Underwater Robotics Conference

1st – 3rd September 2020

15:15 – 17:00

Photo credit: Blue Ocean Monitoring Ltd

1st September 2020

15:15 Welcome from Subsea UK's CEO, Neil Gordon

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.

15:20 The Developmental Pathway for Offshore Wind O&M

Hamish Macdonald
Engineer
ORE Catapult

The scale of offshore wind continues to grow and grow as the market continues to gain momentum. Larger turbine sizes may theoretically be able to achieve higher capacity factors, but the impact of reduced availability will be increasingly significant [1]. To ensure that the industry can effectively deliver generation to match ambitious installation targets, optimisation of Operations and Maintenance (O&M) at future windfarms is imperative.

Robotic systems are envisaged to play an enhanced role within O&M activities in order to bring about reductions in both cost and Health and Safety (H&S) risk. Short-term and long-term advancements are discussed within a roadmap of RAS implementation that will eventually result in an advanced utilisation of subsea robotic technologies at current and future offshore windfarms. As the expansion continues further from shore into deeper waters, resident systems or the interplay of collaborative, automated platforms are being explored as potential strategies.

However, the transition from existing practices to fully commercialized autonomous robotic solutions will not be immediate. There are numerous specific challenges, both technical and practical, that will require significant development for the vision to become a reality.

This presentation aims to demonstrate the importance of Verification and Validation (V&V) in the developmental process to overcoming these barriers and vital, not only to demonstrate effective commercial solutions to end users but numerous other industry stakeholders.

[1] Wood Mackenzie, "Offshore Wind Operations and Maintenance Trends," 2019.

Hamish Macdonald is an Engineer sitting within the Operational Performance directorate at the Offshore Renewable Energy Catapult. He has been heavily involved in renewable energy since leaving university. He gained experience in the biomass sector as a design engineer before going on to complete a PhD investigating the influence of hail on wind turbine blade leading edge erosion and damage. Since joining OREC he has found an additional focus in robotics & autonomous systems; evaluating potential applications within offshore windfarm O&M, along with the testing and demonstration of novel technologies and platforms.

15:45 Quantifying the impact of robotics in offshore wind applications

Anthony Gray
Techno-economic Analyst
ORE Catapult

Robotic applications are expected to revolutionize the way that operations are currently undertaken, by automating processes, removing humans from dangerous and hazardous environments, improving the way that certain tasks are performed, offering repeatability of actions and contributing to remote and more accurate monitoring of engineering assets. However, one of the many uncertainties that the offshore wind industry is currently facing is the ability to quantify the impact of robotics in terms of overall cost reduction opportunities. There are many different technologies and applications of robotics in the offshore industry, research is still on going with novel robots, analytics and software applications being developed in order to support the assets throughout their lifetime.

This project, led by Xodus Group, in partnership with the ORCA Hub and ORE Catapult and partly funded by the Offshore Wind Innovation Hub aims to quantify the impact of the benefits that robots will offer to offshore wind farm projects. Initially an expert elicitation methodology was developed, by identifying the uncertainties and selecting the right experts to be interviewed or surveyed. Then, a technology roadmap will be created, taking into consideration all the different cases where robots would be part of and the different technology penetration rates. Finally, a cost model will be developed in order to present all the different scenarios and the associated costs. Xodus and OREC will run their internal cost models in parallel for greater precision and accuracy in the results.

This presentation will outline the methodology and provide preliminary anonymized results on the findings of this project and key trends, from the interviews and questionnaires with key industry and academic players.

Dr Anthony Gray has been researching and working in the field of offshore renewable energy for seven years. He is currently a techno-economic analyst at the Offshore Renewable Energy Catapult in Glasgow, UK, where he undertakes a wide range of cost modelling activities. He gained a Masters degree in Civil Engineering (MEng) from Cardiff University in 2011 and an Engineering Doctorate (EngD) in Offshore Renewable Energy from the University of Exeter in 2017 through the Industrial Doctoral Centre for Offshore Renewable Energy (IDCORE).

16:10 Generating Actionable Information from HUGIN AUV Data

Richard Mills
Vice President
Marine Robotics
Sales
Kongsberg Maritime

The HUGIN AUV has been in commercial use for more than 20 years. Since then it has evolved to carry a wide array of sensors, coupled to accurate navigation system capable of long endurance missions. One of the challenges now facing operators is how to make meaningful information our of raw AUV data.

