

Connecting the Dots: Ocean Research and Public Policy

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Abstract - Canada has gained a world-leading position in the science and technology of cabled ocean observing systems, principally through the federal and British Columbia (BC) government investments (\$120M) in the VENUS and NEPTUNE Canada ocean observatories, now deployed in coastal to deep ocean waters off BC's West Coast. The combination of continuous power, high bandwidth and real-time data streaming make the VENUS and NEPTUNE Canada observatories transformative in their capacity to support research applications to key areas of public policy, including environmental monitoring, hazard mitigation, resource assessment, and sovereignty and security. While deployed off the West Coast, the technologies are applicable in other settings including the Arctic. Ocean Networks Canada (ONC) was created as a not-for-profit agency by the University of Victoria in 2007 to manage and develop the VENUS and NEPTUNE Canada observatories and their applications to public policy, commercial development, and public outreach. To advance its mandate, ONC was recently named as a federal Centre of Excellence in Commercialization and Research. The public policy initiatives of ONC, in the context of its broader strategic plan, have included: (a) a review of Canadian federal and provincial policy initiatives and priorities and their relationship to the data types generated by the NEPTUNE Canada and VENUS research programs; (b) planning of workshops with federal science-based departments and agencies to be held later in 2010; (c) discussions with BC government departments related to their emerging Ocean and Coastal Strategy; and, preparation of a discussion paper for federal government departments on application of cabled observatory technologies to the Arctic.

endeavors which promise extraordinary outcomes, such as: revolutionizing entire disciplines; creating entirely new fields; or disrupting accepted theories and perspectives. In other words, those endeavors which have the potential to change the way we address challenges in science, engineering, and innovation. Supporting more transformative research is of critical importance in the fast paced, science and technology intensive world of the 21st Century."

The VENUS and NEPTUNE Canada ocean observatories are at the forefront of these *disruptive technologies*. Involving consortia of Canadian universities, federal government research agencies and international research institutions, led by the University of Victoria, both observatories are now operational, supporting coastal to deep ocean investigations of the interactions of biological, chemical, physical and geological processes. They are national facilities engaging a global research community who can access the systems and the data through the Internet. This creates opportunities for collaborative ocean science similar to that of other 'big science' ventures based on major research infrastructure platforms - a sociology of science long established in such fields as high energy physics and astronomy. The VENUS and NEPTUNE Canada observatories are forerunners of related facilities at various stages of planning and implementation in the US (the *Ocean Observing Initiative*), Europe (*ESONET*), and Japan (*DONET*).

These ocean observatories are typically driven by science challenges in the first instance and depend on the excellence of the science teams to meet the rigorous international peer-review processes required by the funding agencies. That said, applications and impacts of the science in addressing high priority public policy issues are expected by funding agencies and governments (given the typical reliance on public funding), and figure strongly as evaluation criteria in determining and justifying commitments of the large capital and operating funding required to build and sustain the facilities. Two examples amply demonstrate this. The NSF funding of the Ocean Observing Initiative, approved in 2009, required late on in the evaluation process that the proposals be

I. TRANSFORMATIVE OCEANS RESEARCH

The advent of cabled ocean observatories heralds a new era in oceans research. Historically limited by under-sampling, the new generation of cabled systems brings power and the Internet to the oceans enabling continuous measurement of a broad suite of critical variables, so providing real-time and legacy data for integrated ocean system science in ways not possible hitherto. As such, the new research possibilities meet the definition of *transformative research* which in a recent NSF statement [1] has been described as "A range of

revised to show convincingly to the National Science Board that the research programs would yield research of direct relevance to major public policy issues, including climate change, ocean acidification and healthy marine ecosystems. In Canada, the primary funding agency for the VENUS and NEPTUNE Canada observatories, the Canada Foundation for Innovation, adjudicated the proposals on the basis of expected benefits to Canada (socio-economic, environmental, and health), as well as the excellence of the research and the strength of the research teams. In short, public policy issues were writ large in both cases; similar priorities are just as evident in other jurisdictions, for example the UK, with the recent release of the UK Marine Science Strategy (2010-2025) [2].

It is the nexus between oceans research and public policy, in the context of the new generation of ocean observing systems, which are the frame and focus for this paper. The NEPTUNE Canada and VENUS observatories are the case example to consider how that nexus can best be developed in ways that advance the research at the same time as informing public policy and so achieve a substantial and legitimate return on investment of public funds for the public good.

