WORLD OCEAN COUNCIL

Sustainable Ocean Summit 2015 Report

Singapore, November 9th – 12th

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Executive Summary

The World Ocean Council held its third Sustainable Ocean Summit (SOS) in Singapore in November 2015. Over 200 participants gathered to discuss the role of the ocean business community in addressing critical marine environment and sustainability challenges. SOS 2015 brought together a wide range of industries involved in the use of marine space and marine resources, including shipping, fishing, oil and gas, aquaculture, ports, mining, renewable energy, tourism, dredging, marine science and technology, maritime law, insurance, finance and others. Attendees were primarily high-ranking executives and senior environment and sustainability officers from the Ocean Business Community. Representatives of international organizations, government agencies, and academic research institutions were also in attendance.

The theme of SOS 2015 was "**Sustainable Development and Growing the Blue Economy – the next 50 years**". The conference sought to build on the highly successful discussions held at SOS 2010 in Belfast and SOS 2013 in Washington DC. It was held at a crucial time for leadership and collaboration on ocean sustainability, coming just after the United Nations' adoption of the Sustainable Development Goals (SDGs) and just prior to the Framework Convention on Climate Change (UNFCCC) that took place in Paris the following month.

Conference sessions reviewed the current state of knowledge of pivotal ocean sustainability issues, including ocean policy, regulation and governance, marine spatial planning, biofouling and invasive species, extreme weather events, fisheries and aquaculture, marine biodiversity, marine debris, and the future of the Arctic region. Leaders and innovators from different ocean sectors discussed these issues and how they relate to the future of the Blue Economy.

SOS 2015 aimed to advance the development and implementation of solutions to ensure sustainability of the marine environment. WOC guided the discussions in order to establish priorities, programs, and projects that will be integral to corporate ocean responsibility. SOS 2015 also fostered crucial information sharing and collaboration among the Ocean Business Community, without which it will be impossible to meet shared ocean environmental challenges.

Plenary Session

1. Singapore and the Blue Economy in the Region and the World

This session analyzed challenges of the Blue Economy internationally. The successes of Singapore's marine economy, and potential methods of replicating these accomplishments, were discussed in detail. Delegates pursued effective approaches to delivering future sustainable solutions, such as creating platforms for knowledge sharing, building partnerships, and fostering the role of Research and Development (R&D).

Andrew Tan, CEO Maritime Ports Authority of Singapore
Mr. Tan discussed the growing international awareness of the economic importance of the ocean. He also spoke about the increasing number of human activities in the ocean, and subsequent environmental consequences. A coordinated policy response is required to manage these environmental threats.

Mr. Tan outlined the following strategies for achieving sustainable development:

- Partnerships in environmental management should be founded on trust and mutual respect (for example, collaboration between Marine Protected Areas and National Parks to translocate coral reefs).
- Technology and innovation are essential in order to achieve both conservation and economic growth.
- Creating platforms for knowledge sharing is paramount in fostering international cooperation.

Christian Mellbye, Senior Analyst, Menon Business Economics
Mr. Mellbye discussed how effective public policy had been in fostering long-term competitiveness that in turn enabled Singapore's to become the maritime capital of the world. Singaporean businesses also benefited from a phenomenon known as *economies of agglomeration,* whereby firms' costs of production decline as a result of their physical proximity to each other. According to Mr. Melbye, Singapore's strength over many fields and disciplines has also been helpful in forming a complete maritime cluster.

Daniel Zhang, Senior Manager, Singapore Maritime Institute (SMI)
Mr. Zhang presented examples of SMI's activities that have helped advance R&D capacity in the maritime industry, including supporting research initiatives, establishing key partnerships to push industry engagement, and developing and showcasing R&D projects.

Tormod C. Endresen, Norwegian Ambassador to Singapore
Mr. Endreson discussed the success of the United Nations Convention on the Law of the Sea (UNCLOS) and the importance of reaching an agreement for the High Seas on the protection of Biodiversity in areas Beyond National Jurisdiction (BBNJ). Mr. Endreson also highlighted ocean acidification and the threats to fish stocks from illegal, unreported, and unregulated fishing (IUU).

2. Ocean +50: Ocean Industry Projections and the Future of the Ocean Economy

Eight speakers presented at the *Ocean +50* plenary session, one from each sector of the Ocean Business Community. Presenters discussed the important issues and future projections for their respective sectors.

Jason Waldie, Associate Director, Douglas-Westwood – Oil and Gas
The oil and gas industry is going through a period of stagnation as it is "changing in mode". Oil is still the leading energy sector, but recently gas has witnessed much faster growth. Demand for natural gas is expected to increase by 55% over the next 20 years. Mr. Waldie believes that oil prices will remain low until the first quarter of 2017, when they will begin to recover.

Alastair Macfarlane, Executive Secretary, International Coalition of Fisheries Associations (ICFA) – Fisheries
Mr. Macfarlane discussed the economic contribution of fisheries. Today 29% of fish are overfished. The solution to overfishing is clear: fewer vessels, fewer catch, and fewer people involved in fisheries. The ICFA is heavily involved in seeking to meet Goal 14 of the Sustainable Development Goals, and Mr. Mcfarlane pointed to compliance with trade agreements, such as the TPP, as key obstacles. He concluded by outlining five challenges to the future of sustainable fishing:

- Movement of fisheries to northern cooler waters poses a geo-political challenge as it muddles existing management and allocation agreements.
- Lack of international management.
- Ocean acidification.
- The appearance of "no-take" marine areas on the high seas.
- Rivalries between ocean business sectors. Collaboration, not competition, is required to deal with challenges to sustainable fishing.

Stephanie Draper, Chair, Sustainable Shipping Initiative – Shipping
Four trends in shipping will shape the entire marine economy: governance of the ocean economy, change in the nature of trade, technological transformation towards low carbon solutions, and a general reduction in carbon emissions. Ms. Draper urged the shipping industry to take these key trends into consideration in designing a roadmap.

