Highlights of

BETTER DECISION MAKING THROUGH MARITIME TRAFFIC MONITORING & MODELLING

"The take-away was the staggering potential for technological applications for marine hazards – given one essential ingredient: greater collaboration…"

Colin Laughlan, BC Shipping News, June 2016

ABOUT THIS REPORT

This report summarizes highlights of the workshop, "Better Decision Making Through Maritime Traffic Monitoring & Modelling" held in Vancouver, BC, Canada on April 11-12, 2016.

The motivation for the workshop stemmed from the realization that a vast amount of marine shipping and vessel traffic data has become available since the widespread implementation of Automatic Identification Systems (AIS).

The workshop was structured to explore the state-of-the-art applications and the immense potential of these rapidly developing technologies to improve the monitoring and management of passing marine traffic by coastal states. The AIS data is also increasingly used to model marine traffic patterns for marine spatial planning, ship noise and emissions assessments, risk modelling for spills and accidents, and other marine management issues.

The timeliness of the workshop was indicated by the vibrant participation of over 100 representatives from industry, government, and academia, and from Europe, the United States, and Canada.

Presentations, panel sessions and interactive group work addressed topics ranging from practical applications to policy making, from multi-stakeholder engagement to data sharing.

Workshop participants agreed to reconvene within a year's time to continue the conversation. The agreed-on next steps and actions included the further advancement of systems and processes, and also the need for enhanced collaboration to make effective use of the existing data.

The co-sponsors would like to extend special thanks to Yolanda Liman of Drawing It Out Graphic Facilitation for creating the visual representations of each session that illustrate this report and Dr. David Semeniuk for providing a written summary of the workshop proceedings.

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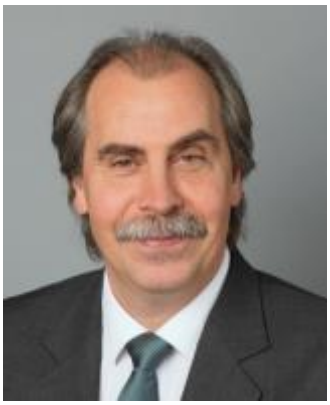
MESSAGE FROM SPONSORS



Dr. Richard Wiefelspuett
Executive Director
Clear Seas

On behalf of Clear Seas, I would like to thank our co-sponsors and all the speakers and participants for generously sharing their insights, knowledge and collaborative spirit during this marine traffic workshop.

We believe this event confirmed the importance of resource-sharing to affect meaningful change for safe and sustainable marine shipping in Canada. By working together to share best practices, we know this collaboration is also important in promoting and advocating for necessary marine shipping changes that are based on a strong, collective voice.

Dr. Ronald Pelot
Assoc. Scientific Director
MEOPAR

MEOPAR was pleased to co-sponsor this event, which was successful on many fronts. The multi-sectoral participation from different levels of government, NGOs, industry and academia was instrumental in addressing the broad range of issues surrounding marine traffic management. A very useful feature was that the presentations ran the gamut from observations (data), to modelling, to decision support and risk management issues, an integrative approach which forms the backbone of MEOPAR's approach to tackling complex marine issues. The outcomes from the workshop will help prioritize and focus efforts to advance this important topic, bolstered by new relationships facilitated by the workshop.

Rajiv Taneja
Regional Sales Manager
exactEarth Ltd.

At exactEarth we were very happy with the wide breadth of topics covered by the presenters and panelists, and the enthusiastic participation by attendees as evidenced through their questions after every presentation and during the networking breaks. We now have a much better understanding of the challenges faced by maritime authorities, and the type of information that researchers require. The insights collected were extremely useful, and exactEarth was thrilled to have partnered with Clear Seas & MEOPAR in conducting a successful workshop.

OVERVIEW

Clear Seas, MEOPAR, and exactEarth hosted an interactive workshop on April 11 and 12, 2016 in Vancouver, BC on how advances in maritime traffic monitoring and modelling can directly improve marine safety, planning emergency response and cross-jurisdictional collaboration across the Pacific Northwest.

The purpose of this two-day workshop was to share best practices in monitoring, modelling/application, resource-sharing, government & community engagement and to better understand the role of these activities in policy-making. The overall goal of the workshop was to generate outcomes that lead to increased collaboration and efficiencies across Pacific Northwest Maritime Domain Management systems.

The model for the workshop agenda was to host progressive sessions that are thematically inspired by a conceptual research and policy development process:

Each session was captured graphically by Drawing It Out Graphic Facilitation, and these session snapshots are presented in the *Workshop Highlights* section.

OBJECTIVES

1. To communicate among attendees – best practices and approaches for acquiring, managing and analysing maritime traffic data for the purposes of maritime domain management

2. To identify and discuss wants, needs, and 'use cases' with respect to marine traffic data and applications, from stakeholders' and decision makers' perspectives, as well as from researchers' and analysts' perspectives

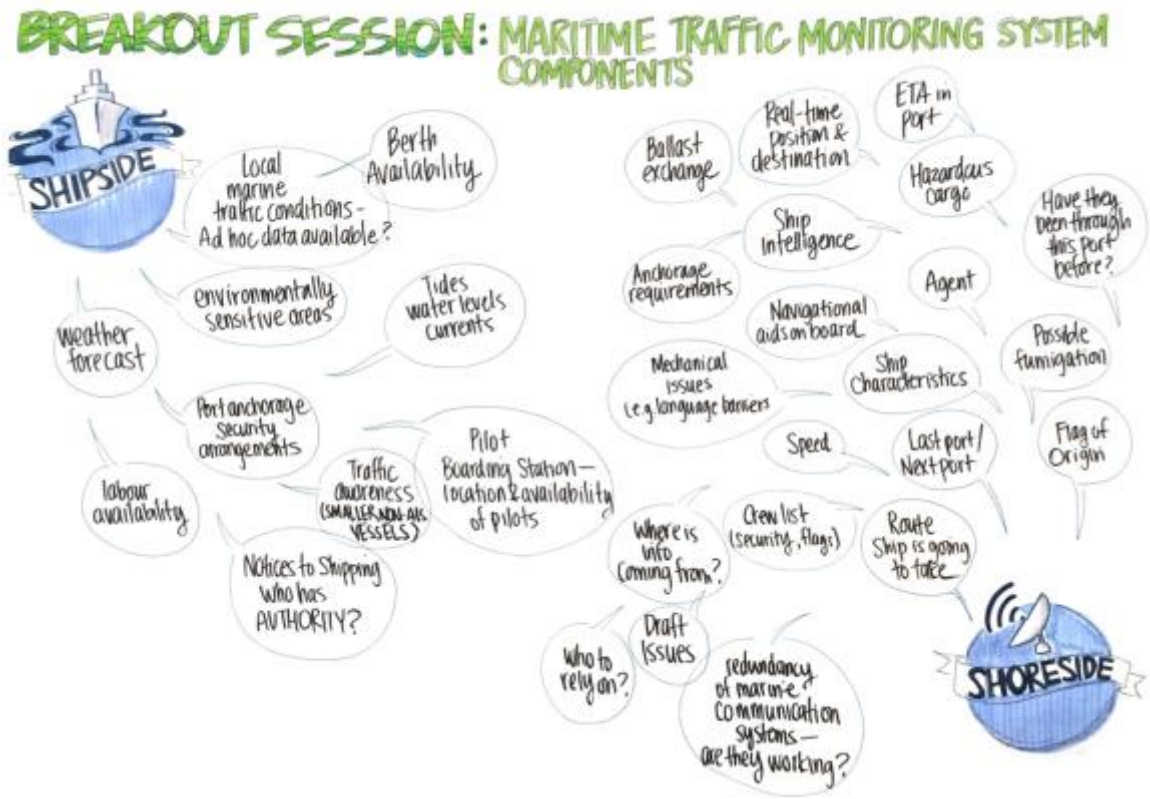
3. To gauge interest in forming an ongoing Working Group (perhaps advising existing marine safety councils and task forces in the PNW) with periodic engagement to continue exploring best practices and developing collaborations in Maritime Domain Management

WORKSHOP HIGHLIGHTS

Monday April 11, 2016

Breakout Session: Maritime Traffic Monitoring System Components

Workshop participants were divided into two groups. One half of the room considered necessary marine traffic monitoring components from the perspective of the ship operator, while the other considered the question from the perspective of a shore-based monitor.



Ship-side
What information do you need to receive from land to enable safe passage to port?

Shore-side
What information do you need about the ship to enable safe passage of the vessel through your waters?

Chris Wellstood | Director, Marine Operations & Harbour Master, Port of Vancouver

What are we looking at and what do we need to be looking at?