II. OCEAN NETWORKS CANADA

As described in previous papers [3-5], Ocean Networks Canada (ONC) was created in 2007 by the University of Victoria as a not-for-profit society to govern and manage the NEPTUNE Canada and VENUS cabled ocean observatories. These are national facilities requiring appropriate and effective governance and management structures recognizing the scope, complexity, duration, and fiscal magnitude of the activities supported by these major research platforms. The *vision* of ONC is: **to position Canada as an international leader in ocean observing system research and to maximize the associated economic and social benefits for Canada and its international partners.**

ONC has five principal goals: supporting transformative science and technology; informing evidence-based public policy; creating opportunities for economic and commercial development; promoting public education and outreach; and demonstrating best practices in the governance and management of a national science facility. All five involve the development of national and international partnerships commensurate with the evolution of the ocean observatories as national/international facilities. ONC is governed by a 15 member Board of Directors comprising senior level and highly experienced individuals drawn from the academic, government and private sectors. In 2009, the capacity and resources of ONC were increased by the addition of the ONC

Centre for Enterprise and Engagement (ONCCEE), a federally funded centre of excellence in commercialization and research. The mandate of ONCCEE is to accelerate the commercialization and outreach programs building on the opportunities created by the VENUS and NEPTUNE Canada research activities.

In September 2008, the ONC Board of Directors approved a Strategic and Business Plan focused on five priority areas aligned with the goals of the organization. One of the five, and the focus for this paper, is ***Informing Evidence-based Public Policy***. As national programs, NEPTUNE Canada, VENUS and ONCCEE serve the public interest through applications of the research results to environmental, economic and social issues of high priority on the public policy agenda. It follows that establishing partnerships with science based departments and agencies at the federal and provincial levels is a priority. Relationship building is well underway with partnerships in place with several federal departments and agencies (Fisheries and Oceans Canada, Environment Canada, Parks Canada, Natural Resources Canada, Department of National Defence, Industry Canada, CANARIE, Western Economic Diversification and the National Research Council).

These links are entirely consistent with the stronger alignment between Canadian universities and federal facilities being promoted through the federal S&T strategy [6]. The strategy highlights the importance of focusing S&T investments on areas in which Canada has international strength and which will result in tangible benefits to Canadians. The ONC research-policy linkages align with all four areas identified as priorities in the S&T strategy - environmental science and technologies; natural resources and energy; health and related life sciences and technologies; and information and communication technologies. The linkages also closely align with related key areas in the BC provincial strategy. Accordingly, strong connections are being built with BC Government ministries (Environment, Agriculture, Advanced Education, Small Business, Technology and Economic Development; Energy, Mines and Petroleum Resources, and Intergovernmental Affairs). In the BC context, two government initiatives are particularly relevant: an emergent *Oceans and Coastal Strategy*; and the *Pacific Coast Collaborative*, a broad-ranging collaboration, including ocean management and policy issues, between the BC Government and the State Governments of California, Oregon, Washington and Alaska.

III. INFORMING PUBLIC POLICY THROUGH THE ONC PROGRAMS

The ONC policy mandate has two primary and complementary objectives:

- To expedite the translation of research results from the ONC programs to inform the development of ocean-related public policy at both the provincial and federal levels in Canada, while recognizing that the issues are in many cases global and so the policy input can and should extend beyond national boundaries;
- To create opportunities for government funding and support of our research programs to advance studies that mutually benefit science objectives and policy priorities.

In meeting these objectives, there are several major national (indeed international) policy priorities for which data from the VENUS and NEPTUNE Canada observatories are immediately relevant. These include, but are not limited to, hazard mitigation, ocean-climate dynamics, ocean health, renewable and non-renewable resource assessment, sovereignty and security issues, and socio-economic development.

As previously stated, establishing strong partnerships with federal and provincial science-based departments and agencies (SBDAs) is key. These should be grounded in the mutual vested interest of the research agencies and governments to optimize the use of valuable and scarce infrastructural and human capital resources in the national interest. For ONC, this lofty goal translates to a careful and critical assessment of the alignment of scientific programs with the evidence-based policy needs of SBDAs. There is an obvious fit in general, but the details matter so that primary objectives are not distorted, expectations are realistic, and timelines are respected. It follows that alignments will be closer and easier to actualize for some relationships than others in the set of potential linkages. Moreover, assessing this will not always be self-evident and so careful and honest appraisal will be necessary on the part of both the research teams and their government colleagues.

A current example makes the point. The federal Department and Fisheries and Oceans released a new Science Plan in 2007 which lists ten priority areas, all of which to varying extent involve collaboration between university and government based scientists. Several of those areas could usefully draw on data from the NEPTUNE Canada and/or VENUS research programs and so could form the basis for additional partnerships and mutual support beyond that already in place. Nevertheless, it will be important to be

proactive and deliberate in identifying specific issues on which to focus, the associated research deliverables, and the resources available to support the effort. This basic principle extends across the suite of possible collaborations with federal and provincial SBDAs to ensure that they are feasible, manageable, affordable, and ultimately productive.