James Hein, Senior Scientist, US Geological Survey – Mining
Mr. Hein described three major environmental concerns related to deep-sea mining: pollution, the dispersal of sediment plumes, and the creation of global Marine Protected Areas. He also mentioned the need for extractive metallurgy to become more efficient and more sustainable. Mr. Hein's projections suggest that the first massive sulphides extraction from the seafloor will occur by 2018, the first manganese nodules by 2023, the first phosphorites by 2025 and the first ferromanganese crusts by 2035.

Bud Darr, Senior VP of Technical and Regulatory Affairs, Cruise Line International Association (CLIA) – Tourism

The cruise tourism industry had 23 million guests worldwide in 2015. According to Mr. Darr, the sector pursues environmental stewardship through "waste stream management, exhaust gas purification, waste water purification, destination conservation efforts, and energy efficiency improvements". The tourism sector has devoted $26 billion to capital investments in the form of larger and more technologically-sophisticated ships.

Robert Beckman, Director, Centre for International Law, National University of Singapore – Cables

Today 98% of global telecommunications travel underwater. Cables are benign to the marine environment as they are buried and laid onto the sea floor. Mr. Beckman discussed three complications that the submarine cables industry is currently encountering. While the Law of the Sea regulates cables, there are no clear guidelines for how to operate within countries where cables pass through. Repairing cables and interpreting state jurisdictions is also ambiguous under current law. Third is the potential threat of terrorist attacks that should be assessed in detail.

Sanjay Kuttan, Director and Country Manager, Clean Technology Centre, DNV GK-Energy –Offshore Renewable Energy

The United Kingdom, Germany, Japan, Taiwan, and the United States are the leading early adopters of offshore renewable energy. The entire industry is moving 30-40m deeper and further offshore than in the past. Costs are also dropping and heading quickly towards £80/MWh. Mr. Kuttan described floating offshore wind farms as a prominent method to look towards in the future. At the moment the technology is nascent.

Patrick Sorgeloos, Past-President World Aquaculture Society, Ghent University – Aquaculture

Two types of aquaculture exist today: traditional food aquaculture and business aquaculture. The latter has existed since 1960 in the form of monocultures. Aquaculture will become increasingly important as the earth's population continues to accelerate. While acknowledging concerns regarding the environmental impacts of aquaculture, Mr. Sorgeloos urged that the positive benefits provided by aquaculture (such as filtering organisms and algae) should also be taken into account. Large-scale environmentally friendly aquaculture systems have been successfully built around the world, particularly by China.

3. Investment and Innovation for Ocean Sustainable Development

In this session five speakers presented current projects and ongoing challenges to investment in the Blue Economy. Approaches and obstacles to securing greater future investment were discussed in detail.

Sverre Pyrtz, Managing Director, Green Marine Capital

Green Marine Capital is a venture capital partnership formed by international shipping and maritime related industrial partners. It invests in businesses that offer products or services that have immediate or future relevance in the maritime sector. These are typically technology-based companies that address some aspect of minimizing the environmental impact of maritime related

activities. Environmental impact, regulatory changes, and cost savings are the three themes that guide Green Marine Capital's investments.

Jacques Demers, Managing Partner, Agawa Partners
Mr. Demers presented Agawa Partners, a new investment firm focused on ocean private asset investment. Agawa seeks to prioritize businesses such as agriculture, food production, trade, aquaculture, fisheries and green energy. Mr. Demers discussed the importance of efficient portfolio construction and business cycle insights for achieving long-term returns.

Alfred Nakatsuma, Director, Asia Region Environmental Office, USAID
Mr. Nakatsuma introduced the Presidential Task Force on Combating Illegal, Unreported and Unregulated (IUU) Fishing and Seafood Fraud, an important USAID initiative. This initiative and John Kerry's involvement in Our Ocean Conference are indicators of the United States' commitment to sustainable ocean development.

USAID's Presidential Task Force specifically targets Asia, where over 200 million people depend on the ocean for their food and livelihood. In Indonesia a US$50 million sustainable fisheries project is underway. A Coral Triangle initiative is underway in Bangkok which includes the development of a catch traceability system from bate to plate and a US$20 million project to sustain biodiversity. Mr. Nakatsuma also stated that USAID is seeking opportunities to work together with the ocean business community in the future.

Cary Anne Cadman, Environment and Natural Resources Coordinator, Indonesia, World Bank
The World Bank is accelerating investment in the Blue Economy and is seeking to increase the maritime sector's contribution and involvement. A key aspect of this process is sharing the value of natural capital with governments and setting up wealth accounts that include environmental factors and sustainability. An example is the WAVES program in Thailand, where asset accounts were set up that took both marketed goods and coastal protection into consideration. Another example is customs reform in Cameroon, which cut bureaucracy in order to facilitate port use, shipping and trade.

Chris Allen, Chris Allen & Associates, Co-Founder Biomimicry 3.8
Mr. Allen addressed the importance of using network thinking to bring investment to the Blue Economy. Effective networks precipitate the diffusion of information (which is often sector and location specific) across sectors, leading to diversification of approaches and portfolios. Networks also allow investors to gauge each other's willingness to invest in promising deals and emerging technologies. According to *The Economist*, the Blue Economy represents a growing but still immature investment opportunity. In order to attract greater investment viable business models aligned to the ecological health of the ocean must be established.