The Vancouver Fraser Port Authority (VFPA), doing business as Port of Vancouver, is mandated by the Canada Marine Act to facilitate the safe and efficient movement of goods through the port in a manner that ensures community safety and environmental protection. To achieve this, Port Metro Vancouver employs a Maritime Domain Awareness (MDA) system that primarily relies on establishing situational awareness within the port's boundaries in real-time. Situational awareness involves many eyes, both digital and human, and requires the coordination, analysis, interpretation, and dissemination of big data sets among stakeholders. An array of surveillance technologies (e.g., drones, CCTV cameras, AIS monitoring, moorings) is combined with land- and ship-based human observers (e.g., security guards, coast guard, other stakeholders) to convey real-time information about the vast and complex Port system. The MDA system includes a Domain Awareness Platform that files, processes, and interprets situational information provided by all stakeholders, and includes electronic detection systems to identify aberrant events. Maintaining situational awareness in Port Metro Vancouver requires continuous monitoring efforts by a 24/7 operations center.

Session 1: Maritime Traffic Monitoring

Bernie Dumas | President & CEO, Nanaimo Port Authority

[View Presentation]

All authorities can see the same information at the same time.

The Nanaimo Port Authority (NPA) has partnered with Pentair and Xanatos corporations to apply emerging technologies in establishing Marine Domain Awareness (MDA) within the Port of Nanaimo. The MDA system currently used by the NPA integrates data collected from stakeholders and sensors – including shore- and buoy-based radar systems, AIS gathering and processing, and surface buoys – to provide a holistic view of the port. Pentair buoys have sensors that can send back real-time data to a central data monitoring center, including information on surface oil spills, sea surface height, speed, and direction. The MDA platform developed by Xanatos can produce three-dimensional representations of the port, and allow operators to replay (useful for training purposes). This feature is particularly useful for assessing and providing feedback to marine emergency first responders. Shore-based systems monitor vessels at anchor, and track those moving over a threshold speed. The NPA would like to see their MDA system adopted by ports across the BC coast.

Session 1: Maritime Traffic Monitoring

Gary Paulson | VP Operations & Harbour Master, Prince Rupert Port Authority

Collaboration with many partners allows PRPA to protect safety and the environment in its areas of jurisdiction.

Like all Port Authorities in Canada, the Port of Prince Rupert has been mandated to build marine infrastructure and manage marine services in a safe and ecologically responsible manner. However, the Port of Prince Rupert faces unique problems due to its close proximity to the United States and its isolation from the rest of BC. As the Port expands its activities during the Gateway 2020 Plan, its capacity will increase nearly three-fold, bringing increased vessel traffic and risks. The Prince Rupert Port Authority (PRPA) Harbour Master's Office is responsible for the oversight of all operations, including the maintenance of 24/7 Marine Domain Awareness. The traffic management system includes dedicated communication channels, defined reporting points, AIS monitoring, and soon will include shore-based radar as of July 2016 - a collaborative project with the CCG, RCMP, and Department of National Defense. Safe and secure operations at the Port are maintained by strong collaborations with industrial and governmental stakeholders, including Transport Canada, the Canadian Coast Guard, the Pacific Pilotage Authority, SAAM SMIT Canada, Western Canada Marine Response Corporation, and others. As the PRPA prepares for expanding their operations, they have undertaken a number of initiatives, including improved E-navigation, air and water quality monitoring programs, commercial vessel inspections, and annual tabletop simulation exercises where all stakeholders learn to collaborate effectively.

Session 1: Maritime Traffic Monitoring

Daniel Breton | Senior Director, World Class Strategies, Canadian Coast Guard

View Presentation

Mariners require a single authoritative source of relevant information.

The Canadian Coast Guard (CCG) plays an important role in supporting economic growth in Canada while protecting Canadian waters and those individuals navigating them. The CCG is the primary authority for marine traffic monitoring, and thus plays an integral role in creating and maintaining situational awareness in Canadian ports and surrounding waters. Along with a number of other governmental agencies, the CCG focuses on the provision of authoritative data for mariners. Data sources include land and sea-based radar, AIS monitoring, Long Range Identification Tracking, satellite and aerial surveillance, and radio communications. Recently, the CCG has implemented and refined an e-navigation strategy and Maritime Information Portal. The aim of the e-navigation program is to provide mariners with real-time information they require in order to plan and execute their voyages in a safe and efficient manner. Beginning in 2008, engagement with the primary end-users – pilots, shipping companies, fishing vessels, and the marine industry – began, and involved multiple steering committees and recursive feedback to refine the approach. In 2012, the initiative began, and involved investments into the e-navigation and a ship-source spill prevention and response regime.

Rajiv Taneja | Regional Sales Manager, exactEarth

View Presentation

Tracking small vessels is a challenge for all governments.

exactEarth provides enhanced maritime domain awareness to users around the world using a patented Satellite AIS technology combined with geospatial information analysis and display. AIS is currently the most common method for tracking ships, and all SOLAS vessels must have a Class A transponder (operating at 12.5 W). The cost of Class A transponders can be prohibitive for small vessels, and Class B are used instead (operating at 2 W). Unfortunately, while the former transponder signals can be easily detected by satellites, the latter cannot. exactEarth and SRT have produced a patented Advanced Class-B Satellite Enabled AIS (ABSEA) encoding system that significantly improves Class B transponder signal detection by satellites. ABSEA is compact, battery powered, and transmits a full Class B message with a 2.5 hour battery life.

exactEarth also has a forthcoming exactASM project. All vessels are potential "floating observatories" to collect real-time atmospheric and oceanographic information in addition to ship operating data. Sending this data using current commercial maritime machine-to-machine communications platforms is costly. By using AIS for transferring data from vessels, moorings, and buoys, the data transfer cost is reduced dramatically, which could provide near real-time data for maritime domain management. In 2015, new channels for AIS use were approved.

Donna Kocak | Advanced Programs Engineer, Harris Corporation

View Presentation

Data has many applications and many recipients. Interpreting and understanding data provides value.

Harris Corporation recently teamed with exactEarth to produce the next generation of real-time satellite AIS systems. Currently, 53,000 unique vessels report 6.5 million AIS positions with a 30-minute average global latency period. However, the iridium NEXT satellite constellation, consisting of 66 operational satellites, will increase spatial and temporal coverage of AIS data collection and reduce the latency period to less than 1 minute. This is due in part to the deployment of both omni and collinear antennas that provide increased coverage and detection in regions with high vessel density. Using big data analysis and computation schemes, Harris aims to use big AIS data to understand global trends in vessel movement.

Ed Page | Executive Director, Alaska Marine Exchange (MXAK)

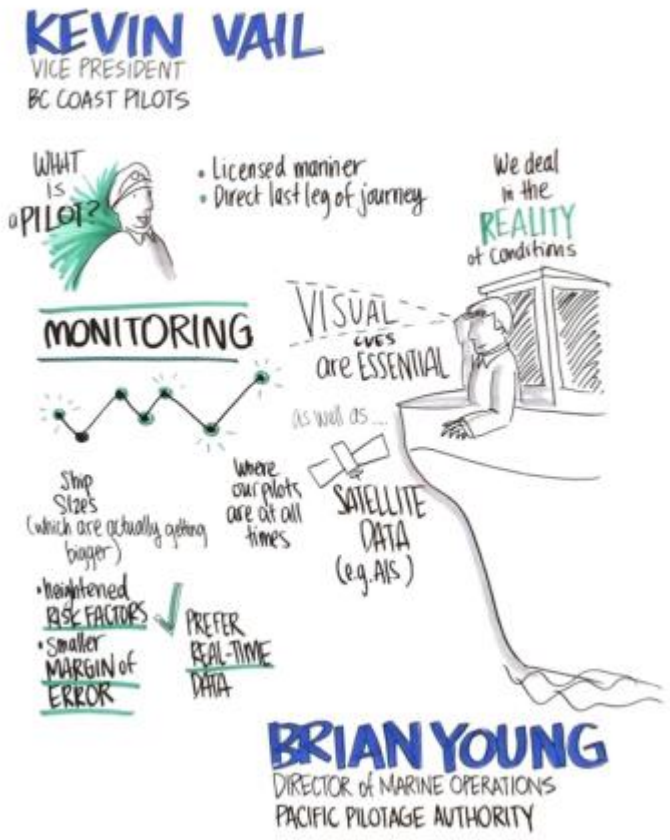
View Presentation

Increase capabilities by sharing information, technology, and solutions.

Although the marine shipping sector has few accidents per year, those that occur often have great environmental and economic consequences, resulting in a high level of public scrutiny. This is particularly important for Alaska, given its proximity to other international waters and difficult transit routes (e.g., inclement weather, Aleutian Islands). The MXAK is a non-profit organization established in 2000 to provide information and services to mariners to ensure safe and secure vessel movement in and around Alaska. The MXAK receives funding from industry and government partners and uses both established and new technologies to manage Maritime Domain Awareness, including satellite and land-based AIS tracking of vessels and self-supported remote transponders. These systems provide MXAK the time required to contact ships that have strayed from approved transit routes before marine casualties occur. The ability to respond is a combination of information (what is going on), time (how long do we have to react), and capabilities (can we help). New risk mitigation protocols help reduce and prevent marine casualties, such as the R&D of a ship arrestor system. To continue the improvement of Marine Domain Awareness across BC and Alaska, MXAK would like increased sharing of vessel information and tracking technologies, and exploring and developing non-regulatory compliance solutions and risk mitigation solutions.

