

Oceans of Knowledge:

Ocean Observations and Emerging
Technologies Enabling the Blue Economy

WEDNESDAY 20 NOVEMBER 2019

The Royal Institution, London

INSTITUTE OF
MARINE
Engineering, Science & Technology

PROGRAMME



Morning session: Addressing challenges in high growth ocean industries

TIME	TITLE	ABSTRACT	SPEAKER/ORGANISATION	BIOGRAPHY
09:00 – 09:25	Keynote: Innovation for a sustainable blue economy	<i>The keynote will give an overview of work of the Organisation for Economic Co-operation and Development (OECD) on understanding the future ocean economy and its dependence on ocean observations. It will identify some of the challenges of a growing ocean economy (e.g. improving scientific knowledge, addressing climate change and sustainability) and the role of science, technology and innovation in responding to these challenges.</i>	Marit Undseth , OECD	Marit Undseth is a senior policy analyst at the OECD Unit for Innovation Policies for Space and Ocean in the Directorate for Science, Technology and Innovation. She has close to fifteen years' experience in science, technology and innovation policy research; especially as regards to developing and analysing indicators for high-technology niche sectors and evaluating related government policies. She has worked extensively on topics such as innovation, digitalisation and sustainability within the context of space and ocean.
09:25 – 09:50	What is the blue economy?	<i>Given the accelerating global interest in strengthening the blue economy, it is not surprising that we also have the issue of defining the blue economy. The blue economy is often defined as all economic activities related to the ocean, even those that are harmful. Thus, the distinction must be made for the sustainable blue economy, which is the sub-set of economic activities that are actively good for the ocean. A parallel example is "green business," which is the subset of businesses that intentionally pursues sustainable outcomes, reduces negative impacts, and increases positive effects on the environment, the economy, and on human communities. Currently there is no formal framework for a sustainable blue economy. Economic and social policies that encourage the growth of the truly sustainable blue economy can provide opportunities for growth and the creation of jobs where there were few historically; make coastal nations better able to recover from short-term disasters; and mitigate some of the longer-term disruptions from climate change, harmful algal blooms, and ocean acidification. Continuing or expanding those activities that actively harm the ocean and the sustainable blue economy is counterproductive and economically harmful. At the regional and global level, the momentum behind the concept of the sustainable blue economy needs to be translated into action—and for that there needs to be investment of intellectual, political, social, and financial capital through projects that are multisectoral, regional in scope, and span many coastal industries.</i>	Mark Spalding , Ocean Foundation	Mark Spalding, President of The Ocean Foundation is a member of the Ocean Studies Board of the National Academies of Sciences, Engineering, and Medicine (USA). He is serving on the Sargasso Sea Commission. Mark is a Senior Fellow at the Center for the Blue Economy at the Middlebury Institute of International Studies. He is also an Advisor to the High Level Panel for a Sustainable Ocean Economy. In addition, he serves as the advisor to the Rockefeller Ocean Strategy (an unprecedented ocean-centric investment fund) and is a member of the Pool of Experts for the UN World Ocean Assessment. He designed the first-ever blue carbon offset program, SeaGrass Grow. Mark is an expert on international environmental policy and law, ocean policy and law, and coastal and marine philanthropy.
09:50 – 10:15	Evolution or revolution? – The future of autonomous shipping	<i>Maritime autonomy is gaining traction in a wide range of applications and hardly a month goes by without a successful trial of the technology being announced. Its champions believe that major scale use in shipping is less than a decade away although much will depend on the regulatory environment as much as the economic imperative. However, the normally conservative International Maritime Organization has instigated a scoping exercise of the regulations which will need to be adopted to permit ocean-going autonomous ships, which some view as a revolution in itself. This presentation will review the current successful uses of autonomy in the marine environment and which technological challenges will need to be overcome if we are to see the global take-up in everyday shipping operations.</i>	John Murray , Society for Maritime Industries	As long ago as 2014, the Department for Business recognised that the emerging technology surrounding maritime autonomous systems (MAS) represented an opportunity for UK business and endorsed the formation of a MAS Steering Group, bringing together industry, users, academia and government, and chaired by John Murray, Chief Executive of the Society of Maritime Industries (SMI). A graduate chemical engineer, John has headed up SMI since 2001 and represents the industry on a number of external bodies including the Board of Maritime UK, Chair of the Maritime UK Technology and Innovation Group, the Maritime Operations and Management Advisory Committee at City University and the Steering Group of London International Shipping Week. A liveryman of the Worshipful Company of Shipwrights, in 2017 John received the Maritime Foundation Fellowship Award for consistent leadership delivering maritime industries back into national prominence.
10:15 – 10:45	Coffee Break			

