ERA-Can+ Roundtable on Marine and ICT

October 19, 2015

Lisbon, Portugal

Fundação Portuguesa das Comunicações (FPC)

Rua do Instituto Industrial, nº 16

1200-225 Lisboa

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EUROPEAN COMMISSION
European Research Area

1 Event set-up

The Centre for Social Innovation (ZSI) supported by the Department of Foreign Affairs of Canada (DFATD) organized a roundtable on "Marine and ICT" on the 19th of October in Lisbon back to back to the ICT2015, tapping synergies from the fact that many ICT specialists from Canada and Europe were already on spot. The objective of the roundtable was to bring together researchers and innovators from the marine and ICT sectors to discuss challenges and opportunities in these sectors and identify particular topics for partnership opportunities identified in the H2020 work programmes and relevant Canadian opportunities. An awareness of what each sector is trying to accomplish by a Canada-EU partnership and where the opportunities exist was raised. Discussions were held on where the Canadian and EU research communities can identify new areas of collaboration, in particular in the two previously identified focus areas:

- Sensors for better measurement, prediction and forecasting (ocean state, living and non-living resources, natural disasters)
  - Internet of Things
  - Data Integration
- Advanced robotics and drones
  - under water vehicles
  - smart buoys/moorings

The Marine and ICT roundtable gathered about 20 European and Canadian experts, observers from the Canadian delegations in Europe and ERA-Can+ team members to discuss the potential for cooperation between the EU and Canada on the targeted challenges mentioned above. Sarah Iverson (OTN) served as the Canadian co-chair, Antonio Pascoal (University of Lisbon) as her European counterpart. Neil Gall (MEOPAR) and Eoin O'Grady (Marine Institute) were so kind to act as rapporteurs for the break-out sessions. According to the break-out session's design, the European co-chair was supported by a Canadian rapporteur and vice versa.

The programme included:

- Presentation of the state of the art in Canada and the EU in "Marine and ICT" research
- Break out / brainstorming sessions: sub-group discussions on the following three questions:
  - What scientific **questions** on the Ocean are most pressing for researchers in Canada and Europe?
  - What technology, infrastructure and **resources** are needed to answer them?
  - How can we **cooperate** and share resources?
- Wrap-up session: moderators for each small group reported back to all participants and shared the outcomes, followed by a general discussion on what the next steps should be.

2 Major challenges identified

During the break-out sessions the following issues and areas were identified and discussed.

As of the major global developments and scientific questions the research communities are engaged in:

- effects of the climate change: including ocean acidification, ocean warming, long term effects on the biology, environmental monitoring

- sensors and platforms,
- measuring subsurface (currents),
- renewable energy for research platforms, modelling, monitoring; reduction of emissions
- machine vision and automatic visualisation,
- strategies of exploitation:
    - aquaculture, fisheries: climate change impact, ecosystem analysis & new stock understanding, low-cost monitoring, harmful algal blooms (HABs) forecasting
    - deep sea mining: oil and liquefied natural gas, mapping, forecasting of conditions, impact to ecosystems (e.g.: Arctic)
-

Behind these global background developments, these are the general challenges Marine research faces in the field of ICT:

- sensor reliability: pH, overall calibration,
- moorings and autonomous underwater vehicles (AUVs) for data collection and mapping
- standardising data, access to research platforms, data publishing and data access
- demonstrating the value of ocean science to decision makers,
- technical limitations of research platforms: endurance and anti-fouling, communication and data transfer, positioning,
- multi-usage and multi-function of research platforms
- renewable energy supplies for research platforms: connection to the grid, storage, impact on the environment, inspection, power supplies in remote areas (seabed, Arctic),
- communication technologies in specific environments (underwater, Arctic)

These are the major challenges for international collaboration:

- how to collaborate and how to fund joint research endeavours,
- joint approaches and starting points for researching the ocean(s),
- joint data management: standards, interoperability,
- collaborate closer with industry – create business cases

3 Results and Recommendations for Future Collaboration

It was identified, that a mapping of research gaps should be facilitated that results in a “research wish list” to be able to piggybank on other research efforts and ensure collaborative funding. On what one break out group called *platforms of opportunity* to possibility to discuss scientific and operational opportunities for collaboration should be provided. A shared platform should also facilitate sharing of data.