Session 2: Modelling & Applications of Maritime Traffic Data

Kevin Vail | Vice President, BC Coast Pilots
Brian Young | Director, Marine Operations, Pacific Pilotage Authority



View Presentation

Safe navigation is possible through a combination of actual (eyes) and perceived (AIS, satellite) data.

Marine pilots are licensed mariners responsible for navigating vessels on their final leg through Canadian waters. Pilots liaise with numerous entities to get the information that they require, including the Canadian Coast Guard, Transport Canada, Environment Canada, local port authorities, and other stakeholders. Maintaining real-time situational awareness is essential for executing safe and efficient vessel transit, as pilots must often take action with less than 4 second latency in order to avoid marine causalities. Pilots have expert knowledge of safe navigation corridors and rely on visual and audio surveillance, augmented with satellite and ship technologies, to reduce the information receiving latency period. Pilots conduct their own measurements and calculations to avoid seabed collisions and make more economical transit decisions. Pilotage knowledge is even more important as ship sizes increase, decreasing any margin of error. Pilots undergo continuous training, including simulations and live trials (e.g., tethered tug exercises) to test the simulations. Given the stakes involved, care must be taken when introducing new technologies or approaches into marine pilotage operations to make sure any new tools add value.

Session 2: Modelling & Applications of Maritime Traffic Data

Orla Robinson | Program Manager, ECHO, Port of Vancouver

View Presentation

Working collaboratively to find effective solutions to cumulative impacts of marine shipping.

Within the Straits of Georgia and Juan de Fuca, cetacean migration and feeding routes overlap with shipping lanes. Through engagement with regional stakeholders – including industry, academia, government, NGOs, and First Nations – Port Metro Vancouver's Enhancing Cetacean Habitat and Observation (ECHO) program aims to understand and mitigate the cumulative effects of commercial shipping activities on sensitive whale populations in British Columbia. ECHO identified vessel noise and strike as two primary risks facing cetaceans, and have undertaken three projects to address these risks. Using vessel size and speed information collected from AIS data, cumulative vessel noise throughout the Straits of Georgia and Juan de Fuca was determined using a regional acoustic model. Vessel noise is due to four primary factors: hull cleanliness, propeller quality, engine dampeners, speed. Total noise also varies seasonally due to changes in seawater temperature and vessel activity. To characterize vessel sounds, the ECHO Underwater Listening Station is quantifying noise emitted by specific vessels transiting over hydrophones installed at the Ocean Networks Canada East Node. AIS data collected concurrently allows individual vessel noise to be ranked, mitigation solutions to be assessed, and could form the basis for future noise reduction incentive programs. Currently, a mobile app is being developed that could alert pilots and vessel captains of whale sightings in order to reduce vessel strikes.

Session 2: Modelling & Applications of Maritime Traffic Data

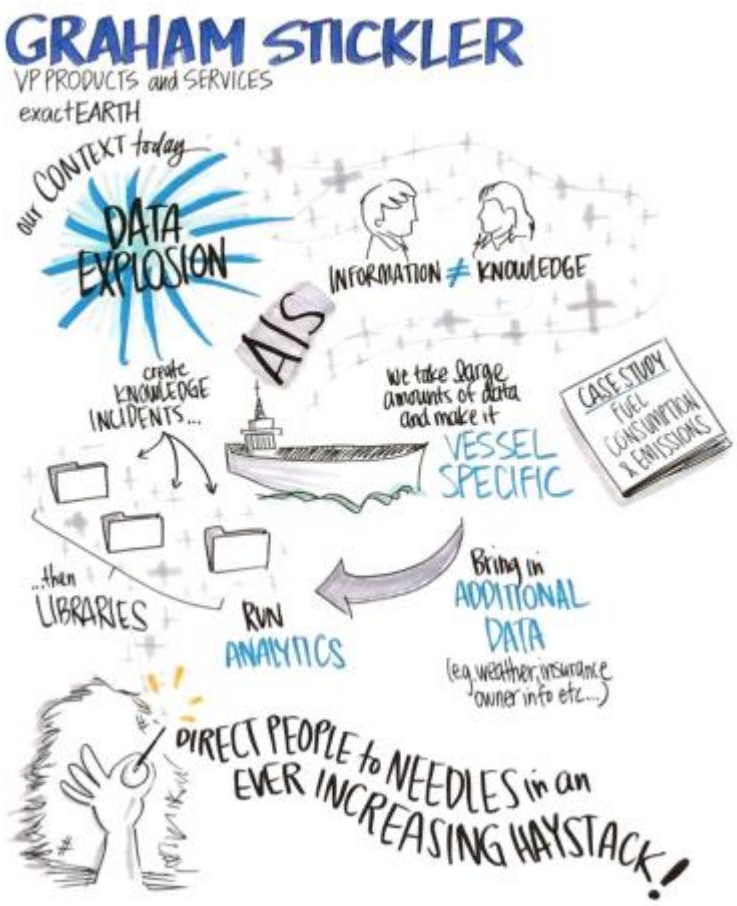
Kristina Boerder | PhD Candidate, Dalhousie University / MEOPAR

Using AIS data to detect, classify, and map global fishing efforts to understand stock management and environmental impacts.

Marine fish catches have stagnated since the 1990s despite increased fishing effort. As a result, currently less than 10% of fish species are underfished, while nearly 30% are overfished by an estimated 4.7 million fishing vessels globally. Understanding *who* is fishing *where*, *when*, and *what* fish species is important for fisheries management, marine conservation, biodiversity, and food security. In collaboration with exactEarth and other government and academic stakeholders, Dr. Boris Worm's group at Dalhousie University set out to develop algorithms using AIS data to categorize fishing vessel types (e.g., purse seine, trawlers, long liners) and estimate fishing effort. Using unique spatial and temporal qualities of ship tracks for different vessel categories, including vessel speed, time of day, duration of fishing, and spatial-temporal movement patterns, the algorithms were able to correctly identify fishing vessel categories with a minimum 83% accuracy. This tool can be used to map fishing trends, protect sensitive marine areas, predict fishing efforts, identify variances with established policies, and quantify fishing benefits and bycatch. By the end of 2016, the Worm group will be releasing their algorithms as a tool to make data widely available in combination with Skytruth, Oceana, and Google Earth Outreach.

Session 2: Modelling & Applications of Maritime Traffic Data

Graham Stickler | VP Products & Services, exactEarth



[View Presentation]

The explosion of AIS data does not equate to an explosion of knowledge about maritime traffic.

Big AIS data is upon us, and there are unique and powerful opportunities available through increased marine traffic monitoring. In order to access this knowledge, the development of appropriate methods for processing and analyzing the data, along with frameworks for understanding emergent data properties, is necessary. exactEarth is creating big data AIS infrastructure, allowing for real-time collection and limitless archive of all data. Currently, exactEarth and its partners are mining AIS data in order to identify and characterize "needles" within the big "AIS" haystack of data, including vessel behavioral anomalies. The AIS data infrastructure is connected with other data sources (e.g., environmental data sources), and this allows exactEarth to study and model vessel activities. For example, the exactEmissions program combines AIS information and operational assumptions to estimate vessel emissions, and these estimates are validated with actual vessel operational data. This will help shipping companies reduce greenhouse gas emissions, and allow them to monitor real-time emissions estimates.