This challenge includes several aspects such as managing the on-board data flow for high resolution sensors, especially when the data volumes are so large; accessing the data quickly after recovery for quality control purposes; post-mission processing, and how to generate actionable information as quickly and reliably as possible.

This presentation will discuss all of these challenges. We will present some of the latest upgrades to the HUGIN AUV System such as high-speed data storage access and in-mission processing and analysis of mission data in near real-time. We will also present how to distribute mission data globally for instant access, visualization and processing using Ocean Insight. Finally, we will try to identify how we may try to provide in-mission decision making to enhance the autonomous capabilities of the system.

Richard leads the Kongsberg Maritime Marine Robotics sales team and is responsible for the HUGIN and Sounder families of marine robotics systems from Kongsberg Maritime. Working across the commercial, defence, government and scientific market segments Richard has a global remit for the promotion and sales of Autonomous Underwater Vehicles (AUVs) and Unmanned Surface Vehicles (USVs). Prior to joining Kongsberg Maritime in 2012, he held a similar position with International Submarine Engineering Ltd. in Vancouver, Canada. Richard has lived in the UK, Norway, Canada and Qatar and in a previous career was a member of the Royal Air Force.

16:35 Propulsion technology for next generation subsea robotic platforms

Jonathan Greening
Chief Engineer ROV
Systems
SMD

As the subsea sector strives to support a growing blue economy, there is not only a need for greener and more efficient technologies but also higher performance and Smart capabilities. A key element of a subsea robotic system designed to fulfil these new requirements is its motive system. The culmination of 4 years of R&D, SMD will present its new subsea robotic propulsion technology and the cost reducing value it brings through compatibility with unmanned surface vessels and its high speed and high current capabilities. The presentation will step through the original goals, the engineering, the testing, the technology and its key features

Jonathan started his career as a Mechanical Engineer at Sellafield in Cumbria in the 1990's. He later moved to Gilkes who specialise in hydro electric turbines and pump systems which was his introduction into the subsea industry. Jonathan joined SMD in 2001 and spent 5 years designing trenching systems before moving over to the ROV side of the business in 2006. Jonathan is currently Chief Engineer ROV Systems at SMD and is the technical lead on SMD new EROV development program.

Close

2nd September 2020

15:15 Welcome from Subsea UK's CEO, Neil Gordon

15:20 When Physical and Virtual Worlds Collide. Data, Digital Twins and Smart Machines in Offshore Energy

Professor David Lane
Founding Director
Edinburgh Centre for Robotics and National Robotarium, Heriot-Watt University

Smart machines are revolutionising our world, affecting everything that moves, in transport, healthcare, construction, agriculture and especially offshore energy. Programmes and Hubs such as ORCA https://orcahub.org are connecting scientists and companies to develop and transition capabilities to supercharge offshore asset integrity management, reducing risk and cost. Semi-autonomous and autonomous robots in the air, underwater and on the asset are inspecting and will eventually maintain and repair these assets.

Developing these systems and systems-of-systems starts with simulation to develop and illustrate basic parameters and competencies. Using digital twins of the machines and the assets this later moves to emulation, hardware in the loop and eventually living labs to transition from the virtual to the physical, running both in lockstep to train machine learning, tune parameters, debug code and certify performance safely. The digital twin and its physical alter-ego work together to predict performance, detect failure, visualise events, and capture non physical attributes such as workflows. Linked to cloud services storing and providing data from assets the digital twin is thus a key enabler. Beyond this, connecting digital twins through a digital common offers the prospect of query through fractal digital systems of systems analogous to search in the world wide web. Such a connected worldwide twin, or twinternet, has applications and use cases we cannot yet imagine, exactly as the web before it

Covid-19 taught us we currently lack common standards and smart tools that can empower researchers, engineers, regulators, investors and policy makers to collaborate in this way so as to visualise, develop and repurpose smart machines at pace in response to exogenous shocks and economic opportunity.

The presentation will discuss some of these themes and make the case for connected digital twins and the digital commons as a piece of key national infrastructure, used by everybody and owned by nobody. It is a key ingredient in the secret sauce to make UK more resilient, sustainable, productive and economically successful in a post Covid world

Professor David Lane Ph.D., CBE, FREng, FRSE is a passionate scientist, innovator, educator & personal investor in the twin disciplines of Robotics & AI.