- There was consensus amongst the participants and the EC representative over the importance of including marine issues to the next ICT work programme under alignment with the ICT-related research strands within the Blue Growth programme under Societal Challenges or under Research Infrastructures.
- It is necessary to maintain joint databases, and raise awareness about and extending already existing ones, like EUROcean Marine research infrastructure database http://rid.eurocean.org/

+ With the Galway Agreement, the collaboration on joint issues on the Atlantic was agreed upon trilaterally: between Europe, Canada and the USA. The intersecting fields of Marine and ICT research are not bound to the Atlantic Ocean only and therefore collaboration endeavours should be conceptualised and conducted globally.

4 Conclusions

The ERA-Can+ Roundtable on Marine and ICT convened a diverse and active group of discussants from various backgrounds from Europe and Canada.

Although new trans-Atlantic networks were created and a lively exchange of experience and learning took place, the framing of a single workshop does not allow concrete formulation of “topics” even behind the previously defined expert-driven focus areas.

Follow-up was made on different levels, but needs to be further structured.

5 ANNEXES

5.1 Agenda

8:30	**WELCOME COFFEE**
9.00	**Welcome by ERA-Can+** Overview of the day, goals of the roundtable, and indication of next steps + *Isabella Wagner, ZSI, Austria*
9.05	**Orientation** Outline of the importance of connecting ICT technologies to ocean research and technology initiatives + *Morten Møller, Head of Unit, DG CNET*
9.15	**Opening remarks from event co-chairs.** What the challenges are from the Marine perspective and how ICT can respond. + Canada: *Sara Iverson, Ocean Tracking Network, Canada* + Europe: *Antonio Pascoal, Institute for Systems and Robotics, Portugal*
9.30	**Identification of synergies** Introduction and presentation of the researchers (1-2 min), about previous experiences and current challenges (this will be an opportunity for any participant to share where specific challenges related to the breakout sessions in order to ensure objectives are achieved).
10.00	**COFFEE BREAK**
10:30	**Break-out sessions** + Participants will break into two groups in order to engage into an interactive discussion and in-depth exchanges on the following three questions: 1. What are the scientific questions currently being tackled on both sides of the Atlantic? 2. What technology, infrastructure and resources are needed to answer them? 3. How can we cooperate and share resources? **Chairs**: + Group 1: *Sara Iverson, Ocean Tracking Network, Canada* + Group 2: *Antonio Pascoal, Institute for Systems and Robotics, Portugal* **Rapporteurs**: + Group 1: *Eoin O'Grady, Marine Institute, Ireland* + Group 2: *Neil Gall, MEOPAR, Canada*

13.00	**LUNCH BREAK**
14.30	**Plenary discussion** The rapporteurs of the two break-out sessions will report back to the plenary and share the outcomes of the discussions. + Group 1: *Eoin O'Grady, Marine Institute, Ireland* + Group 2: *Neil Gall, MEOPAR, Canada*
15.30	**COFFEE BREAK**
16.00	**Next steps** An open discussion/brainstorming session about potential next steps based on the ideas raised in the plenary discussion. + Group 1: *Sara Iverson, Ocean Tracking Network, Canada* + Group 2: *Antonio Pascoal, Institute for Systems and Robotics, Portugal*
17:00	**Closing remarks**
17:15	30 min Guided tour through the Telecommunication Museum at FPC
18:00	**Reception by the Canadian Embassy to Portugal**