Session 2: Modelling & Applications of Maritime Traffic Data

Dr. Rosaline Canessa | Associate Professor, University of Victoria / MEOPAR

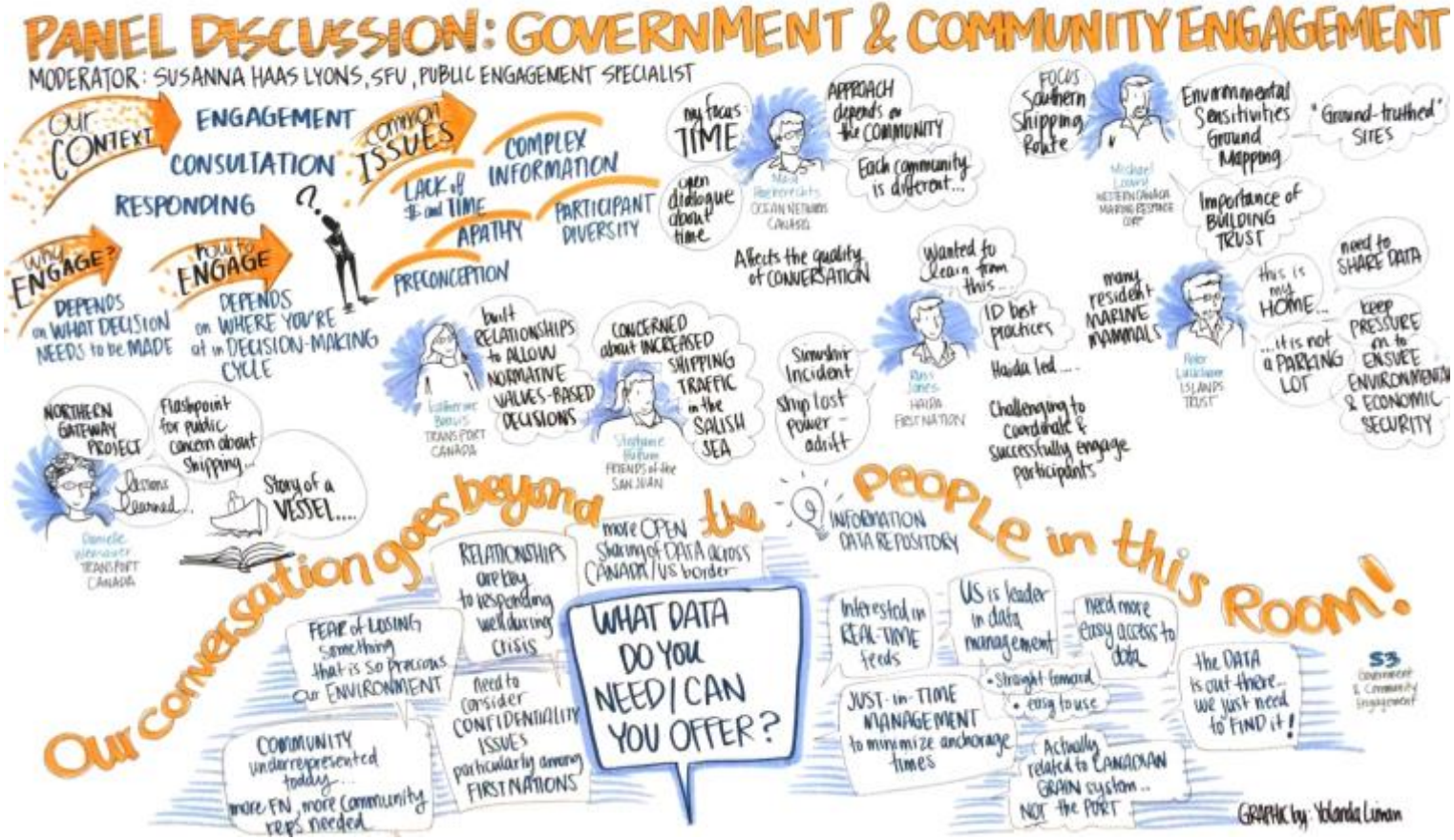
[View Presentation]

Shipping traffic can be used as a proxy for underwater noise to determine cumulative impacts.

Marine vessel traffic in and around Marine Protected Areas (MPA) present a number of stressors to sensitive marine life, including groundings, discharges, oil spills, and noise. Cumulative vessel noise in offshore MPAs is difficult to assess due to the use of cost prohibitive acoustic recorders. However, satellite derived AIS data could reduce tracking costs and improve models of vessel traffic and cumulative noise. Although the SGaan Kinghlas – Bowie Seamount (SKBS) has been designated an MPA, the volume of vessel traffic and noise stress to marine mammals has not been quantified. In the SKBS, a collaborative group has begun building spatio-temporal vessel movement and cumulative noise exposure models. Although there are AIS data gaps, and the current model has difficulty estimating vessel speed, satellite-based AIS surveillance coupled with acoustic monitoring was able to cross-verify between 31% and 72% of vessel traffic near the SKBS. Other sources of data are being considered to further corroborate AIS data, such as permits. Once the vessel traffic and cumulative noise models are refined, they will be integrated to build decision support tools that can help inform stakeholder decision-making and noise mitigation strategies. A number of emerging noise concerns at the SKBS have emerged, including the projected growth at the Port of Prince Rupert and possible changes to Alaskan route regulations.

Session 3: Panel Discussion – Government & Community Engagement

Moderator	**Susanna Haas Lyons** | Simon Fraser University	
Panel	**Katherine Beavis** | Transport Canada	**Danielle Wensauer** | Transport Canada
	Michael Lowry | WCMRC	**Peter Luckham** | Islands Trust
	Maia Hoeberechts | Ocean Networks Canada	**Russ Jones** | Haida Nation



Session 3: Panel Discussion – Government & Community Engagement

Engagement is seeking decision-making input from people most likely to be impacted; consultation is seeking feedback on established topics from people most likely to be impacted. In both situations, the process matters.

Engagement and consultation are important components when effectively and efficiently addressing an issue with multiple stakeholders. Engagement improves the quality of decisions, increases understanding of issues and perspectives, provides transparency, identifies critical issues early in the decision-making process, and promotes collaboration. The goal is to create a collaborative and productive relationship with stakeholders.

The extent of engagement recommended for an issue depends on whether the issue is technical or values-based, routine or controversial, offers one or many solutions, impacts few or many people, and is perceived as low or high risk. Engagement and consultation are required at different and often multiple points in the decision-making cycle as a project progresses.

Using a number of case studies, the panel addressed important aspects concerning community engagement, including:

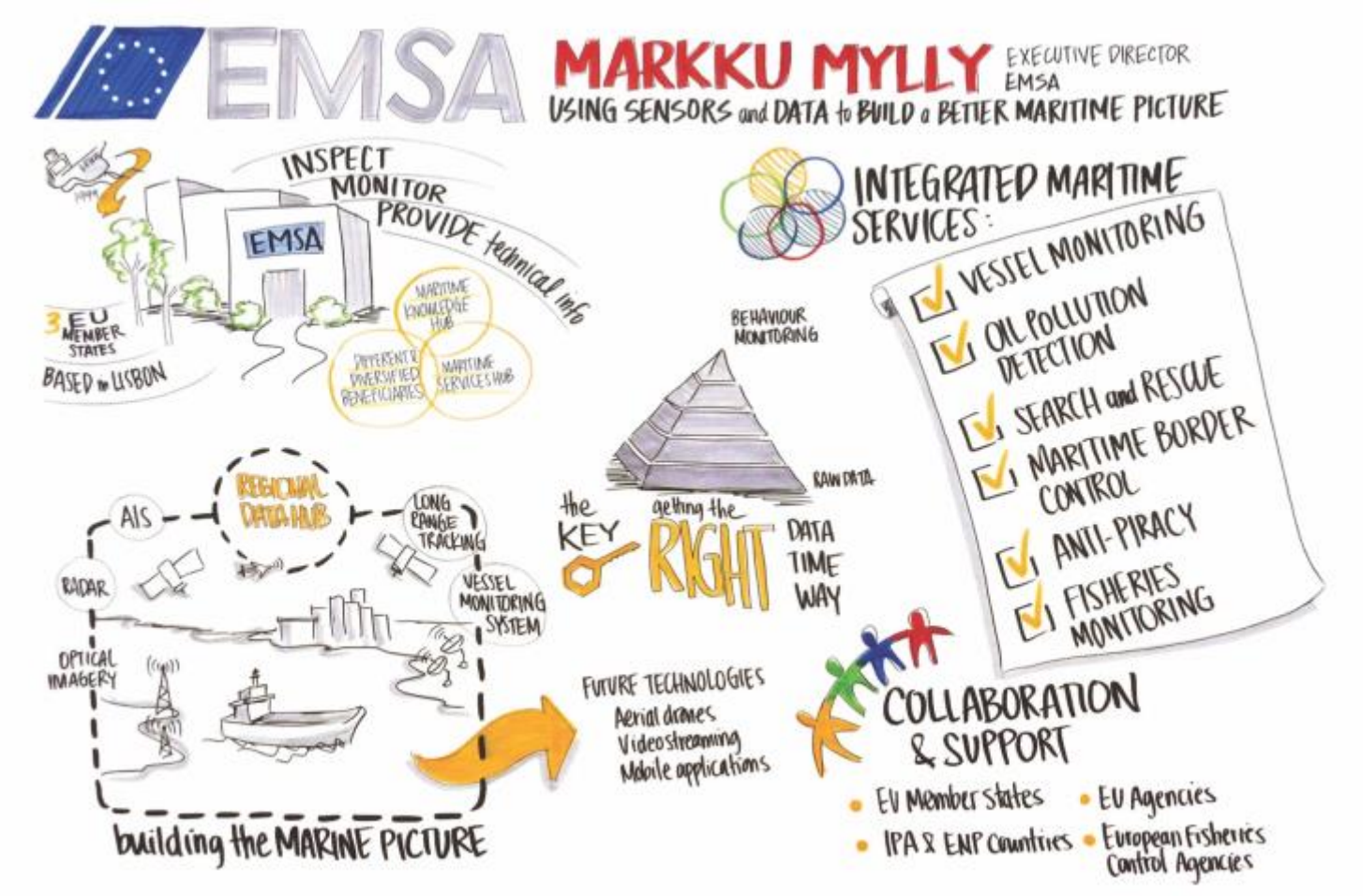
- Creating a common level of understanding can be challenging: communities typically have a broad range of understanding and knowledge about a topic.
- Investing the time that engagement requires to be successful.
- Respecting different cultural perspectives while balancing technical and values-based concerns
- Providing information that is accessible and has relevance to the community you are engaging – and knowing that each community is different
- Recognizing that important conversations take time and may not conform to your schedule.
- Understanding that the conversation has to go both ways – ask communities for their knowledge and values.
- Relying on relationships created in advance of a crisis – it is much harder to create an atmosphere of trust during a crisis.
- Sharing, coordinating, and harmonizing data is necessary for evidence-based engagement and decision-making, but stakeholders' confidentiality requirements must be respected.