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10:45 – 11:10	The future of offshore wind: Maximising the marine resource	<i>The offshore wind energy sector continues to grow and is looking to maximise the marine resource for sustainable energy production. With floating wind now getting ready to deploy commercial-scale projects globally, this presentation will discuss how these developments enable countries to capitalise on their offshore wind resource regardless of water depths. This presentation will also take a close look at the example of the WindFloat semi-submersible platform.</i>	Cian Conroy , Principle Power	Cian Conroy is Business Development Manager for Principle Power, a technology and services provider for the offshore deep-water wind energy market. Cian is responsible for business development activities related to Europe. Cian has been working in the UK's offshore wind sector for over 10 years covering key areas such as the establishment and delivery of Phase One of the Floating Wind JIP. He graduated from the Michael Smurfit Business School at University College Dublin with a Master's degree in Strategic Management
11:10 – 11:35	Sea farming: Feeding the future	<i>Aquaculture is recognised by the United Nations as a key supply of healthy food while at the same time achieving every one of the UN's Sustainable Development Goals. While freshwater farming dates back thousands of years, the farming of the seas is still comparatively untapped. This presentation will look at the technologies required to enable farmers to dive deeper into the ocean to produce seafood.</i>	Ian Roberts , Mowi	Ian Roberts has been farming the seas for 26 years in Canada, Norway and the UK. Working for one of the world's largest seafood companies, Mowi, since 1993, Ian has experienced all aspects of salmon culture: from egg to plate. A graduate of aquaculture (1992), and receiving a BA in Communications in 2015, Ian currently works as Mowi's Director of Communications and Business Development.
11:35 – 12:00	The future of marine mining	<i>There is more nickel, manganese and cobalt - some of the key ingredients for a lower carbon future - lying on the abyssal plain of the North East Pacific Ocean than is contained in the rest of the planet's mining reserves combined. Yet five decades of effort and investment from nations and corporations has yet to generate a commercial-scale industry to bring this metal into the global economy. What are the principal barriers standing in the way, what potential do new and emerging technologies have to offer, how can we account for our growing awareness of the oceans' importance and vulnerability, - and are we any closer to production than we were 40 years ago?</i>	Ben Geldart , Lockheed Martin	Ben Geldart is the Technology Development Manager at UK seabed Resources, a wholly owned subsidiary of the Lockheed Martin. In this diverse role which entails a blend of skills in programme management, business development, supply chain management and systems engineering, a future seabed mining system and mature development programme is being established to diversify and secure the supply of critical metals required for a low carbon future in the UK. Prior to life in seabed mining, Ben worked as the project team lead on various UK defence contracts for complex vehicle development programmes as well as within the automotive industry as a tier 1 supplier of underbody production facilities into Jaguar - Land Rover. Ben has a Bachelor of Engineering (BEng) degree in aerospace engineering.
12:00 – 12:30	Technological challenges and the role of ocean information		Panel	
12:30 – 13:30	Lunch			

Afternoon session: Future direction of emerging technologies and the role of ocean information