5.2 Participants

Name	Institution	Country
Canada		
Neil Gall, RAPPORTEUR	**MEOPAR**	**CA**
Dr. Maria Hoeberechts	ONC	CA
Richard Kelly	Marine Institute	CA
James Albright	BCIT	CA
Kim Dotto	BCIT	CA
Martin Taillefer*	Maritimeway	CA
Sara Iverson, CO-CHAIR	**Ocean Tracking Network**	**CA**
Jason Gillham	2G Robotics	CA
Europe		
Stéphane Pesant	Center for Marine Environmental Sciences, University of Bremen	DE
Ayoze Castro Alonso	PLOCAN	ES
Igor Radusinovic	BIO-ICT, first Montenegrin CoE	MN
Chris Cardwell	Ocean Technology and Engineering Group here at the NOC; SenseOCEAN	UK
Piotr Szymak*	Institute of Naval Weapons at the Polish Naval Academy in Gdynia	PL
Beate Kvamstad-Lervold	Vice President Maritime, MARINTEK	NO
Antonio Pascoal, CO-CHAIR	**Institute for Systems and Robotics (ISR), IST, University of Lisbon**	**PT**
João Sousa*	University of Porto, Faculty of Engineering	PT
Eoin O'Grady, RAPPORTEUR	**Marine Institute**	**IE**
Eleni Patouni	CMRE NATO	GR/IT
Telmo Carvalho	FCT	PT
European Commission		
Morten Møller	EC / DG CONNECT	
ERA-Can+		
Isabelle Couture	Public Policy Forum	CA
Isabella Wagner	Centre for Social Innovation (ZSI)	AT
Stefan PHILIPP	Centre for Social Innovation (ZSI)	AT
Observers		
Michael Willmott	DFATD - Brussels	CA
Eurico Nobre	DFATD - Lisbon	CA
Fatima Carvalho-TBC	DFATD - Lisbon	CA
Michael Wylie	DFATD - Lisbon	CA

*Regrets

Detailed profiles

James Albright, Director Applied Research at BCIT, Canada
Mr. Albright's career has spanned both the private and public sectors with a common theme of technology and innovation. He has spent 20+ years in executive roles in the Health Care/Pharmaceutical industry and 10+ years in leadership roles in the public sector; as Executive Director of the Office of Technology Transfer of McGill University and most recently at BCIT as Director, Applied Research Liaison Office after having completed a 2 year term as Acting Dean, Applied Research. Understanding how Applied Research can raise the state of practice for students and how this impacts job opportunities and economic development and prosperity via the multiplier effect, has been Mr. Albright's passion and the principle reason for his returning to academia, first to McGill University and next, the British Columbia Institute of Technology. He received his Bachelor of Science, Masters of Science and a Masters of Business Administration from McGill University, Montreal, Quebec, Canada.

Chris Cardwell, Ocean Technology and Engineering Group at the NOC; SenseOCEAN
Chris Cardwell is Head of the Electronics and Software team in the Ocean Technology and Engineering Group. His main research interest is the development of autonomous nutrient and electro-chemical in-situ sensors with the goal of increasing the sensitivity and frequency of data acquisition in a marine environment. He focuses on the design, improvement and integration of high precision, pressure tolerant electronic systems in these sensors, working closely with the science and mechanical teams.

Telmo Carvalho, FCT, Portugal
Telmo Carvalho is coordinator of the Ocean Office of the Fundação para a Ciência e Tecnologia (FCT) and is a delegate to the OECD for its Future of the Ocean Economy project. From 2009 to 2014 he was executive director of the European Centre for Information on Marine Science and Technology (EurOcean). He is an anthropologist and holds a master´s degree in Social Sciences with a specialisation in scientific policy. He began working in management of science in 1995 at Portugal´s Science and Technology Observatory and served as executive secretary of the Intersectorial Oceanographic Commission. He has worked on science policy and information management in marine science and technology to establish bridges between scientific knowledge and other sectors of society.