View Presentation

Tuesday April 12, 2016

Keynote Presentation

Marku Mylly | Executive Director, European Maritime Safety Agency



Tuesday April 12, 2016

Selecting and presenting data to create the right information at the right time in the right way for each end-user.

As a result of the *M/V Erika* sinking and oil spill off the coast of Brittany in 1999, the European Union (EU) established the European Maritime Safety Agency (EMSA) in 2002. Based in Lisbon, Portugal, the agency acts as a hub for maritime knowledge and services to a diverse group of beneficiaries and stakeholders across the EU. The EMSA assists the commission by monitoring and implementing EU maritime shipping regulations, visits the 23 coastal member states to verify that directives are implemented and transposed to legislation in a harmonized way, and provides aid to member states through prevention and detection of, and response to, marine pollution events. The EMSA relies on a complex array of information sources to provide its Integrated Maritime Services (IMS) product for users across the EU. These sources include satellite-based optical imagery and AIS surveillance (e.g., the European Space Agency *Copernicus Project*), drones, land-based radar and video imagery, and other sources of meta-ocean data. The surveillance system is managed by individual member states, and collected information is transferred to regional EMSA databases to be analyzed and incorporated into the IMS. Data products are tailored for end-users while respecting local government rules for data privacy. Using big data analytics, EMSA is developing algorithms to define and monitor anomalous vessel behavior. EMSA provides end-users with 24/7 support, and automatic alerts can be sent to mobile devices. The coordination and collaboration between EMSA, government, and other organizations allows for enhanced Marine Domain Awareness within the EU while reducing redundancy and unnecessary spending. This awareness has been used to detect oil spills, monitor fisheries, limit piracy, and rescue vessels in distress, such as a refugee vessel off the coast of Libya with 370 lives saved as a result of satellite surveillance.

View Presentation

Benoît Pirenne | Director of User Engagement, Ocean Networks Canada

View Presentation

Discover the ocean, understand the planet.

Based at the University of Victoria, BC, Ocean Networks Canada (ONC) operates a set of subsea observatories with installations in the Salish Sea, BC, the Northeast Pacific Ocean, BC, Cambridge Bay, NU, and the Bay of Fundy, NS. ONC addresses four primary scientific themes: human-induced change, life on the BC coast, seafloor/ocean/atmosphere links, and the seafloor in motion. The sensors installed at each observatory provide near real-time access to physical, chemical, biological, and geological information about the ocean over long periods of time. The ONC Smart Ocean Systems™ support marine safety, public safety, and ocean health via Marine Safety Data products. These include sea state information and surface current maps for vessels in transit, marine mammal avoidance systems using real-time hydrophone data and alert systems, real-time traffic alerts, oil spill response, and early earthquake and tsunami warning systems. Work at ONC is done in partnership with academic, governmental, and industrial partners to advance marine research and technological advancement for the benefit of Canadians.

Session 4: Resource-Sharing and Collaboration

John Veentjer| Chair, Puget Sound Harbor Safety Committee

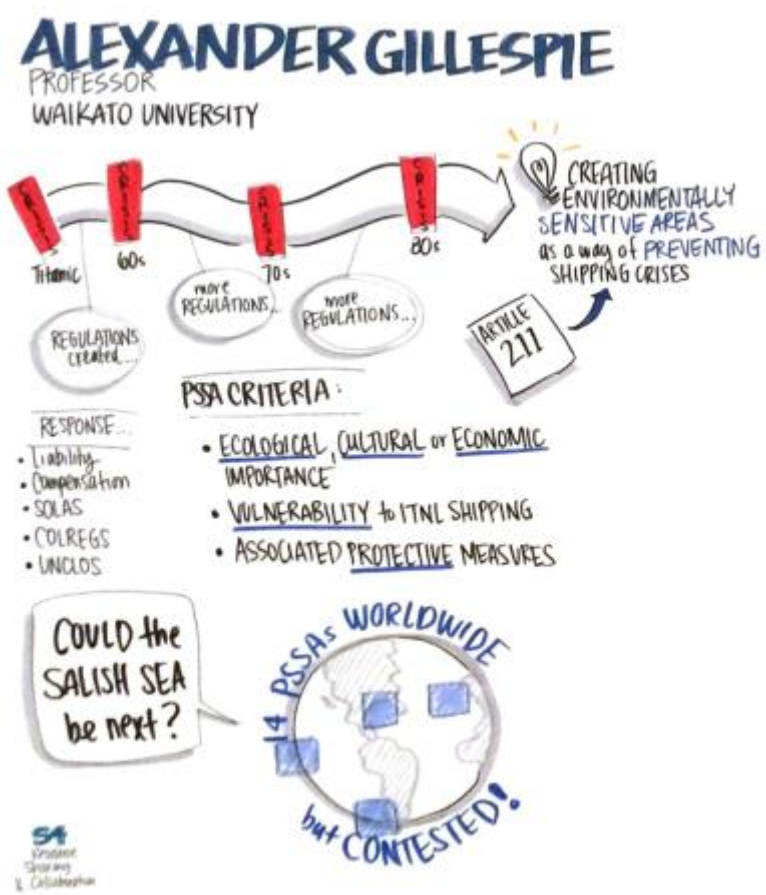
View Presentation

Mutual cooperation creates a unique partnership for success.

The Marine Exchange of Puget Sound (MXPS) is a non-profit organization that provides its members – vessel operators, port authorities, state and federal agencies – information and services to ensure safe and efficient marine operations in the Puget Sound area. This includes monitoring and tracking of deep-draft vessels, daily shipping and AIS reports for Puget Sound and Grays Harbor, and data analysis and statistical reports, among others. The MXPS owns and operates a shore-based AIS network that tracks vessel movement along the north Washington coast. The Puget Harbor Safety Committee (PSHSC) is a volunteer organization that brings stakeholders, including the MXPS, together to balance economic, security, recreational, and environmental needs and prevent accidents. All work performed by PSHSC is consensus based enabled by close collaboration between partners. Voting members include groups from local labor organizations, commercial fishing, environmental, Native American, port authorities, and many others. The PSHSC receives advice from state and national governmental organizations, including NOAA, the DoD, the USCG, and the US Navy. Important initiatives developed in Puget Sound include the Puget Sound Harbor Safety Plan, a Comprehensive Marine Safety System, the Canada/United States Cooperative Vessel Traffic System, and the West Coast Offshore Traffic Risk Management Project. Cooperation among stakeholders has been key to the ongoing development of best practices in Puget Sound.

Session 4: Resource-Sharing and Collaboration

Dr. Alexander Gillespie | Professor, Waikato University



View Presentation

Time to move from reactive regulation to proactive protection.

International law and regulations have a history of reacting to significant maritime accidents instead of proactively protecting people and the maritime environment. As the number and size of ships has increased, crises have occurred, to be followed by the establishment of SOLAS, MARPOL, IMO and other regulations and institutions. Despite these developments, spills and vessel loss are not impossible, and some believe that certain areas are too sensitive to be put at risk of maritime accidents. The development of Particularly Sensitive Sea Areas (PSSA), protected by the IMO due to recognized economical, culture, or ecological reasons, are intended to protect areas particularly vulnerable to maritime activities. Protections afforded by PSSA include limiting vessel traffic, recommended pilotage, no or limited anchorage, and discharge prohibition, but do not limit recreational and commercial fisheries. Criteria for the PSSA designation are based on international best practices, and include ecological, cultural, scientific, and shipping criteria. Currently, there are 14 recognized (and highly contested) PSSA worldwide, and the Salish Sea is contending to qualify as one. Compared to the other PSSAs, the Salish Sea shares a number of ecological resources (e.g., fish, marine mammals), cultural uses (e.g., tourism, fishing, indigenous groups) and scientific resources (e.g., government and academic researchers). Whether the Salish Sea will receive PSSA status is not yet certain.