As Founding Director he co-created the Edinburgh Centre for Robotics and National Robotarium, a £120m research and translation hub at Heriot-Watt and Edinburgh Universities with 150+ staff and PhD students. He is Principle Investigator in the EPSRC ISCF/Industry Offshore Robotics for Certification of Assets (ORCA) Hub developing advanced robotics for offshore energy asset integrity management from the science base in Edinburgh, Oxford, Imperial College and Liverpool. He has published 300+ peer

reviewed papers engineering advanced cognition, sensing & bio-inspiration into unmanned systems,

A founding startup-to-scaleup award winning CEO (http://www.seebyte.com Edinburgh, San Diego) he is Chairman or NED in 5 businesses & 1 fund in UK, Norway, Hong Kong with experience in Edtech, Healthcare, Manufacturing, Offshore Energy, Defence and Food.

His entrepreneurship has been recognized through the 2011 Praxis Unico Business Impact Achieved Award, the 2013 Scottish Digital Technology Award for International Growth, the 2018 Guardian University Business Collaboration Award and the 2019 Scottish Knowledge Exchange Champion Award.

He is co-chair of the UK Government Robotics Growth Partnership appointed by the Minister of State for Universities, Science, Research and Innovation and a member of the UK AI Council.

15:45 **Expanding the potential capabilities of AUV as inspection method for subsea pipeline**

Minehiko Mukaida
Managing Director
Kawasaki Subsea (UK) Limited

Kawasaki has been developing leading key technologies for AUV operation to contribute Offshore Energy Industry. “SPICE” (Subsea Precise Inspector with Close Eyes) is the latest AUV system of Kawasaki, and it is now focused on long distance pipeline inspection jobs.. SPICE has a Robot Arm which can realize several closed inspections of pipeline. In combination with subsea docking station, SPICE can continue own operation without frequent launch and recovery. SPICE contributes to reduction of co2 emissions, operating cost, and mitigation of HSE risk during subsea inspection.

In the conference, the speaker will introduce the summery of progress of the development of SPICE.

Minehiko is a Managing Director of Kawasaki Subsea (UK) Limited which was established in February 2019 as a subsidiary of Kawasaki Heavy Industries, Ltd(KHI). He is BEng, and his speciality is Mechanical Engineering. He has been engaged around 20 years in design and development of human-occupied submersibles and robotics. In 2013, he was involved a development project of Autonomous Underwater Vehicles of KHI. In 2019, he took up a post as Managing Director of Kawasaki Subsea (UK) Limited.

16:10 The world's smallest hybrid acoustic-inertial navigator

Alan MacDonald
Sales Manager
Sonardyne

New generation remotely operated vehicle (ROV) systems are increasingly capable and automated. Station-keeping and fly-by-wire operations are now commonplace. How well these modes of operation perform is tied closely to the quality of the navigation systems on-board. Navigation sensors can take a lot space and demand additional power, premium commodities when operating at depths of thousands of metres.

This challenge has inspired the development of the world's smallest hybrid acousticinertial navigator. This navigator brings together all the sensors required to enable station-keeping and fly-by-wire operations in a single instrument. It replaces separate attitude heading reference (AHRS), Doppler velocity log (DVL) and depth sensor with a single instrument. There are many advantages from doing this. For a start, the system is pre-calibrated from the factory, meaning that complex and time consuming DVL calibrations are no longer necessary when mobilising. Another obvious advantage is that a single instrument uses less cables and take up a lot less space than three separate instruments. The systems also use a single clock and a fuse all the data together in innovative ways to improve the performance. It is also North seeking and does not rely on a fluxgate or magnetic compass. This is a vital feature when operating offshore as an ROV generates soft-iron distortions and must typically work around a field with hard-iron distortions. It will find North accurately and not be distorted.

The talk will provide a technical overview of the building blocks, how they work together and early results.

Alan MacDonald holds a BSc in Electronic & Electrical Engineering from the Robert Gordon University in Aberdeen. He has been a Sales Manager at Sonardyne since 2009 and is responsible for sales in Scotland, Scandinavia and the Benelux countries. His main areas of work are acoustic positioning systems for subsea survey & construction applications and integrated navigation/communication solutions for subsea vehicles.

Before Sonardyne, he worked at TSS for 12 years in various technical, training and sales roles, primarily focused on subsea pipe and cable tracking systems.

16:35 Sonars utilizing AI

Allan Donaldson
Senior Sales Engineer
Tritech International Limited

The use of Multibeam sonars is now more of an industry norm within the world of subsea operations. Using Multibeam on a moving platform such as an ROV allows the user to operate more efficiently due to the high update rate of the sonar image, and does not require the operator to stabilise the ROV or interpolate an image blurred due to the slow update of a mechanical scanning sonar. This, along with advances in machine learning, has resulted in Tritech improving on the earlier algorithms that were developed to identify and track specific target types.