Parallel Sessions

1. Smart Ocean Smart Industries

Speakers:

- Peter Glazebrook, Rio Tinto
- Amos Barkai, OLRAC SPS
- Bill Dewey, Taylor Shellfish Farm
- Scott Johnston, US Fish and Wildlife Service
- Robin Falconer, International Hydrographic Organization

Peter Glazebrook introduced the "Future Reef AMP" project, which aims to develop a greater understanding of the ocean chemistry along the Great Barrier Reef. Three organizations collaborated on this project – Rio Tinto, The Great Barrier Reef Foundation, and the Commonwealth Scientific and Industrial Research Organization (CSIRO) - an excellent example of a Public Private Partnership (PPP). The project collected data using Rio Tinto vessels and analyzed results at CSIRO laboratories in Tasmania. Scientists were able to create cumulative maps displaying ocean acidification's impact on the Great Barrier Reef over time, filling an important knowledge gap in the scientific community. The project also revealed a pattern of seasonal transportation of coral seawater along the reef.

Panelists agreed on the need for urgent action to combat the issue of ocean acidification. According to Bill Dewey, acidification is likely to increase by 100-150% by 2100. Data collection and monitoring should be collaborative efforts between different ocean sectors and users.

Robin Falconer spoke about the incredible lack of available data regarding the ocean floor, 90% of which is currently unmapped. Efforts to map the marine seabed have been less effective than those applied to Mars and the Moon. Mr. Falconer introduced bathymetry data, a crowd-sourced data processing approach that is being deployed to fill in the gaps in our knowledge of the ocean floor.

2. SE Asia and Coral Reefs: Responsible Ocean Industry Operations in the "Coral Triangle"

Speakers:

- Widi Pratikto, Coral Triangle Initiative Secretariat
- Benjamin Kahn, Apex Environmental
- Daniel Middleton, Liquid Robotics
- Richard Kenchington, University of Wollongong

Widi Pratikto presented the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF). The CTI-CFF is a multilateral partnership between the governments of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. The partnership was founded in 2009 as a concerted effort to preserve the Coral Triangle, home to the highest

level of marine biodiversity on earth. CTI-CFF member states are collaborating to ensure food security, mitigate the effects of climate change, protect biodiversity, and combat other sustainability challenges.

Benjamin Kahn described the need for large scale spatial planning in the Coral Triangle. Rising usage activity has led to the need for planning in order to protect biodiversity, define boundaries for oil and gas fields, and manage crowded shipping routes, particularly on narrow island passages. According to Mr. Kahn, ocean sectors must collaborate on spatial planning as there is a great deal of overlap, particularly in the case of mining and oil & gas, which are major players in the region. For example, 40% of the permitted area for oil and gas has been identified as crucial for marine conservation. Environmental impact studies of potential oil spills in the area suggest that between 100,000 and 10 million citizens could be affected by a moderate to large spill.

Daniel Middleton showcased Wave Gliders, a new data collection and observation technology he described as "sustainable small green floating computers detecting everything". Wave gliders are entirely solar powered, collect useful ocean data, and can even avoid large ships using a GPS tracking system. Richard Kenchington discussed local engagement resiliency methods to combat climate change. Corporate involvement in isolated Small Island Developing States (SIDS) is continuing to be looked at in the form of specific projects, long-term change programs, social credits, and partnerships between industries and regulators.

3. Sea Level Rise/Extreme Events: Port and Coastal Infrastructure Adaptation and Resiliency

Speakers:

- Andreas Brogaard Buhl, DHI
- Josh Sawislak, AECOM
- Kevin MacIntosh, Baird
- Marco Pluijm, Bechtel
- Helena Hulsman, National University of Singapore

This session illustrated the impact of climate change on the marine environment, in particular flooding risk due to sea level rise, temperature increase, and ocean acidification

Andreas Brogaard Buhl introduced an information management system called MIKE. Using present day measurements the program is able to develop models of hypothetical extreme event scenarios, as well as the consequences associated with each, and potential solutions.

Helena Hulsman highlighted the need for green and nature-based solutions as tools to enhance coastal resilience. These types of solutions will allow for a balance between civil engineering and nature, and make optimal use of potential ecosystem services. Ms. Hulsman discussed the *Building with Nature* program, which is able to utilize natural processes, provide opportunities for nature, and build cost-effective hydraulic infrastructure at the same time.

4. BioFouling and Invasive Species: Understanding and Addressing a Global, Multi-Industry Issue

Speakers:

- Serena Teo, National University of Singapore
- Rob Hilliard, Intermarine
- Tim Wilkins, Intertankto
- Chris Ryan, Akzo Nobel Marine Coatings
- Stein Kjølberg, Jotun Performance Coatings
- James Bassadone, CleanHull

Rob Hilliard emphasized the need for more proactive, collaborative roles in biofouling management in order to address the unwanted spread of invasive species by trading ships, work vessels, and drilling units. Proliferation of invasive species is continuing to accelerate globally, regionally, and locally through ballast water and hull fouling. Mr. Hilliard's fellow speakers echoed his concerns.

According to James Bassadone, the issue of biofouling can be traced back more than two millennia. Only recently, over the past 50 to 60 years, have ship-owners begun to conduct conscious underwater hull cleanings. Mr. Bassadone discussed CleanHull's mechanical system of hull cleaning, which does not require human divers and captures approximately 40-50% of waste. CleanHull is actively pursuing technology that will allow for 100% waste collection.

Stein Kjølberg presented *ISO 19030* – a market standard currently being developed for anti-fouling products. The standard's objective is to recommend voluntary, practical techniques for measuring changes in ships' hull and propeller performance. Adoption of these methods would reduce global fleet energy costs and carbon emissions.

5. Shipping, Sustainability and Synergies: Engaging Green Shipping Initiatives with Each Other and with Other Ocean Industries

Speakers*:*

- Stephanie Draper, Sustainable Shipping Initiative
- Kris Fumberger, Right Ship
- Angie Farrag-Thibault, Clean Cargo Working Group, Business for Social Responsibility
- Galen Hon, Carbon War Room
- Keita Shinohara, Green Award

Global shipping is one of the largest sources of CO_2 emissions in the world. A 25% reduction in emissions for new ships has been mandated by 2025, but this does not include ships built before 2013, which make up most of the global fleet. Kirs Fumberger presented RightShip, a benchmark emissions rating system which compares ships of similar size and type.