Session 4: Resource-Sharing and Collaboration

Dr. Richard Wiefelspuett | Executive Director, Clear Seas Centre for Responsible Marine Shipping

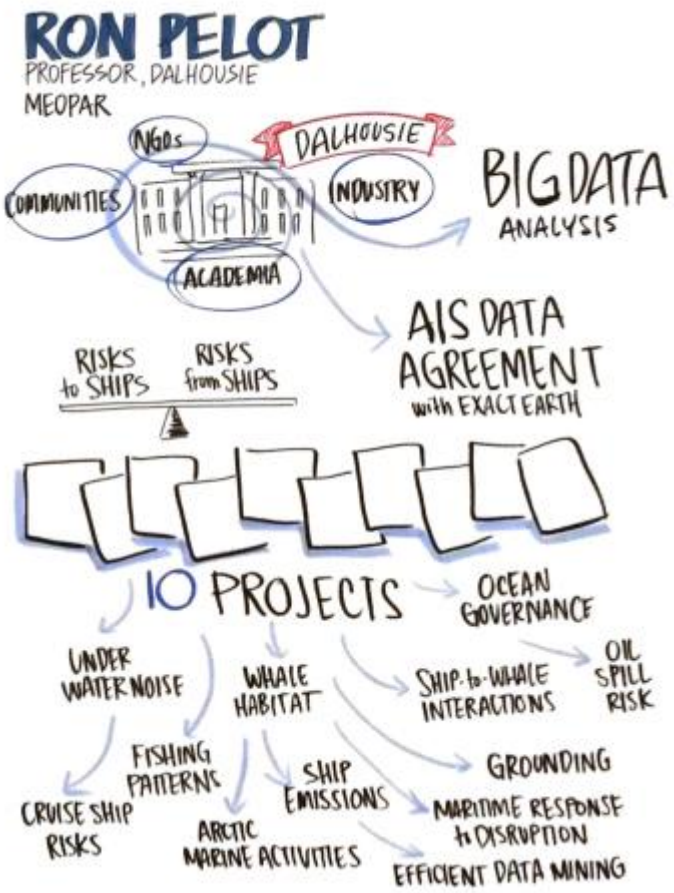
View Presentation

Canadians expect better collaboration among marine shipping stakeholders.

Marine shipping is increasing worldwide, and with this comes increased risks, both real and perceived, and the potential for increased conflict among stakeholders. Clear Seas aims to provide accurate, evidence-based, and impartial information to inform decisions about marine shipping made by private and public organizations in Canada. In fall 2015, Clear Seas partnered with Angus Reid Institute to poll 2300 Canadians to determine how they feel about marine shipping. Approximately 75% of those polled felt that marine shipping made vital contributions to the economy in Canada and benefited coastal communities. Although 73% of Canadians thought that marine shipping activities are generally safe, ~40% felt worried about the transport of petroleum in Canadian waters, despite a low occurrence of accidents as a percentage of total vessel transits. The majority of Canadians (64%) are confident in the regulations covering marine shipping, while ~50% of Canadians are concerned that not enough oversight is in place. When asked whether there had been a major oil spill in Canadian waters in the last decade, only 14% of Canadians answered correctly. This demonstrates that there exists significant public misinformation concerning marine shipping safety records. Clear Seas will seek to change the risk/benefit equation by reducing risks and increasing benefits resulting from marine shipping through the development and implementation of best practices.

Session 4: Resource-Sharing and Collaboration

Dr. Ronald Pelot | Professor, Dalhousie University / MEOPAR



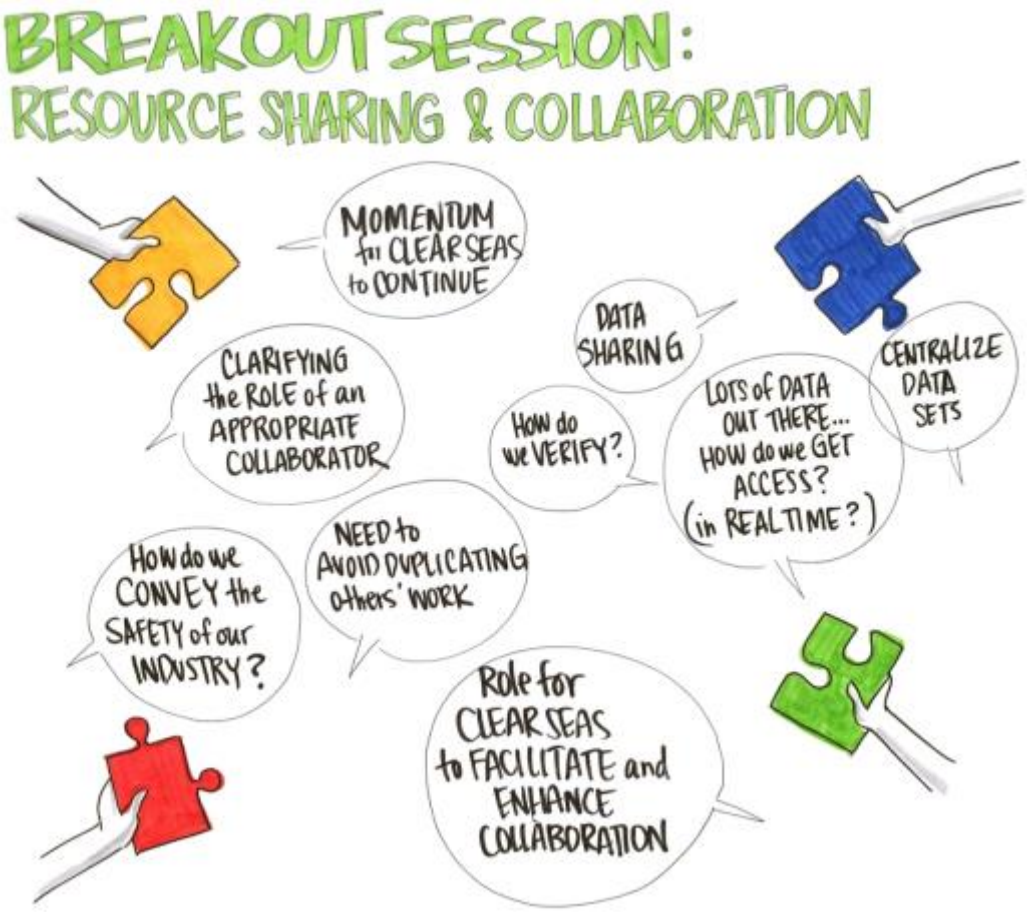
View Presentation

Combining big data with collaborative partnerships to investigate risks to ships and risks from ships.

Based at Dalhousie University, the Marine Environmental Observation, Prediction, and Response Network (MEOPAR) aims to understand, research, and provide mitigation solutions to marine risks through developing partnerships among communities, universities, NGOs, and industry. The marine risks include risks to ships (e.g., ice, weather, tides and currents) and risks from ships (e.g., whale strikes, noise, water and air pollution, invasive species transport). One example of successful partnership is the engagement by MEOPAR, exactEarth, the Big Data Analytics group at Dalhousie University, and multi-disciplinary research groups across Canada to acquire, process, and analyze satellite AIS data. This data is currently being used in ten projects being undertaken by MEOPAR funded groups. These include developing an early warning system to prevent whale strikes; identifying patterns of fishing activity; creating 3D models of whale-ship interactions in the St. Lawrence Seaway to reduce whale strikes; developing emergency response and planning measures for shipping routes in the Strait of Georgia; quantifying marine vessel aerosol pollution in Halifax harbour; identifying shipping trends in Arctic waters; modeling end-to-end oil spill risks in Atlantic Canada; and establishing ideal vessel distribution for Search and Rescue Planning in the Northeast Atlantic. Lastly, the Institute for Big Data Analytics is developing novel ways to process, store, analyze, and present big data products for end-users.