Earlier algorithms implemented in Tritech's Gemini EVO software have been used extensively to automatically track and report marine life around tidal turbine sites, both prior to an installation and also following installation. This same technique has also been used by developing custom algorithms to identify and track Sharks for the Cleverbuoy system developed in Australia.

Once again the same custom algorithm technique has been used to track known target types in the O&G industry, such as monitoring pipe during pipe lay operations to alert if the target is deviating from where it's required to be. Similarly the Real Time Integrity Monitoring System (RAMS®) made use of this early algorithm technique.

With advances in Machine Learning we are now offering a more refined approach to target tracking within our Genesis software.

During this presentation we will discuss target tracking both before and after implementing AI into Tritech software for use with Gemini sonars.

Allan joined Tritech in November 2011 and is responsible for key account sales creation. He is based in Tritech's Westhill office.

Allan's role is to generate sales leads for the full range of Tritech products, as well as managing new and existing relationships. He is focused on delivering product demonstrations and facilitating customer training for the local customer base. Allan previously worked for a global subsea rentals company.

Close

3rd September 2020

15:15 Welcome from Subsea UK's CEO, Neil Gordon

15:20 Marine Autonomy Systems in Ocean Science: Developments, Operations and Integration

Maaten Furlong
Systems Engineer
National Oceanography Centre

The National Oceanography Centre (NOC) has been a world leader in the use of Marine Autonomous Systems (MAS) in Oceanography since the early 90s. It undertook its first trials of the Autosub AUV in 1996 and started science missions in 1998. Since then NOC developed Autosub AUVs have been continuously available to support UK Marine science and have undertaken ground breaking missions under the Arctic and Antarctic ice shelves. Over the last decade the Marine Autonomy and Robotics Systems (MARS) group within NOC has been tasked to develop innovative MAS capabilities to support UK Marine science and to lay the foundations for the next generation of oceanographic observing systems. This talk will: give an overview of NOC and its mission; describe the NOC autonomous fleet and operational programme; outline the next generation of vehicles and systems being developed; and describe how the data collected links to other organisations and is integrated into the global ocean observing systems (GOOS). The talk will conclude with a vision of an integrated observing systems for marine science.

Dr Maaten Furlong is a Systems Engineer with 20 years of experience of Marine Autonomous Systems. He initially focused on Autonomous Underwater Vehicle development and operation, but latterly has worked on the full range of Marine Autonomous Systems. Over this period, he has been involved in most aspects of the research, development and operation of these system. He has led and participated in numerous science and engineer trials cruises with Marine Autonomous Systems and has published peer reviewed papers in this area. In 2013 he became the head of the Marine Autonomous and Robotics group at NOC where he has been instrumental in guiding the expansion from 15 engineers and researchers to over 50. As head of MARS he oversees the operations and development of the NOC MAS fleet and is actively involved in improving the operational efficiency of the fleet. He has won Innovate UK funding to develop the next generation of marine autonomous systems and was responsible for the technical development of the £16M Oceanids programme for which he now acts as a technical advisor.

15:45 Remote subsea inspection of offshore assets: current and future capabilities

Dan Jones
Business Development Manager (IRM)
Fugro

The speaker will outline Fugro's developments in the provision of remote and autonomous subsea inspection projects, including an overview of their current capabilities. A case study will demonstrate the journey of how remote platform inspections have successfully supported our Clients in the UK sector of the North Sea, utilising the Remote Operations Centre (Aberdeen). This remote capability has been beneficial to the industry in reducing personnel numbers at offshore installations, particularly during the recent Covid-19 outbreak. The speaker will also outline the ongoing developments of these technologies and Fugro's view of the future. Our vision is for remote robotic technologies and unmanned surface vessels to be capable of many of the operations which currently rely on large (manned) DPII Diver/ROV support vessels.

Dan has spent his career in the provision of subsea IRM services. He started with CP services provider Subspection in 2003 and has since worked for a variety of contractors and operators. With over 15 years offshore operations experience and further onshore management roles with Rever, Rovop and now Fugro, he has substantial experience of both diver and ROV projects in both oil/gas and renewables sectors. He joined Fugro in Aberdeen during March 2020 as Business development Manager for the IRM service line. He has since been able to utilise his operational and commercial experience and help the development of the Fugro remote offerings. These developments include remote ROV inspection and Unmanned Surface Vessels (USV) with launchable ROV capabilities.