Ayoze Castro Alonso, PLOCAN, Spain
Dr. Ayoze Castro, is the Head of the PLOCAN Innovation Unit. After 7 years of R&D work in Veterinary Sciences, he moved to a R&D Project Management position. He is a certified PRINCE2™ Practitioner (Projects in a Controlled Environment), Deputy Coordinator of the NeXOS project and PLOCAN responsible for the management the SWARMs project:

+ NeXOS consortium is coordinated by PLOCAN. The main objective of this project is to develop new cost-effective, innovative and compact integrated multifunctional sensor systems (ocean optics, ocean passive acoustics, Ecosystem Approach to Fisheries (EAF) sensor system), which can be deployed from mobile and fixed ocean observing platforms, as well as to develop downstream services for GOOS, Good Environmental Status (GES) and the Common Fisheries Policy (CFP).
+ PLOCAN is partner of the SWARMs Project. The main objective of this consortium is to expand the use of AUVs/ROVs and facilitate the creation, planning and execution of maritime and offshore operations, thereby making autonomous operations a viable option for new and existent industries.

Kim Dotto, Dean Applied Research at BCIT, Canada
BCIT is a polytechnic institute engaged in undergraduate- and graduate-level education as well as in applied research as demonstrated by its various schools: School of Computing and Academic Studies; School of Business; School of Construction and the Environment; School of Health Sciences; School of Energy; School of Transportation.

Neil Gall, MEOPAR, Canada
Neil Gall is Executive Director at MEOPAR. The Marine Environmental Observation Prediction and Response Network (MEOPAR) is a national team of outstanding Canadian scientists meeting the challenges of our changing ocean. MEOPAR is working to better understand and predict the impact of marine hazards on human activities and ecosystems, and improve our response when hazards occur. They work with federal & provincial partners, as well as industrial and other partners…in Canada and beyond. They collaborate on large, multi-investigator, multi-disciplinary research projects and core observation and prediction research activities. Hosted at Dalhousie University, MEOPAR is funded by the Government of Canada's Networks of Centres of Excellence Program and was established in 2012.

Jason Gillham, 2G Robotics, Canada
Jason Gilham is CEO at 2G Robotics. Our mission at 2G Robotics is to provide the best subsea imaging and measurement technology. We are dedicated to advanced research, development, and engineering for the innovation and the production of cutting-edge solutions. The foundation of 2G Robotics is its wealth of engineering expertise in the development of innovative and reliable systems, which has led to the success of its market-leading ULS line of underwater laser scanners.

Maria Hoeberechts, Ocean Networks Canada, University of Victoria, Canada
Maria Hoeberechts is Associate Director, User services at ONC. Ocean Networks Canada operates the world-leading NEPTUNE and VENUS cabled ocean observatories for the advancement of science and the benefit of Canada. These observatories collect data on physical, chemical, biological, and geological aspects of the ocean over long time periods, supporting research on complex Earth processes in ways not previously possible.
The NEPTUNE regional observatory and VENUS coastal observatory provide unique scientific and technical capabilities that permit researchers to operate instruments remotely and receive data at their home laboratories anywhere on the globe in real time. The Ocean Networks Canada Innovation Centre (previously called the ONC Centre for Enterprise and Engagement)—one of Canada's Centres of Excellence for Commercialization and research—promotes the advanced technologies developed by NEPTUNE and VENUS. ONC also operates a community observatory in the Arctic Ocean offshore Cambridge Bay, Nunavut.

Sara Iverson, Ocean Tracking Network, Canada
Dr Sara Iverson is the Scientific Director of the global Ocean Tracking Network (OTN), an international infrastructure, research, and technology development platform, headquartered at Dalhousie University. OTN is building an entirely new global ocean observation system, one that is centered on measuring marine animal movements, habitat use and survival, in relation to changing ocean conditions, with a focus to advance the governance and sustainability of the world's oceans. OTN uses both sensor technologies and robotic underwater vehicles to provide state-of-the-art capacities in ocean observation. OTN also

focuses on technology development, global data warehousing and management, international sharing and partnership strategies, and education and training.
Sara is a professor in the Department of Biology and is a former NSERC E.W.R. Steacie Fellow. She received her PhD jointly from the Smithsonian Institution and the University of Maryland. Sara also leads an active research program in physiological ecology, whose laboratory uses a suite of tools ranging from biochemical tracers to energetic measurements to tracking studies to better understand the biology of marine vertebrates and the food webs and environments within which they function.