Breakout Session: Collaboration for Traffic Monitoring in the Pacific Northwest

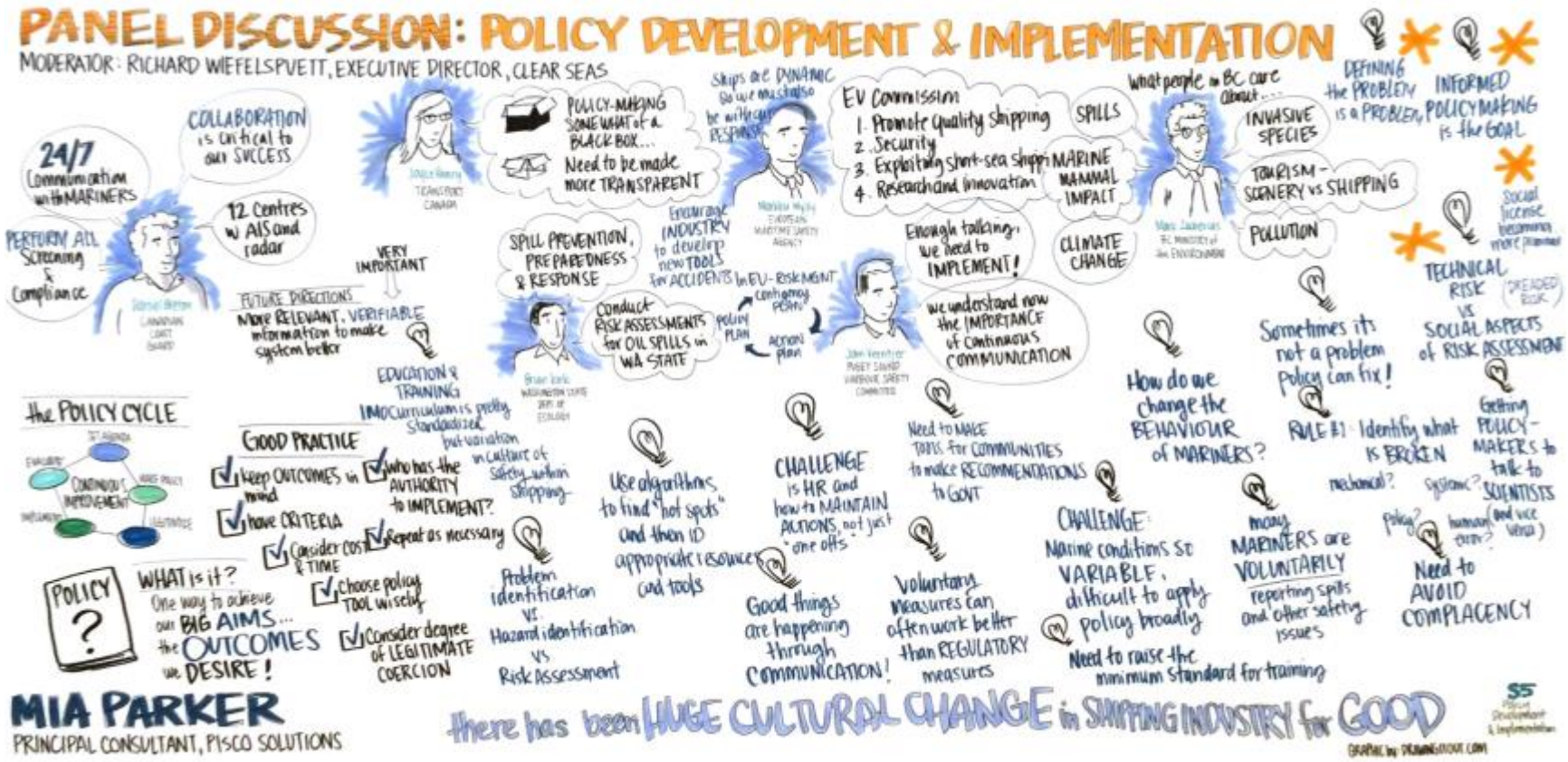
- What can we take away from the morning's examples to improve collaboration in the Pacific Northwest region?
- What is the common ground among us?
- We have a lot of information – how do we move forward?



Session 5: Policy Development & Implementation

Moderator: **Mia Parker |** Principal, Pisco Solutions

Panel: **Daniel Breton |** Canadian Coast Guard
Brian Kirk | WA Department of Ecology
Mark Zacharias | BC Ministry of the Environment
Joyce Henry | Transport Canada
John Veentjer | Puget Sound Harbor Safety Committee
Markku Mylly | EMSA

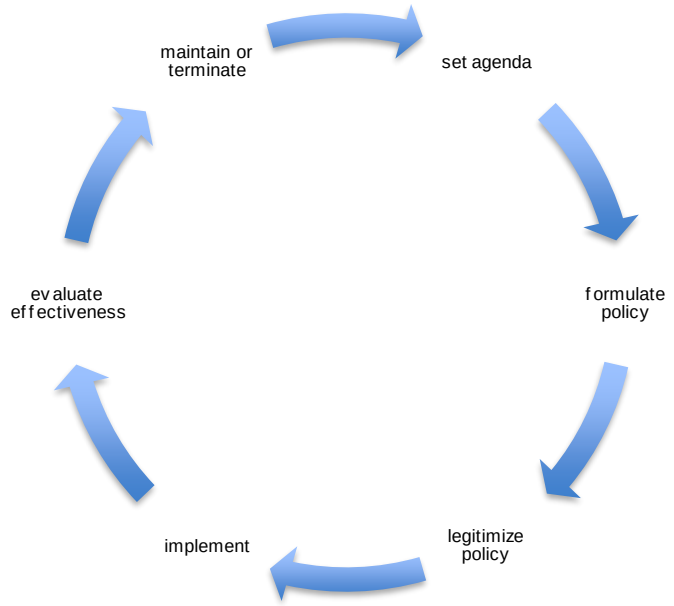


Session 5: Policy Development & Implementation

Ask what people care about and whether we have a common problem definition, before trying to create policy to solve it.

Developing any policy for implementation, whether public, regulatory, or fiscal, requires a number of steps. Start by defining the problem, then assemble evidence, construct alternatives, select evaluation criteria, project outcomes, confront trade-offs, and tell the story. Evidence to support policy formation can include statistical analyses, science-based advice, legal opinions, expert knowledge, or public opinion.

Policy formulation happens according to a development cycle that can repeat as necessary:



View Presentation

The panel participants had a number of comments on policy making as applies to marine shipping and safety:

Policy creation needs to be an open and transparent process, moving away from the "dark art / sausage factory" it is perceived to be.
When defining a problem for policy to solve, recognize people have different values and views. The first step is to create agreement on the definition of the problem.
Take your findings and use them to create actions.
Policy comes from *polis* (Latin for "people"). Ask first: "what do people care about?"
The gold standard is informed policy making based on a robust framework and supported by evidence.
Start by creating common ground upon which a conversation can take place.
Voluntary measures can often be more effective than regulation – it doesn't have to be the default.
Maritime accidents are difficult to predict due to variability in conditions, making appropriate policy equally difficult to predict.

Session 6: Next Steps & Action Planning

- ☑ Government to take a stronger role in creating policy from information.
- ☑ Improve quality control process for reviews (did they find all relevant points), timeliness for feedback, iterative process of review with follow-up, focus on broader socioeconomic context.

- ☑ Need representative, standardized data.
- ☑ Need to prevent privacy concerns from becoming a barrier.
- ☑ Different groups have need for different types of data.

- ☑ Facts don't matter if misperception of risk persists.
- ☑ Need a coordinating body – when people have an interest in maritime issues, need to have a single source of info.
- ☑ Information going to ships must be important – do not distract from navigation.

COMMENTS AND FEEDBACK

"Super workshop and again I recommend this be repeated at least annually. Working with the U.S. counterparts, this workshop can and should be semi-annual alternating between countries."

"Extremely useful from the perspective of global monitoring and management of maritime traffic."

"Use of a graphic artist to capture ideas and comments was a great idea."

"The networking opportunity was excellent as there was diversity in the room and many experts to speak with."

"Appreciated Clear Seas bringing shipping and related leaders and the opportunity to hear from the EMSA."

"Look forward to Clear Seas continuing to support collaborative interactions with shipping and related stakeholders."

In the opinion of participants…

95%	information presented was quite/extremely well organized
78%	event was quite/extremely well-structured
75%	all/most objectives were met
70%	information presented was quite/extremely useful
60%	event was somewhat/quite a bit better than expected

View Complete Feedback Results

APPENDIX 1 - PROGRAM AGENDA

Day 1: April 11, 2016

Registration

Opening Remarks

Breakout Session: Challenges of Existing Traffic Monitoring System

Session 1: Maritime Traffic Monitoring

- Maritime traffic data acquisition, storage, processing
- Best practices for Maritime Domain Management
- Different organizations and technological platforms involved in maritime traffic monitoring on the PNW Coast

Chris Wellstood | Director of Marine Operations & Harbour Master,
Port Metro Vancouver

Bernie Dumas | President & CEO, Nanaimo Port Authority

Networking Break

Gary Paulson | VP Operations & Harbour Master,
Prince Rupert Port Authority

Daniel Breton | Senior Director, World Class Strategies,
Canadian Coast Guard

Donna Kocak | Advanced Programs Engineer, Harris Corporation
Rajiv Taneja | Regional Sales Manager, exactEarth

Hosted Lunch

Session 2: Modelling & Applications of Maritime Traffic Data

- Use-cases for maritime traffic data in terms of modelling trends in shipping, risks, noise, collision areas, pollution, planning for shipping exclusion zones, applications for traffic management
- Future directions in modelling for improving Maritime Domain Management