Speakers discussed a number of certifications and awards programs intended to reward and incentivize green and environmentally friendly shipping. Businesses with green certifications receive benefits such as positive publicity and name recognition, assistance tracking and

benchmarking environmental performance, and financial incentives from recognized ports. Keita Shinohara reviewed the Green Award Program, which is building a network of sustainable shipping companies by certifying and connecting safe, clean-energy ships.

Stephanie Draper presented the Sustainable Shipping Initiative (SSI), which also supports awards and certification as a means of encouraging environmentally friendly shipping. SSI aims to establish sustainable approaches as the new norm in the industry. It focuses on three main areas: cost-effective responsible ship recycling, improving the working conditions of maritime industry laborers, and demonstrating a clear and practical pathway towards low-carbon shipping.

Panelists expressed concerns about the often-excessive guidelines, paperwork, and audits required to receive green certifications. The shipping industry is particularly concerned about the overlap between certification programs, which undermines their attraction to the industry. Green awards programs should collaborate to identify and avoid overlaps and merge indices when necessary.

6. Marine Mining: Fisheries Interactions with Extractive Industries

Speakers:

- Renee Grogan, Nautilus Minerals
- Paul Eagleson, Nautilus Minerals
- Govinder Singh Chopra, SeaTech Solutions International
- Aleyda Ortega, IHC
- Andrew Baird, Benthic Metals
- Ken Lee, CSIRO

Paul Eagleson presented the Solwara 1 Project, which aims to extract high-grade polymetallic Seafloor Massive Sulphide deposits located at a depth of approximately 1,600 meters on the floor of the Bismarck Sea. According to Mr. Eagleson, the project is firmly committed to environmental protection. There will be no haul roads or tailings dams, no chemical blasting and no direct impact on communities. Nautilus Minerals plans to work closely with local fisheries and to use relocatable infrastructure.

In order to carry out deep-sea mining effectively in "the Area", Aleyda Ortega introduced the DEED (Development, Exploration, and Environment Decision) framework that comprises three programs:

- Exploration program responsible for assessment of resources.
- Development program responsible for feasibility, production, and management of exploitation licenses.
- Environmental program responsible for environment and sustainability assessment and management.

Andrew Baird discussed hydrothermal vents – fissures in the earth's crust through which geothermal heat and water escape. Low impact sustainable marine mining should avoid digging and aim for hydrothermal vents, meaning zero impact to the seabed. Smaller vessels and passive collection systems should be employed for optimal results.

7. Ocean Policy and Governance: Creating an Informed and Engaged Ocean Business Community

Speakers:

- Lora Nordtvedt Reeve, Wollongong University
- Youna Lyons, National University of Singapore
- Paul Holthus, World Ocean Council

Lora Reeve presented the new United Nations Biodiversity Beyond National Jurisdiction (BBNJ) instrument. BBNJ is a legally binding provision intended to address the difficulties of implementing UNCLOS on the High Seas and in the Area. The objective of BBNJ is to establish a legal framework, best practice management, and a minimum standard procedure framework for the transfer of marine technology and data sharing. Benefits to the ocean business community include

- A level playing field, predictable legal framework, and foreseeable enforcement of regulations.
- A sustainable business model.
- An opportunity to influence international ocean policy.

Paul Holthus discussed the WOC's Ocean Policy Program. WOC monitors, analyzes and reports on behalf of its members on major ocean policy and decision-making processes and developments. Mr. Holthus highlighted the importance of the Sustainable Development Goals (SDGs), in particular SDG 14, which specifically targets the ocean and states the goal to "conserve and sustainably use the oceans, seas and marine resources for sustainable development". WOC maintains an active presence in the UN and provides the Ocean Business Community with an opportunity to participate in the SDG process.

8. Marine Ecosystems, Biodiversity, and the Blue Economy: Challenges and Solutions at all Scales

Speakers:

- John Ridley, Ocean Nourishment
- Ilona Porsche, GIZ Germany
- Xiao-Bo Chen, Director of Deepwater Techonology & Research Centre
- Abigail Alling, Biosphere Foundation
- Ryan Whisnant, Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)
- Peter Myles, Nelson Mandela Bay Maritime Cluster

The ocean is the largest carbon sink on earth, responsible for 27% of all carbon dioxide removed from the atmosphere. John Ridley recommended several methods of increasing the ocean's carbon uptake: ocean iron fertilization, ocean macronutrient fertilization, enhanced upwelling, ocean alkalinity, direct capture, and geological storage. Mr. Ridley called for the development of

a global ocean CO_2 removal plan and recommended that the Ocean Business Community signs a joint statement recognizing the impending problem of atmospheric CO_2.

Xiao-Bo Chen presented the Achieve Quieter Oceans Project (AQO). AQO's stated goals are to fulfill the objectives of the Marine Framework Directive, support policy makers, establish practical guidelines to reduce shipping noise, and to propose design solutions to mitigate Underwater Radiated Noise (URN). Chen referred to studies conducted on marine fauna which demonstrate that URN impairs animal hearing cells, changes animal behavior, and causes auditory interference through masking. The industry must seek to reduce and mitigate the impact of URN by amending the rules for ships and class units.

A Biosphere Foundation study found approximately 1,016 interactions between ships and blue whales per year off the southern coast of Sri Lanka. Mean shipping densities peaked at 1,090 kilometers per year in the westbound lane, and 810 kilometers per year in the eastbound lane. Abigail Ailing suggested an alternative shipping route roughly 15 nautical miles further off the coastline. This re-route could reduce the risk of collision by 95% and would add only 5-10 nautical miles of additional traffic.