Richard Kelly, Marine Institute of Memorial University of Newfoundland, The Center for Applied Ocean Technology (CTEC), Canada
At the Centre for Applied Ocean Technology, we focus on two main areas for applied research and development: Ocean Mapping and Observing Systems.

+ Ocean Mapping: Our strategy for ocean mapping extends beyond a single platform. We strive to capitalize on every maritime asset as a data collection opportunity - navigational aids, fishing vessels and more. Our ocean mapping philosophy? - Collect data once, store closest to source, and use it many times.
+ Ocean Observing Systems: Ocean observing systems are based on networks of sensors and the data they generate. The goal of ocean observing systems is to improve access to data and information to improve decision-making by a broad range of public and private sector stakeholders. Technologies to gather ocean data are varied. From surface buoys and cabled seabed networks, to satellite and airborne remote sensing, to ship-borne sensors and surveys, a flood of data is gathered each day. Converting data to useful information is a key goal of an ocean observing system. The Centre for Applied Ocean Technology's (CTec's) focus is on serving the information needs of individuals who work on the ocean or are responsible for marine operations. Our aim is to provide dynamic information that enhances safety, operational efficiency and situational awareness.

Beate Kvamstad-Lervold, MARINTEK, Norway
Beate Kvamstad-Lervold is the Vice President Maritime at the Norwegian Marine Technology Research Institute (MARINTEK) performs research and development for companies in the field of marine technology. MARINTEK is a company in SINTEF, the largest independent research organization in Scandinavia, and develops and verifies technological solutions, business and operating concepts for the shipping, marine equipment, ocean energy and petroleum industries.

Eoin O'Grady, Marine Institute, Ireland
Eoin O'Grady is IT Manager at the Marine Institute (Foras na Mara) which is Ireland's national agency responsible for Marine Research, Technology Development and Innovation. The institute aims to assess and realise the economic potential of Ireland's 220 million acre marine resource; promote the sustainable development of marine industry through strategic funding programmes and essential scientific services; and safeguard our marine environment through research and environmental monitoring.

Antonio Pascoal, Institute for Systems and Robotics (ISR), IST, University of Lisbon, Portugal
António M. Pascoal received the Ph.D. degree in Control Science from the University of Minnesota, Minneapolis, Minnesota, USA in 1987. From 1987-88 he was a Research Scientist with Integrated Systems Incorporated, Santa Clara, California. He is currently an Associate Professor of Control and Robotics at IST.

He has held visiting positions with the Department of Electrical Engineering and Computer Science of the University of Michigan, Ann Arbor, Michigan, USA and with the Department of Aeronautics and Astronautics, Naval Postgraduate School, Monterey, California, USA. He is the Associate Professor at the Dynamical Systems and Ocean Robotics Laboratory of ISR. Over the past years, he has participated actively in the design and development of prototype marine robots, including autonomous surface craft and underwater vehicles. His research interests include linear and nonlinear control theory, integrated design of navigation, guidance and control systems, and mission control of complex autonomous systems with applications to the control of air, land and underwater robots.

Eleni Patouni, CMRE NATO, Italy/Greece
Eleni Patouni is Strategic & Business Development Research Manager at the Centre for Maritime Research and Experimentation, a NATO research centre. Besides, she is Senior Research Associate at University of Athens, Department of Informatics and Telecommunications. Her main research interests include network-management and decision-making mechanisms, load balancing algorithms, object-oriented design of mobile network systems, reconfigurable protocols and component-based models, as well as cognitive and autonomic networking issues.

