, fuel cell technologies with a focus on powering air-independent applications, and battery

systems for energy storage. His battery system focus is on advanced passive thermal management to enhance durability and address failure propagation mitigation in lithium-based batteries.

Thomas has over 28 years of experience in the area of advanced power systems for military, space, underwater, and commercial applications. His career began at NASA's Jet Propulsion Laboratory (JPL) where he was a major contributor to the JPL Fuel Cell Group and Power Systems Section. Thomas has received various NASA New Technology Awards, has published several technical papers in scientific journals, and has co-authored three book chapters on fuel cell technology. He has several patents with regard to his work on fuel cells, electrochemical sensors, and energy harvesting systems.

His educational background starts with being a student of Mr. Jaime Escalante, whose teachings were the basis of the Hollywood movie Stand and Deliver. Thomas holds a Bachelor of Science degree in Mechanical Engineering and a Masters of Science degree in Materials Engineering from the University of California, Irvine. He completed his doctorate in Materials Science under Professor Florian Mansfeld, winner of the Electrochemical Society Vittorio de Nora Award, at the University of Southern California.

08:35 Subsea Pumping Technology for Chemical Injection

Greg Vaselakos
Sales & New Product Development Manager
Oceaneering

Subsea Pumping Technology offers an alternative solution to umbilical-delivered subsea chemical injection. The system reduces or eliminates the storage, pumping, and delivery systems that typically occupy valuable topside real estate and the interface resources associated with topside chemical storage, bunkering, and handling. Multiple efficiencies can be realised by moving the equipment to the seabed and positioning them locally to the point(s) of demand. Tanks of chemical product are replenished via tank exchange or filled from support vessel down line(s).

Using modular, off-the-shelf, and scalable equipment to meet chemical storage and injection requirements offers significant advantages. Not only are costs and lead times reduced when compared to conventional umbilical systems performing the same task, but the systems can be deployed from a multi-service vessel, eliminating the requirement for a large intervention vessel. Once deployed to the seabed, tanks of chemical products are replenished via tank exchange or filled from support vessel down line(s). The technology is complementary to all electric systems and architectures, and the overall cross section and complexity of the required field service umbilical can be simplified significantly. Additionally, the local storage and injection concept is a strong enabler for longer subsea tiebacks, where chemical

delivery and distribution to the field(s) via long and/or multiple umbilical sections is challenging and costly.

08:50 HALO energy storage for brownfield subsea power applications

Richard Knox
Managing Director
EC-OG

EC-OG has developed the HALO subsea energy storage system for a variety of uses, including autonomous power delivery to brownfield subsea control systems.

As a standalone energy storage system, the EC-OG HALO system can deliver electrical power capable of powering subsea control systems for extended periods of up to 12 months between charges.

Installation of the HALO energy storage system as a remedial power source for wells suffering from electrical supply problems provides a cost-effective temporary or permanent solution by providing an energy source on the seabed, as the point-of-use.

Utilising Lithium ion battery technology, the HALO system adopts a flexible charging methodology to provide the operator with a range of options for asset life extension.

HALO can be 'fast charged' in-situ from a vessel downline, or can be integrated with marine renewable energy technology such as EC-OG's Subsea Power Hub or wave energy converter systems.

By offering a modular and fully adaptable solutions, the EC-OG HALO system can offer life of field project savings over alternative power delivery methods.

09:05 Energy for Subsea Power

Cameron McNatt
Managing Director
Mocean Energy

Getting Power to remote locations, such as O&G tiebacks, is challenging and expensive. Subsea umbilicals cost approximately £1m per km, and electrical infrastructure is difficult and expensive to modify. Furthermore, umbilicals fail with Insulation Resistance (IR) failures, which shuts in the wells.

Mocean Energy develops wave energy converters which transform energy in ocean waves into electricity. Our product, Blue Star, can be used as a backup power source to keep wells open in the events of an IR failure, and can be used to provide power for new tiebacks or tieback modifications such as integrating residential AUVs. Battery storage and communications are integrated.

Mocean's innovation is the shape of the hulls, which increases wave foreces and amplifies motions to capture up to 5x more power compared to competing designs.

NSRI National Subsea Research Initiative

SUBSEA UK™

Blue Star provides about 2kW of power, which is enough to power a cluster of wells or recharge a large AUV.

Cameron is the co-founder and Managing Director of Mocean Energy. He is an experienced innovator in ocean energy with a 15-year track record of business success and academic excellence. He has Master of Ocean Engineering from Oregon State University and a PhD from the University of Edinburgh. Prior to undertaking these post-graduate studies, Cameron worked as a naval architect writing software for ship simulations. He also has a BSc from Yale University, majoring in electrical engineering, and is a keen sailor who has crossed the Atlantic under sail.

09:20 Introducing the Most Reliable Subsea Control System as recognised by Operators

Iain Smith
Subsea Controls President
Proserv

Proserv's subsea control technology has and never will experience obsolescence, it is able to connect to any tree, and is recognised by industry to be consistently the most reliable in the market.

Our presentation will highlight where we differ, what we do to improve reliability within the subsea control systems, how our modular subsea electronics is designed to be kept easily up to date, and how our latency through copper wire provides control at the subsea wellhead which is unrivalled.