Ed Page | Executive Director, Alaska Marine Exchange

Kevin Vail | VP, BC Coast Pilots
Brian Young | Director of Marine Operations, Pacific Pilotage Authority

Orla Robinson | Program Manager, ECHO, Port Metro Vancouver

Kristina Boerder | PhD Candidate, Dalhousie, MEOPAR

Energizer Break

Graham Stickler | VP Products & Services, exactEarth

Rosaline Canessa | Associate Professor, UVic, MEOPAR

Networking Break

Session 3: Government & Community Engagement

- Perceived risks of marine shipping in coastal and Aboriginal communities
- Lessons learned from ongoing community engagement programs focused on understanding perceived risks and educating citizens about marine shipping issues
- Data requirements and needs for coastal communities, Aboriginal communities, and municipal governments

Susanna Haas Lyons | Public Engagement Specialist, SFU
Presentation: *Principles for Effective Dialogue and Civic Engagement*

Panel Discussion:

- **Katherine Beavis** | Senior Consultant, Aboriginal Relationships, Transport Canada
- **Stephanie Buffum** | Executive Director, Friends of the San Juans
- **Maia Hoeberechts** | Associate Director of User Services, Ocean Networks Canada
- **Russ Jones** | Project Manager for Haida Oceans Technical Team, Haida First Nation
- **Michael Lowry** | Manager of Communications, Western Canada Marine Response Corp
- **Peter Luckham** | Council Chair, Islands Trust
- **Danielle Wensauer** | Special Advisor, Marine Safety & Security, Transport Canada

Reception at Lions Pub, 888 W Cordova St

Day 2: April 12, 2016

Markku Mylly | Executive Director, European Maritime Safety Agency Keynote Presentation: *Using Sensors and Data to Build a Maritime Picture - Maximizing the Usefulness of Available Information*

Session 4: Resource-Sharing & Collaboration

- Challenges and opportunities for developing coast-wide monitoring systems across national jurisdictions
- Case studies of successful multi-jurisdictional Maritime Domain Management systems
- Creating uniform repositories for maritime traffic data

Benoît Pirenne | Director of User Engagement, Ocean Networks Canada

John Veentjer | Chair, Puget Sound Harbour Safety Committee

Networking Break

Alexander Gillespie | Professor, Waikato University

Richard Wiefelspuett | Executive Director, Clear Seas

Ron Pelot | Professor, Dalhousie, MEOPAR

Breakout Session: Collaboration for Traffic Monitoring in the PNW

Hosted Lunch

Session 5: Policy Development & Implementation

- Role of science and evidence-based research in marine policy development
- Data requirements for policy development in marine safety
- Inter-agency collaborations related to marine safety

Mia Parker | Principal Consultant, Naga Environmental
Presentation: *Research to Action*

Panel Discussion:

- **Daniel Breton** | Senior Director, World Class Strategies, Canadian Coast Guard
- **Joyce Henry** | Director General, Marine Policy, Transport Canada
- **Brian Kirk** | Marine Risk Management Lead, Washington State Department of Ecology
- **Markku Mylly** | Executive Director, European Maritime Safety Agency
- **John Veentjer** | Chair, Puget Sound Harbour Safety Committee
- **Mark Zacharias** | Assistant Deputy Minister for the Environmental Protection Division, BC Ministry of Environment

Networking Break

Session 6: Next Steps & Action Planning

Closing Remarks

APPENDIX 2 - WORKSHOP PARTICIPANTS

First Name	Last Name	Organization
Yeasmin	Alfaruq	Enbridge
Geraldo	Araujo	Moffatt Nichol
Alexandra	Barron	Canadian Parks and Wilderness Society
Katherine	Beavis	Transport Canada
Keith	Beckett	UrtheCast Corp.
Kristina	Boerder	MEOPAR / Dalhousie University
Amar	Bokhari	Alberta Energy and Utilities Board
Daniel	Breton	Canadian Coast Guard
Allanah	Brown	MEOPAR / UBC Civil Engineering Department
Stephanie	Buffum	Friends of the San Juans
Rosaline	Canessa	MEOPAR / University of Victoria
Jon R.	Ciobanu	GFY Group
Julie	Compton	Western Economic Diversification Canada
Rita	Conti	International Study of Arctic Change
Rodrigo	Costa	Algarve University
Michael	Cowdell	Advisian
Susan	Davidson	Sea Science Inc.
Andrew	Day	Environment & Climate Change Canada
Robert	Dick	Transport Canada
Steve	Diggon	Coastal First Nations
Darcy	Dobell	World Wildlife Foundation - Canada
Mike	Dodd	FocusOne Solutions Inc.
Ray	Doering	Enbridge
Peter	Dorcas	exactEarth
Bernie	Dumas	Nanaimo Port Authority
Karen	Dunn	Canadian Coast Guard
Leslie	Elliot	Ocean Networks Canada
Evangeline	Englezos	Port Metro Vancouver
Kris	English	Xanatos Marine

First Name	Last Name	Organization
Amanda	Fehr	
Clare	Frater	Islands Trust
Bonnie	Gee	Chamber of Shipping of BC
JATINDER	GILL	Transport Canada
Alexander	Gillespie	Waikato University
Susanna	Haas Lyons	Simon Fraser University
Trevor	Heaver	UBC Centre for Transportation Studies
Kathy	Heise	Vancouver Aquarium
Joyce	Henry	Transport Canada
Paul	Hilder	Seapsan
Lanna	Hodgson	International Study of Arctic Change
Maia	Hoeberechts	MEOPAR / University of Victoria
Lara	Hoshizaki	Coastal First Nations
Gordon	Houston	Transport Canada
Erik	Hoy	Seaspan
Mark	Johncox	Western Canada Marine Response Corp.
Karolyn	Jones	Fisheries and Oceans Canada
Russ	Jones	Haida Nation
Bikramjit	Kanjilal	Valiance Maritime Consultants
Brian	Kirk	WA Department of Ecology
Donna	Kocak	Harris Engineering
Roger	Korus	UrtheCast Corp.
David	Kyle	Pacific Northwest LNG
Kleo	Landucci	Ashcroft Terminal
Helmut	Lanziner	Russell Technologies
Kelly	Larkin	Transport Canada
Colin	Laughlan	BC Shipping News
Captain Petar	Lolic	International Study of Arctic Change
Michael	Lowry	Western Canada Marine Response Corp.
Peter	Luckham	Islands Trust

First Name	Last Name	Organization
Roe	Markham	Ocean Networks Canada
Christopher	McDougall	Haida Nation
Scott	McLean	Ocean Networks Canada
Sean	McNulty	Port Metro Vancouver
Sonya	Meier	Hemmera
Jon	Mikkelsen	UBC Applied Science and Marine Engineering
Alex	Morkin	SiiTech
Louise	Murgatroyd	Transport Canada
David	Murray	Natural Resources Canada
Yvette	Myers	Transport Canada
Markku	MYLLY	European Marine Safety Association
Sulaiman	Olanrewaju	University Malaysia Terengganu
Ed	Page	Alaska Marine Exchange
Mia	Parker	Pisco Solutions
Jim	Parsons	Memorial University of Newfoundland
Gary	Paulson	Prince Rupert Port Authority
Ronald	Pelot	MEOPAR / Dalhousie University
Benoit	Pirenne	Ocean Networks Canada
David	Prince	Fisheries and Oceans Canada
Kyle	Robertson	Port Metro Vancouver
Orla	Robinson	Port Metro Vancouver
Jakub	Rosicki	Western Economic Diversification Canada
Analise	Saely	Canadian Environmental Assessment Agency
Norma	Serra	University of Victoria
Laura	Smith	Canadian Coast Guard
Stephanie	Snider	Trans Mountain Expansion Project
K. Joseph	Spears	Horseshoe Bay Marine Group
Art	Statham	Canadian Coast Guard
Graham	Stickler	exactEarth
Laura	Strand	Port Metro Vancouver

First Name	Last Name	Organization
Rajiv	Taneja	exactEarth
Richard	Teece	Pentair
Matthyw	Thomas	Vard Marine
Krista	Trounce	Port Metro Vancouver
Brian	Tuomi	Nautical Consulting
Kevin	Vail	BC Pilots
Ferdie	Van de Kuijlen	International Study of Arctic Change
Everhardus	van den Heuvel	Klein Systems
Richard	Variyan	FocusOne Solutions Inc.
John	Veentjer	Marine Exchange of Puget Sound
ISRAR	WAHEED	Transport Canada
Chris	Wellstood	Port Metro Vancouver
Andrea	Wenham	Environment & Climate Change Canada
Danielle	Wensauer	Transport Canada
Sean	Wheeler	RCMP
Sarah	Wongkee	Simon Fraser University
Brian	Young	Pacific Pilotage Authority
Mark	Zacharias	BC Ministry of the Environment