9. Marine Spatial Planning/Ocean Zoning: Ensuring that Ocean Planning Engages Ocean Industries

Speakers:

- Lucy Greenhill, Scottish Association for Marine Science
- Domenico Andreis, CESI S.p.A.
- Sharon Tatman, Deltares
- Marta Pascual, Basque Centre for Climate Change
- Ivana Lukic, University of the Azores

Panelists stressed the importance of Marine Spatial Planning (MSP) as a tool for managing marine resources. Lucy Greenhill explained how MSP could emerge as an industry by improving government decision making, enabling sustainable ocean sector activity, creating a framework for cross-sectoral collaboration, integrating coexisting solutions and providing data management and gap analysis.

Ivana Lukic described how MSP fosters knowledge sharing and encourages collaboration between investors and government agencies. MSP also offers businesses transparency and assurance.

Sharon Tatman presented the North Sea 2050 Spatial Agenda, an initiative led by the Dutch Government to identify blue growth opportunities and collaborative projects at the sea basin level. The goal is to work towards a safe, clean, healthy, and ecologically diverse North Sea that contributes to economic and social well-being.

10. Reducing Industry Input of Marine Debris, Plastics and Other Wastes through Adequate Port Reception Facilities and a Circular Economy

Speakers:

- Aleyda Ortega, Royal IHC
- Kevin Vang, United Nations and Multilateral Affairs, World Animal Protection
- Stephanie Maes, Waste Free Oceans
- Rob Coombs, Interface Asia-Pacific

Aleyda Ortega analyzed ocean debris in three key areas: the ocean, the sea and near shore, and ports and inland waters. In the ocean there is currently 2.6 times more plastic than zooplankton. The degradation and clustering of plastics has led to the formation of giant garbage gyres, including the Great Pacific Garbage Vortex. Garbage vortexes present a supranational threat but thus far states have been reluctant to invest in solutions. Because of the difficulties of analyzing water quality in the middle of the ocean, the exact scale of the gyres is unclear. Ms. Ortega recommended investment in technology to monitor the location of ocean debris and plastics.

Marine debris found in the sea and near the shore is typically larger plastic particles. This area is of vital importance since 90% of marine life is found near the shore. Larger plastics are also common on ports and inland waters. The sheer volume of large plastics is so great in these areas that streamflow often washes them onto land. Ms. Ortega called for municipality and government cooperation to deal with the threat of large plastics. Compliance with environmental law must also be measured and enforced.

11. Arctic Business Leadership and Collaboration for Responsible Development

Speakers:

- Paul Berkman, Tufts University
- Lawson Brigham, University of Alaska Fairbanks
- Lars-Henrik Larsen, Akvaplan-Niva Ltd
- Tu Jingfang, Polar Research Institute of China
- Marvin (Blake) McBride, U.S. Navy and Office of Naval Research

The Arctic region is changing rapidly in structure and composition as a result of the recent dramatic acceleration in the loss of arctic sea ice. It is difficult to predict exactly how the Arctic region will look in the coming decades, but glacial melting will certainly open new navigation routes and possibilities. Tu Jingfang described the International Maritime Organization's "Polar Code", a new set of rules for navigating the region that include additional safety and pollution prevention measures.

Navigating current Arctic shipping routes is far from straightforward, according to Lars-Henrik Larsen, who advocated risk modelling within the Arctic risk evaluation as a key tool to overcome

temporal and geographic data shortages. Mr. Larsen also reflected on the calamitous diesel oil spill at Skjervøy, which provided a unique data set for future disaster-response programs in the region to learn from.

Paul Berkman described the huge potential for oil and gas in the region. The continental shelf of the Arctic is estimated to contain 30% of global gas and 13% of global oil reserves. Because of the colossal economic interest in the region there is a need for infrastructure (including communications) along with more research, information systems and international regulation. National and common interests must be weighed evenly in the process of infrastructure development, in particular environmental protection, societal welfare and economic prosperity. Sustainable infrastructure is already being developed. Mr. Berkman cited the Arctic Options program which aims to achieve holistic integration for arctic coastal-marine sustainability in the infrastructure development process.

12. Big Ocean Data: The Business of Marine Data Collection, Management, Analysis and Mapping

Speakers

- Daniel Middleton, Liquid Robotics
- Graham Stickler, Oceaneering International
- Yuval Magid, Windward
- Jerome Cuny, Open Ocean SAS
- Rainer Sternfeld, Planet OS

Daniel Middleton discussed the challenges of building robotic technologies to monitor the ocean. Effective technology systems must be autonomous, reliable, sustainable, operable close to the shore, able to harvest energy and, most importantly, low cost. These ambitious requirements have inhibited the industry and led to relatively few innovative solutions in the ocean for the past 20 years. However, technology developers are excited by the recent success of the Wave Glider, an invention that has revolutionized ocean monitoring. Mr. Middleton hopes to build on this success to begin discussing an “Ocean Sensor Network for the Blue Economy”.

Jerome Cunny introduced a Global Measurement Program intended to facilitate decision-making and sustainable development of offshore projects by allowing for faster and easier access to ocean knowledge. The Global Measurement Program is comprised of the Global Drifter Program, a satellite-tracked observation network of buoys, and the ARGO program, an international web of temperature and salinity profiling floats.