Stéphane Pesant, Center for Marine Environmental Sciences, University of Bremen
Dr. Stéphane Pesant is a biological oceanographer. PhD at Laval University, Québec (1999), working on plankton food webs and their associated biogeochemical carbon fluxes. He was scientific advisor for Marine Ecosystem Health and assistant to Jake Rice (stock assessments) at the Department of Fisheries & Oceans Canada, Ottawa (2000-01); Postdoc at the University of Western Australia, Perth (2002-04); and assistant to the Scientific Director of FP6-NoE-Eur-OCEANS, Villefranche/Mer (2005-09) for which he coordinated data integration in close collaboration with WDC-MARE / PANGAEA®. Since 2009, he joined PANGAEA and is involved in the integration of scientific data for several European, national and international projects, including EUR-OCEANS, EuroMarine, Tara Oceans, CoralFISH, EuroBASIN, MicroB3, EPOCA, BioAcid and MedSeA.

Igor Radusinovic, BIO-ICT, first Montenegrin CoE
Igor Radusinovic is university professor at the Faculty of Electrical Engineering University of Montenegro. Besides his involvement in consulting and industries, he is project leader of the first Montenegrin Centre of Excellence BIO-ICT. This centre was founded with the aim to bring cutting edge ICT technology in the area of water and sea ecosystems, amongst others.

João Sousa, University of Porto, Faculty of Engineering
João Tasso de Figueiredo Borges de Sousa is a lecturer at the Electrical and Computer Engineering Department from Porto University in Portugal and the head of the Underwater Systems and Technologies Laboratory. Since 1997 he has been leading the design, implementation and deployment of advanced unmanned vehicle systems in projects funded by the Portuguese Foundation for Science and Technology, Portuguese Innovation Agency, Luso-American Foundation, NATO, Office of Naval Research and DARPA. He was a member of the SHIFT language development group at UC Berkeley. He was a Visiting Scholar at the Center for Intelligent Robotics for Space Exploration, Rensselaer's Polytechnic Institute, Troy, New York, USA in 1991. He had several Visiting Scholar appointments at the University of California at Berkeley since 1997. In the last 15 years he has been involved in fostering and growing a world-wide research community in this field with yearly conferences and workshops in the areas of Hybrid Systems, Intelligent

Control, Networked Vehicle Systems and Multi-Agent Systems. He has been lecturing and delivering seminars on networked robotics in major universities in the US and EU.

Piotr Szymak, Institute of Naval Weapons at the Polish Naval Academy in Gdynia
Piotr Szymak is a Senior Lecturer and Head of Department of the Automatics in the Institute of Electrical Engineering and Automatics in Polish Naval Academy in Gdynia. He received his MSc degree in Electronics and Telecommunication in 1999. In 2004, he received PhD degree with thesis focused on using artificial intelligence methods to control underwater vehicles. His research interest is in autonomous underwater vehicles and surface vehicles, fuzzy logic systems with neuro-evolutionary adjusting.

Martin Taillefer, Maritime Way
Martin Taillefer is Operational Oceanographer, President and Owner of Maritime Way Scientific Ltd. Maritime Way Scientific Ltd. specializes in providing consulting and scientific services to Marine Industry, Maritime Research and Development, Fisheries and Defence. Our team is composed of operational subject matter experts in the fields of theoretical oceanographic and acoustic propagation modelling, marine science, situational awareness solutions and tactical decision aids. Maritime Way Scientific Ltd. (MWS) was formed in 2010 and its membership and collaborators have decades of combined operational experience in the application of operational science particularly in the fields of ocean-acoustic propagation modelling.

<u>European Commission</u>

Morten Møller, EC / DG CONNECT
Morten Møller is Head of the Unit Programme Coordination at the Directorate for Digital Economy & Coordination at DG CONNECT. The Unit provides the overall coordination of the DG's research and innovation activities, developing, defending and promoting the DG's position in the various coordination bodies, both within and outside the EU.


3 questions for the break-out sessions
1. What scientific questions on the Ocean most pressing for researchers in Canada and Europe?
2. What technology, infrastructure and resources are needed to answer them?
3. How can we cooperate and share resources?
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