By highlighting our reliability performance and technical advantages, we plan to leave you considering what the best procurement options are; total life of field cost of the asset or the traditional best of three bids with follow up repair/replacement unknown costs.

09:35 Acoustically Aided Inertial Navigation Systems for Dynamic Laser Mapping

Alan MacDonald
Sales Manager
Sonardyne International Ltd

High resolution geo-referenced underwater surveys using mobile lase, LiDAR and multi-beam technologies have widespread application including; contactless metrology, structure mapping, pipeline inspections, mooring chain surveys, inland waterway inspections, scour surveys, seabed coral/fauna mapping, wreck and drilling mud surveys.

Until now, because dynamic centimetric-level navigation with fast update rates has not been commercially available, subsea laser and LiDAR systems have predominantly been used in a static mode. Due to the relatively short ranges achievable from these systems (anywhere between five and thirty metres depending on the type of system), multiple scans are required. This involves relocating the system to a number of locations on the seabed to cover the required area, whilst ensuring each scan has common features allowing them to be merged together. By

adopting a dynamic platform, such as an ROV navigated using Sonardyne's SPRINT INS, Syrinx DVL and Fusion 6G (sixth generation) LBL acoustics, the site can be mapped much quicker with no issues of reduced visibility as the ROV does not have to come into contact with the seabed at the survey site and can move to scan any target of interest.

09:50 Subsea 3D visualisation using Photogrammetry

Raymond Ruth
UK and North Sea Agent
Comex

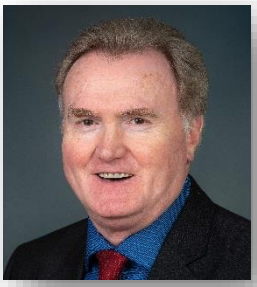
The historical process of inspecting a subsea asset is no longer ft for purpose. If we are looking to extend the life of an assets or plan its decommissioning, we need more than a random set of photographs, video clips and sporadic CP and marine growth measurements. We need a robust and holistic approach to inspection that will give us more data from which to make clearer decisions or more accurate measurements.

Subsea photogrammetry can give more information in the same given time as a normal ROV GVI by producing a 1:1 scaled reconstruction of an asset from which accurate measurements can be made for fabrication replacement parts, analysing anode wastage giving better overview of the asset. Such reconstructions can be used onshore to fly or walk through the asset to give ROV, diving and other subsea contractors a better real view of the assets position and condition thus reducing time offshore in acquiring the data, there would be no vessel time wasted whilst someone voices over the state of an anode etc, arising from better planning.

From a decommissioning point of view, imaging that you had a 3D model of the asset to be removed. So many assets do not have digital models, there are perhaps paper drawings of separate associated components, but how much better would it be if an up to date model of the complete worksite was available. This would make planning much easier. And, even possibly give credence to leaving the asset in situ instead of removing it.

The Comex ORUS3D is a BV certified ROV mounted photogrammetry systems and requires no contact with the asset whilst producing results independent of all external data. It has a proven track record in all water depths and is available to work on a variety of ROV classes.

10:05 Stress Not… Just because someone said “management software!”



Iain Fullerton
Business Development
Caiman Software Development Ltd

Doesn’t matter what you do, one of the most difficult decisions that business owners and senior management teams have to make, is how and when to upgrade the systems they rely on to manage the business effectively and efficiently.

And it can be stressful. It need not be the case.

Any new management s/w system is expected to ensure that hard won compliance with standards such as ISO 9001 etc, will automatically be retained and that the system will transform the business and QHSE operating activities, streamline processes and workflows, driving down the time and cost and provide competitive advantage!

“Caiman IQ” has a “cunning staged plan” which removes the stress and successfully delivers:

- Affordable – proven – easy to use system
- Comprehensive system implementation plan, training and ongoing system support.
- Single point of access for all pertinent business information available at the point of need.
- Much improved, intuitive, access to company information, enabling informed decision making.
- Track, link and report, assets and utilisation, personnel information, projects and process, and QHSE
- Make it easier to demonstrate standards and procedure compliance during audits.
- Reduced data entry duplication, administrative cost and no paper-based system time delay.
- Improved organisational and operational efficiency and productivity – at all levels of the business.
- Faster task completion.
- Monitoring and measurement of your business KPI’s and targets
- Continual monitoring of compliance records, automatic workflow and action alerts and reminders.
- Encourage and assist initiative by making access to relevant business information much easier.
- Add business value by significantly streamlining business operations and processes.
- Find information and respond to customers faster and more accurately.
- Effective data analysis providing information to support your sales effort.

"Caiman IQ" system allows you all this and more… and you only pay for the functionality you need, when you need it.

Qualified with B.Sc. Electronic Engineer in 1975. Began career an offshore engineer in the offshore sector with Decca Survey. Worked as a Senior Engineer with companies such as, UDI, Brown & Root Construction, before moving into sales & business development with Swire, Montrose Fire & Emergency, Kongsberg Maritime. Now working as a Business Development Specialist with Caiman Software Developments Ltd.

10:20 Close

NSRI National Subsea Research Initiative

SUBSEA UK™