Program Summary

SOS 2015 Opening
Opening Plenary Session: Day 1 – Mon, 9 Nov, 13:30-13:45

- Andrew Tan, Chief Executive, Maritime and Port Authority of Singapore (MPA) *Welcome and Introductory Speech from Singapore*

Singapore and the Blue Economy in the Region and in the World
Opening Plenary Session: Day 1 – Mon, 9 Nov, 13:45-14:45

Chair/Moderator
- Esben Poulsson, President, Singapore Shipping Association (SSA)

Speakers/Panel
- Andrew Tan, CEO, Maritime and Ports Authority of Singapore (MPA)
- Christian Mellbye, Senior Analyst, Menon Business Economics
  - *Singapore – the leading maritime capital of the world*
- Daniel Zhang, Senior Manager, Singapore Maritime Institute (SMI)
  - *Advancing R&D capabilities for a vibrant maritime industry*
- Tormod C. Endresen, Norwegian Ambassador to Singapore
  - *Stewardship of our most important global commons*

"Our Oceans Challenge"
Opening Plenary Session: Day 1 – Mon, 9 Nov, 14:45-15:00

Chair/Moderator
- Paul Holthus, CEO, World Ocean Council

Speakers/Panel
- ***Thom Koning, Chairman, Our Oceans Challenge; Vice President Quality, Safety, Health & Environment (QASHE), Heerema Marine Contractors Nederland SE***
- ***Seriena Bal, Manager, Our Oceans Challenge***

Ocean + 50: Ocean Industry Projections and the Future of the Ocean Economy
Plenary Session: Day 1 – Mon, 9 Nov, 15:30-17:30

Chair/Moderator
- Bjørn Kj. Haugland, Executive Vice President and Chief Sustainability Officer, DNV GL

Speakers/Panel
- *Oil and Gas:* Jason Waldie, Associate Director, Douglas-Westwood
- *Fisheries:* Alastair Macfarlane, Executive Secretary, International Coalition of Fisheries Associations (ICFA)
- *Shipping:* Stephanie Draper, Chair, Sustainable Shipping Initiative
- *Seabed Mining:* James Hein, Senior Scientist, U.S. Geological Survey
- *Cruise Tourism:* Bud Darr, Senior Vice President of Technical and Regulatory Affairs, Cruise Line International Association
- *Submarine Cables:* Robert Beckman, Director, Centre for International Law, National University of Singapore

- *Offshore Renewable Energy:* Sanjay Kuttan, Director and Country Manager, Clean Technology Centre, DNV GL – Energy
- *Aquaculture:* Patrick Sorgeloos, Past-President, World Aquaculture Society, Ghent University

Ocean Executive Forum: Exploring Industry Leadership and Collaboration Across the Sectors
Plenary Session: Day 2 – Tue, 10 Nov, 08:30-10:00

Chair/Moderator
- Paul Holthus, CEO, World Ocean Council

Speakers/Panel
- *Shipping:* Kenneth Koo, CEO, TCC Shipping
- *Shipbuilding/dredging:* Bram Roelse, CEO, Royal IHC Merwede
- *Fisheries:* Volker Kuntzsch, CEO, Sanford Ltd *(confirmed)*
- *Ocean data/technology:* Daniel Middleton, Executive Vice President, Global Sales and Business Development, Liquid Robotics
- *Offshore wind energy:* Joao Metelo, CEO, Principle Power
- *Aquaculture:* Prathapachandra Shetty, Executive Director, Emirates Star Fisheries

Smart Ocean-Smart Industries: Industry Data Collection to Improve Ocean Knowledge
Parallel Session: Day 2 – Tue, 10 Nov, 10:30-12:00

Chair/Moderator
- Simen Knudsen, Opportunity Manager, DNV GL

Speakers/Panel
- Peter Glazebrook, Principal advisor, Product Stewardship – Health, Safety, Environment and Communities, Rio Tinto
  - *Great Barrier Reef's 'Ship of Opportunity' - a world-first*
- Amos Barkai, CEO, OLRAC SPS
  - *Marine data collection from commercial and recreational vessels: Opportunities, constraints and solutions*
- Bill Dewey, Public Policy and Communications Director, Taylor Shellfish Farm
  - *Aquaculture industry network of data collection on ocean acidification in partnership with government and science*
- Scott Johnston, Branch Chief, US Fish and Wildlife Service
  - *Wildlife data collection from ships with WOC Smart Ocean-Smart Industries Program*
- Robin Falconer, Guiding Committee, Intergovernmental Oceanographic Commission (IOC) – International Hydrographic Organization (IHO) GEBCO
  - *Crowd Source Bathymetry: An important way to map the oceans*

SE Asia and Coral Reefs: Responsible Ocean Industry Operations in the "Coral Triangle"
Parallel Session Day 2 – Tue, 10 Nov, 10:30-12:00

Chair/Moderator
- Benjamin Kahn, Executive Director, Apex Environmental

Speakers/Panel
- Widi Pratikto, Executive Director, Coral Triangle Initiative Secretariat (CTI-CFF)
  - *Coral Triangle Initiative for Corals Reefs, Fisheries and Food Security: A six-country partnership to sustain one of the most biodiverse regions on earth*
- Benjamin Kahn, Executive Director, Apex Environmental *(confirmed)*
  - *Mapping the overlap between offshore industries and conservation areas in the Coral Triangle*
- Daniel Middleton, Executive Vice President, Global Sales and Business Development, Liquid Robotics *(confirmed)*

- *Developing a sustainable future in the Coral Triangle: Wave Gliders, environmentally friendly ocean robots*

- Richard Kenchington, Professorial Fellow, Australian National Centre for Ocean Resources and Security, University of Wollongong *(confirmed)*
  - *Setting (Community) Priorities in the complex environment: Lessons from the Pacific Coral Triangle for application in the South-East Asia Coral Triangle*

Sea Level Rise/Extreme Events: Port and Coastal Infrastructure Adaptation and Resiliency
Parallel Session: Day 2 – Tue, 10 Nov, 13:30-15:00

Chair/Moderator

- Stephanie Groen, Managing Director, DHI Water & Environment, Singapore

Speakers/Panel

- Andreas Brogaard Buhl, Head of Department, Ecology and Environment, DHI
  - *Tools to ensure that ports become more resilient to climate change*
- Josh Sawislak, Global Director of Resilience, AECOM *(confirmed)*
  - *The business case for investment in resilient infrastructure and the ocean supply chain*
- Kevin MacIntosh, CEO, Baird
  - *Applying coastal science, technology, and engineering in relation to challenges associated with sea level rise*
- Marco Pluijm, Ports and Marine Sector Manager, Bechtel
  - *Future ports and adaptation to extreme events and sea level rise*
- Helena Hulsman, Researcher/Consultant, Marine and Coastal Environment, National University of Singapore (NUS)/Deltares
  - *Green Adaptation: Enhancing resilience of coastal infrastructure by building with nature*