TIME	TITLE	ABSTRACT	SPEAKER/ORGANISATION	BIOGRAPHY
13:30 – 13:55	From sensors to information	<i>Sensors are the vital first link in a chain of technologies, often overlooked, that support metocean observations. The data and information provided at the end of this chain inform operational oceanography on which mission-critical decisions are made. This presentation will explore the importance of both sensors in the measurement process and understanding their limitations. It will also provide an insight into the current state of sensor technology along with a glimpse into future developments, particularly against the backdrop of the increasing use of autonomous platforms and citizen science.</i>	Terry Sloane , Planet Ocean	Terry is owner and managing director of Planet Ocean Ltd. which represents gold standard manufacturers of oceanographic and meteorological instruments, as well as designing and manufacturing bespoke instruments and systems for ocean research. Terry has been active in the marine and meteorological industry since 1975 when he began his career as an electronics engineer working on submarine-launched weapon systems. He then moved into the world of marine science, continuing as a technologist and eventually becoming technical director at NBA Environmental Systems before moving to Space Technology Systems Ltd, where he added satellite remote sensing and space-based telemetry systems to his knowledge base. In 1994, Terry co-founded Hydrosphere UK Ltd, and in 2003, Terry formed Planet Ocean Ltd to concentrate on the marine and environmental science sector. Terry is a Fellow of both the IMarEST and the Royal Meteorological Society, and serves on a number of committees and boards.
13:55 – 14:20	Opportunities to enhance maritime knowledge from emerging space capabilities	<i>Although expectations related to “new space” developments may be somewhat exaggerated, the underlying facts are that we are seeing an evolution in information processing and analysis paradigms, coupled with both a step change in systematic observations from programmes such as Copernicus and new observation approaches enabled by small satellite developments. Complementary developments such as autonomous surface and underwater platforms (both fixed and mobile) can also be combined with the expanded satellite observations to better characterize marine and coastal processes over a wider range of spatial and temporal scales. Finally, the possibilities of integrating AI and data-driven analysis with conventional modelling to better characterize complex processes that cannot be modelled using conventional analysis tools alone may be the basis for an enhanced understanding of aspects of coupling mechanisms between marine and coastal processes and dynamic processes such as exposure to geophysical risk, disease outbreak patterns and economic development opportunities.</i>	Gordon Campbell , European Space Agency	Gordon has been working on the development of applications of satellite Earth Observation (EO) data since 1995, covering a range of capabilities and domains including natural resources management, marine and coastal management, law enforcement and environmental protection. In particular, he was responsible for the projects that developed the precursor pan-European services under GMES that became CleanSeaNet and the Copernicus Security Services. Since 2018, he has been Head of Enterprise with the Science Applications and Climate department of the European Space Agency, focussing on how emerging digital platform capabilities can support a closer embedding of EO within improved analytics capabilities in a range of demand sectors.
14:20 – 14:45	Improving communications at sea	<i>In 1979, Inmarsat was established as an intergovernmental organisation at the behest of the IMO to provide safety of life at sea (SOLAS) services to mariners. Since that intervention, satellite communications have revolutionised connectivity at sea with customer demand continuously driving technology innovation. This presentation charts the evolution of maritime satellite connectivity services to the present day, and provides a glimpse of the emerging and future capabilities that will continue to support the transformation of the blue economy.</i>	Paul Febvre , Satellite Applications Catapult	In March 2013, Paul was appointed Chief Technology Officer at the Satellite Applications Catapult. Prior to joining the Catapult, Paul held positions at Inmarsat as Satellite System Architect, Head of the BGAN Evolution Team, responsible for system engineering on the Inmarsat BGAN system and managing the European Space Agency (ESA) ARTES (Advanced Research Telecommunications Systems) Alphasat-extension programme. Paul was also the Chief Architect for Inmarsat's proposal to ESA in response to the SESAR (Single European Skies Advanced Research) joint undertaking to develop the next generation of air traffic management communications systems over Europe. Paul specialises in the bidding process and contract negotiations within ESA ARTES and the EC Framework programmes, consortium creation and maintenance, and R&D technical programme management.
14:45 – 15:15	Coffee Break			