16:10 Reducing Emissions, HSE Exposure, and Cost: The Liberty E-ROV System

Christopher Lyons
Onshore Remote Operations Centre
Oceaneering

What once started in 2017 as an offshore pilot project between Oceaneering and Equinor, has evolved into the Liberty E-ROV system – now successfully completing IMR missions in the North Sea.

The Liberty system, described at a very high level, is a self-contained work class ROV system deployed in a subsea garage that is traditionally located on the seabed.

The garage contains a battery power pack and connection to a surface communication buoy that provides control. Liberty and complete missions ranging from a few days to up to two months without needing a surface support vessel.

The E-ROV is controlled from an Onshore Remote Operations Center– a land-based workspace for relevant subject matter experts – and a 500 kWh battery pack, larger than ever seen before subsea, powers the system during operations. Safe operation of this power pack has been paramount in the design and concept development.

For system real-time control and HD quality video transfer, the system relies on a low latency broadband data connection. This is typically provided through a 4G LTE offshore link, microwave P2P link, or connection to subsea infrastructure.

The Liberty vehicle not only increases the applications for ROV systems, but also for deployment of other systems like subsea sensors, pumping systems, and monitoring equipment.

The first system is currently on a five-year contract and has been in operation for over a year and a half. This presentation will detail lessons learned and the experience and valuable experience gathered during the transition from development to operation. It will also focus on how the operation of the vehicle reduces emissions, HSE exposure, and cost.

Types of operations completed thus far include inspections, commissioning, gas line flapper valve operations, leak detection, and riser monitoring.

Liberty Performance and track record:

Number of dives: 21 (deployments)

Dive time: 2909 hours (121 days)

Longest dive: 1445 Hours (60 days)

Christopher Lyon's current role sees him responsible for running Oceaneering's Onshore Remote Operations Center (OROC) in Stavanger, Norway. He also supports both technical and engineering teams as they research and develop new technologies and solutions while supporting the day-to-day technical operation of Oceaneering's offshore assets in Norway. Chris leads a multi-organizational team dedicated to the evaluation and certification of Remote Operated Vehicle pilot-competency in the oil and gas industry, with emphasis on mechatronics, high-voltage applications, fiber optics, subsea operations, and safety.

16:35 Gemini™ - Transforming the Productivity of Subsea Robotics

Peter MacInnes
Marketing Director Manager
TechnipFMC ROV Services

The ROV industry has made tremendous advancements in the last 30 years, particularly in terms of system reliability, capability and even the more recent transition towards remote operations. However, one facet of the industry that has remained a constant during this timeframe is the delineation between the ROV, manipulators and tooling. This has resulted in today's normal operating environment where the skillset of the ROV crew is heavily relied upon to technically integrate these three elements and operate them independently to achieve the desired outcome. With tools that typically require hydraulic, electrical and communication services, this commonly results in complex configurations of the ROV for each dive, with multiple hoses, cables and even rope and duct tape to deploy dive-specific tooling configurations. With limited ability to carry and interchange ROV tooling, this also necessitates multiple trips to surface for system reconfiguration. When compared to surface based industrial robotics where machines can readily change tools and operate 24/7 without reconfiguration, subsea robotics has to close this gap to achieve similar levels of efficiency.

This presentation will explain how the Gemini™ ROV system can deliver higher levels of productivity through the comprehensive integration of the workclass ROV,

manipulators and tooling. Through this approach, these three elements now function at a system level, enabling ROV pilots to focus on performing the task at hand, leveraging machine vision and precision robotics to execute flawlessly. Tooling interventions can be completed in a consistent timeframe, taking only a fraction of the traditionally accepted task time. Additionally, with over 30 tools and 100 gallons of intervention fluid readily available subsea, the ability to perform the vast majority of intervention tasks on subsea production systems without recovery to surface for system reconfiguration significantly increases operational productivity.

Peter MacInnes is Marketing Director for TechnipFMC ROV Services, responsible for deploying Schilling Robotics latest advancement in workclass ROV technology, the Gemini™ ROV system. His 30 year career in the subsea robotics and subsea production systems industry has spanned offshore operations and successive commercial and marketing roles, with a focus on cultivating new business opportunities for high-technology subsea companies including; Perry Tritech, Schilling Robotics and TechnipFMC. During his career, he has led the commercialization of many new and widely adopted robotic technologies in the subsea industry.

Close