BioFouling and Invasive Species: Understanding and Addressing a Global, Multi-Industry Issue Parallel Session: Day 2 – Tue, 10 Nov, 13:30-15:00

Chair/Moderator

- Tim Wilkins, Regional Manager, Asia-Pacific, INTERTANKO

Speakers/Panel

- Serena Teo, Tropical Marine Science Institute, National University of Singapore *Biofouling - update on research relevant to ocean industries*
- Rob Hilliard, Director, Intermarine *Achieving effective biofouling management without overly-complex, burdensome regulations*
- Tim Wilkins, Regional Manager, Asia-Pacific, INTERTANKO *The growing need to tackle biofouling in the shipping industry and the practical measures being undertaken by tanker owners*
- Chris Ryan, Regional Marketing Manager, South Asia, Akzo Nobel Marine Coatings
  - *Coatings industry progress and perspectives on addressing biofouling*
  - Stein Kjølberg, Global Sales Director - Hull Performance Solutions, Jotun Performance Coatings, Jotun A/S
  - *The value of Performance Analysis on efficiency and how it addresses the challenges of biofouling*
  - James Bassadone, CEO, CleanHull
  - *Removing biofouling: Status and progress in environmentally sound hull cleaning*

Shipping, Sustainability and Synergies: Engaging Green Shipping Initiatives with Each Other and with Other Ocean Industries Parallel Session: Day 2 – Tue, 10 Nov, 15:30-17:30

Chair/Moderator

- Neil Baird, Roving Ambassador, International Marine Environment Protection Association (InterMEPA)

Speakers/Panel

- Stephanie Draper, Chair, Sustainable Shipping Initiative
- Kris Fumberger, Sustainability Manager, Right Ship
- Angie Farrag-Thibault, Associate Director, Transport and Logistics, Clean Cargo Working Group, Business for Social Responsibility
- Galen Hon, Manager, Ship Efficiency, Carbon War Room
- Keita Shinohara, Certification Manager, Green Award

Marine Mining; Fisheries Interactions with Extractive Industries
Parallel Session: Day 2 – Tue, 10 Nov, 15:30-17:30

Chair/Moderator

- Ken Lee, Director, Oceans and Atmosphere National Research Flagship, CSIRO, Australia *(confirmed)*

Invited Speakers/Topics

- Renee Grogan, Environment Manager, Nautilus Minerals
  (Presenter: Paul Eagleson, Principal Geologist, Nautilus Minerals) *Environmental management in seafloor mining – a collaborative approach*
  - Govinder Singh Chopra, Director, SeaTech Solutions International *New frontiers in deep sea mining*
- Aleyda Ortega, Research Engineer Environment, Royal IHC
  - *DEED, an integrated decision-making framework for seabed mining projects*
- Andrew Baird, CEO, Benthic Metals
  - Submarine hydrothermal vents: A low impact, renewable source of metals
- Ken Lee, Director, Oceans and Atmosphere National Research Flagship, CSIRO, Australia
  - *Fisheries and ocean extractive Industries: Science and risk assessment for sustainable development*

Panel: Fisheries and Ocean Extractive Industries

- *Fisheries:* Mikael Thinghuus, CEO, Royal Greenland
- *Fisheries:* Volker Kuntzsch, CEO, Sanford Ltd
- *Geophysical survey:* John Hughes, IAGC Regional Consultant, International Association of Geophysical Contractors (IAGC)
- *Marine mining:* Robin Falconer, Executive Director, Chatham Rise Phosphate
- *Marine mining:* Henk van Muijen, Managing Director, IHC Mining

Ocean Policy and Governance: Creating an Informed and Engaged Ocean Business Community Parallel Session: Day 3 – Wed, 11 Nov, 8:30-10:00

Chair/Moderator

- Peter Hinchliffe, Secretary General, International Chamber of Shipping

Speakers/Panel

- Lora Nordtvedt Reeve, Australian National Centre for Ocean Resources and Security, Wollongong University *(confirmed)*
  - *New UN Implementing Agreement: Possible changes for high seas industries*
- Youna Lyons, Centre for International Law, National University of Singapore
  - *Ocean governance, ocean conservation and ocean industries*
- Paul Holthus, CEO, World Ocean Council
  - *UN Sustainable Development Goals (SDGs) and ocean industries*

Marine Ecosystems, Biodiversity, and the Blue Economy: Challenges and Solutions at all Scales Parallel Session: Day 3 – Wed, 11 Nov, 8:30-10:00

Chair/Moderator

- Marco Pluijm, Ports and Marine Sector Manager, Bechtel

Speakers/Panel

- John Ridley, Managing Director, Ocean Nourishment
  - *The role of the ocean in regulating climate and the need and opportunity to securely store carbon in the marine environment*
- Ilona Porsche, Head, Blue Solutions Project, GIZ Germany
  - *Blue Business Solutions for Sustainable Development*
- Xiao-Bo Chen, Director of Deepwater Techonology & Research Centre (DTRC)
  - *AQUO project: Assessing the impact on marine fauna from shipping noise*
  - Abigail Alling, President, Biosphere Foundation; Swire Pacific Offshore *Blue Whales and ship-strikes off the southern coast of Sri Lanka*
- Ryan Whisnant, Head, Professional Services, Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)
  - *Business and the Blue Economy in East Asia*
- Peter Myles, Chair, Nelson Mandela Bay Maritime Cluster
  - *The case for a Western Indian Ocean (WIO) Regional Ocean Business Council*