Afternoon session: Addressing challenges in high growth ocean industries

TIME	TITLE	ABSTRACT	SPEAKER/ORGANISATION	BIOGRAPHY
15:15 – 15:40	Surface robotics and automation	<i>This presentation will give an overview of the key steps in unmanned surface vehicle development, looking at technical, legal, operational and financial aspects. Looking at where the industry has come from it will explore some ideas for where it is heading and in particular the inter-operability with different surface, underwater and aerial platforms.</i>	Daniel Hook , Consultant	Daniel Hook is a Naval Architect and has been working in the marine robotics industry for 18 years. He was one of the founding members of ASV Ltd where he took on the role of Managing Director and helped to grow the company from two people to nearly 150 before being acquired by L3 Technologies. Since leaving ASV he has been helping several small startups in the marine technology market, has launched a new company addressing the growing need for electric propulsion and continues to work in the marine robotics industry as a consultant. He is a trustee of the National Oceanography Centre and helps where possible in a wide range of industrial collaborative roles.
15:40 – 16:05	Subsurface robotics and automation	<i>As human activities expand into deeper and more remote parts of the ocean, submarine robots are playing an increasingly important role in data collection. Conventional 'high-power short-range' Autonomous Underwater Vehicles (AUVs) continue to support seabed mapping and monitoring, while submarine gliders have become a primary component of many ocean observing systems. But new long-range AUVs, deep gliders, and micro-AUVs are rapidly expanding the toolkit available to science, industry and policy end-users, with applications including long-endurance under-ice and deep-sea missions, rapid emergency response (including aerial deployment), and seasonal hibernation. Combined with a rapidly expanding array of miniaturised sensors, and new techniques for transmission and interpretation of real-time data, these platforms are becoming our eyes, noses and ears in the ocean. This presentation will showcase some of the latest developments in submarine robotics, and how they can be combined with satellite observations and ocean modelling to provide a step change in our understanding of the last great unexplored environment on Earth.</i>	Russell Wynn , National Oceanographic Centre	Prof. Russell Wynn is NOC Associate Director for Government, International and Public Engagement, and is responsible for advising UK government and a wide range of industry partners on NOC's science and technology capabilities. He oversees the NOC Communications team and the International and Strategic Partnerships Office. Russell has also been NOC's Chief Scientist for Marine Autonomous and Robotic Systems (MARS) since 2013. He leads external engagement for the ongoing UK government investment in the MARS fleet, and is coordinator of the annual 'MASSMO' series of demonstrator missions for UK Marine Autonomous Systems, involving the Royal Navy and Defence Science and Technology Laboratory. Russell was previously Head of NOC Marine Geoscience, and has published over 100 peer-reviewed science papers on topical marine matters, including submarine geohazards, Marine Protected Areas, and novel use of Marine Autonomous Systems. Russell is also an Honorary Professor at University of Southampton, where he completed his PhD in marine geoscience in 2000.
16:05 – 16:30	Machine learning and data assimilation for expert systems	<i>Imagine a world where it is possible to accurately predict the weather, climate, storms, tsunami and other computationally intensive problems in real time from your laptop or even mobile phone – with access to a supercomputer then to be able to predict at unprecedented scales and detail. We proved that the introduction of machine learning technologies and their integration with data assimilation can increase the reliability of prediction, reducing errors by including information with an actual physical meaning from observed data. The resulting cohesion of machine learning and data assimilation is then blended in a future generation of fast and more accurate predictive models. Edward Norton Lorenz stated "small causes can have large effects"- the so called butterfly effect. Imagine a world where it is possible to catch "small causes" in real time and predict effects in real time as well. To know to act! A world where science works by continuously learning from observation.</i>	Rossella Arcucci , Imperial College London	Dr Rossella Arcucci is a Research Fellow at Data Science Institute in Imperial College London. She works on numerical and parallel techniques for accurate and efficient Data Assimilation by exploiting the power of machine learning models. She completed a PhD in Computational and Computer Science in 2012 and her expertise covers the main models for DA which are the Kalman Filtering models and the Variational models. Rossella was PI of the H2020-RISE-2015-iInnovative Approaches for Scalable Data Assimilation in Oceanography project until September 2017 and she received the acknowledgement of Marie Skłodowska-Curie Fellow from European Commission Research Executive Agency in November 2017.
16:30 – 17:00	Enabling innovation for a sustainable blue economy		Panel	

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