Marine Spatial Planning/Ocean Zoning: Ensuring that Ocean Planning Engages Ocean Industries Parallel Session: Day 3 – Wed, 11 Nov, 10:30-12:00

Chair/Moderator

- Lucy Greenhill, Research Fellow (Marine Planning), MASTS Marine Planning and Governance Forum Convener, Laurence Mee Centre for Society and the Sea, Scottish Association for Marine Science

Speakers/Panel

- Lucy Greenhill, Research Fellow (Marine Planning), Scottish Association for Marine Science
  - *Marine Spatial Planning: Key challenges and opportunities for industry*
- Domenico Andreis, ISMES Director, Engineering & Environment Division, CESI S.p.A.
  - *Environmental assessment and monitoring of submarine infrastructure engineering: Best practices for MSP in the Mediterranean*
- Sharon Tatman, Marine and Coastal Management Specialist, Deltares
  - *Avoiding conflicts through multi-sectoral coordination in oceans, seas and coasts*
- Marta Pascual, Basque Centre for Climate Change
  - *A decision support system tool chain for marine spatial planning*
- Ivana Lukic, CIBIO Açores, EMMCMSP, University of the Azores
  - *Investment security through maritime spatial planning*

Reducing Industry Input of Marine Debris, Plastics and Other Wastes through Adequate Port Reception Facilities and a Circular Economy
Parallel Session: Day 3 – Wed, 11 Nov, 10:30-12:00

Chair/Moderator

- Peter Glazebrook, Principal advisor, Product Stewardship – Health, Safety, Environment & Communities, Rio Tinto

Speakers/Panel

- Aleyda Ortega, Research Engineer Environment, Royal IHC
  - *Ocean debris, a global issue that demands local and sustainable solutions*
- Kevin Vang, Senior Advisor for Government, United Nations and Multilateral Affairs, Asia-Pacific, World Animal Protection
  - *Global Ghost Gear Initiative: A global, collaborative approach to fish net debris*
- Stephanie Maes, Project Manager, Waste Free Oceans
  - *Recovery and recycling of plastic macro waste floating at sea – towards a circular economy*
- Rob Coombs, CEO and President, Interface APAC
  - *Turning marine trash into treasure for a restorative future*

Arctic Business Leadership and Collaboration for Responsible Development
Parallel Session: Day 3 – Wed, 11 Nov, 13:30-15:00

Chair/Moderator

- Christine Valentin, Director, Strategy, Membership and Finance, World Ocean Council

Speakers/Panel

- Paul Berkman, Professor of Practice in Science Diplomacy, Fletcher School of Law and Diplomacy, Tufts University
  - *Pan-Arctic Options: Scenarios for Arctic infrastructure development*
- Lawson Brigham, Distinguished Professor, University of Alaska Fairbanks
  - *Arctic Shipping Assessment: Update and new developments*
- Lars-Henrik Larsen, Head of Department, Akvaplan-Niva Ltd
  - *Arctic shipping environmental risk assessment*
  - Tu Jingfang, Assistant Researcher, Polar Research Institute of China
  - ***Development of Polar Code and extra-regional stakeholders' contribution***
- Marvin (Blake) McBride, Commander, U.S. Navy, Associate Director, Office of Naval Research (ONR) - Global
  - *Office of Navy Research (ONR) Global and U.S. Navy Research Efforts in the Arctic*

Big Ocean Data: The Business of Marine Data Collection, Management, Analysis and Mapping Parallel Session: Day 3 – Wed, 11 Nov, 13:30-15:00

Chair/Moderator

- John Feenan, General Manager, OceanflORE

Speakers/Panel

- Daniel Middleton, Executive Vice President, Global Sales and Business Development, Liquid Robotics *Transforming ocean data collection with fleets of autonomous robots*
- Graham Stickler, Vice President, Products and Services, exactEarth *The emergence of satellite AIS as a key Big Ocean Data source*
- Tray Mayfield, Director of Operations for Global Data Solutions, Oceaneering International *(confirmed)*
  - *Collection, transport, and visualization of Big Ocean Data*
- Yuval Magid, Business Development, Windward *Maritime Big Data: Opportunities and challenges*
- Jerome Cuny, Business Development Manager/CEO, Open Ocean SAS *(confirmed)*
  - *Obtaining ocean data at the global scale is possible, now what about analyzing it*
- Rainer Sternfeld, CEO, co-founder, Planet OS
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Investment and Innovation for Ocean Sustainable Development
Closing Plenary Session: Day 3 – Wed, 11 Nov, 15:30-17:15

Chair/Moderator

- Kevin Oates, Managing Director, Marine Money Asia

Speakers/Panel

- Charles Goddard, Editorial director, Asia-Pacific, Economist Intelligence Unit *(confirmed)*
  - *EIU Report on "Investing in the Blue Economy"*
  - Sverre Pyrtz, Managing Director, Green Marine Capital *Industry-funded investment partnerships for growth stage companies providing technology-based products and services*
  - Jacques Demers, Managing Partner, Agawa Partners *Private market investment in ocean-sustaining related businesses and projects*
- Alfred Nakatsuma, Director, Asia Region Environmental Office, USAid *(confirmed)*
  - *Government support for innovation and solutions to address ocean sustainable development*
  - Cary Anne Cadman, Environment and Natural Resources Coordinator, Indonesia, World Bank *Multilateral institution investment and innovation for the Blue Economy*

- Chris Allen, Chris Allen + Associates/Co-Founder Biomimicry 3.8
- *Exploring the case for a sustainable Blue Economy investment network*

Closing Plenary: Day 3 – Wed, 11 Nov, 17:15-17:30

Chair/Moderator

- Paul Holthus, CEO, World Ocean Council

Speakers/Panel

- ***Seriena Bal, Manager, Our Oceans Challenge (confirmed)***
- Paul Holthus, CEO, World Ocean Council