In identifying opportunities for linking the research program outputs with federal and provincial policy needs, two main issues arise for ONC: to ensure that the appraisal of opportunities aligns closely with deliverable research results such that expectations created with government agencies can be met; and to evaluate those opportunities based on a realistic understanding of the personnel and other resources required to meet the deliverables. Both depend on close collaboration of senior management - the ONC President and the program directors - on what opportunities should be pursued, the resources required, and the sources for meeting those requirements. Opportunities also exist for government funding of new research (including support for requisite infrastructure and instrumentation) to enhance and/or expand the capabilities of ocean observing systems to address policy priorities. A case in point is the funding by Natural Resources Canada of slope stability studies on the Fraser River delta using the VENUS Strait of Georgia observatory. A possible future development might be the deployment of ocean observing systems in the Arctic as described below. In all cases of such new opportunity, there should be agreed upon and demonstrable mutual benefit for the advancement of the research programs and the pursuit of policy priorities. Central here is the identification of research scientists (university and/or government) who regard the research as important to pursue and congruent with science plans. Again, the ONC senior management is the initial group for assessing the merits and feasibility of any potential initiative.

IV. CURRENT ONC POLICY-RELATED ACTIVITIES

In the short-run, the ONC policy mandate has been advanced through three concurrent activities. The first of these was an initial assessment of the alignment of ONC Programs with the policy mandates and priorities of federal and BC departments and agencies. The report was submitted to the ONC Board in September, 2009 and referred to the Public Policy Committee for detailed review and determination of next steps. To inform that review, a summary tabulation of the potential short and longer term opportunities for research-policy linkages with the federal SBDAs was developed, as well as a compendium of current and near future VENUS and NEPTUNE Canada-based research projects of immediate policy relevance.

A second initiative, closely linked to the first, has been the planning of research-policy workshops with both federal and provincial agencies. Currently, at the federal level, planning is on-going for workshops to be held later in 2010 with senior staff in the Department of Fisheries and Oceans and Natural Resources Canada. At the provincial level, the timeline has been shorter with working meetings in late 2009 and early 2010 with senior staff in the BC Ministries of Environment and Small Business, Technology and Economic Development. These meetings served to identify possible ONC program input to the province's proposed Ocean and Coastal Strategy, specifically on the issues of economic development opportunities and ocean health.

The third initiative is longer-term involving the possible extension and application of cabled ocean observatories in the Arctic. This currently involves a collaboration between ONC and two private sector partners in the marine S&T and environmental consulting fields. In the context of accelerating climate change impacts on the economy, society and culture in Canada's North, the Federal Government released its *Canada's Northern Strategy* in 2009 [7]. This strategy, together with the previous Council of Canadian Academies (CCA) 2008 Report, *Vision for the Canadian Arctic Research Initiative* [8], highlight the vital importance of an expanded applied research program in the Arctic. Indeed, the *Northern Strategy* speaks specifically to Canada being a "global leader in Arctic science" through its investments in S&T. A key requirement emphasized in the CCA report is enhanced **observation and monitoring** facilities and the development of related **marine technologies**. In this regard, Canada is in a world-leading position in the science and technology of cabled ocean observing systems, principally through the investments in the VENUS and NEPTUNE Canada ocean observatories. While deployed in coastal to deep ocean waters off BC's West Coast, the power and Internet technologies are transferable to other settings including the Arctic. The proposed application in Arctic waters would strongly support all five policy components of the *Northern Strategy*, and could become a key element of implementing this strategy over the next decade. Moreover, it will complement initiatives led by the extant federally funded *ArcticNet* and *Amundsen* research programs. To this end, ONC and its partners have completed a concept paper – *Cabled Ocean Observations in the Arctic* – which is soon to be submitted to the co-chairs of the federal DM committee responsible for the development of the *Canada's Northern Research Strategy*. The concept paper invites discussions with Federal Government departments to secure the funding required to conduct a feasibility study on designing, building, deploying, and operating these systems in the Northwest Passage.

The construction and operation of national science facilities typically involves the expenditure of substantial public funds administered by funding agencies accountable to government. As such, democratic governments, themselves ultimately accountable to the public, expect to see returns on the investments in terms of impacts of the facility-based research which translate into national benefits as well as scientific advance. These impacts and benefits are in various areas – socio-economic, environmental, health, etc. – but there is an increasing expectation that they will either directly or indirectly address priority issues on the public policy agenda. This is especially true of facilities which support environmental science programs, particularly in such high priority policy areas as climate and oceans research.

These expectations are formalized *a priori* by the principal funding agencies - the Canada Foundation for Innovation and National Centres of Excellence – which have supported the VENUS and NEPTUNE Canada observatories and the ONC Centre for Enterprise and Engagement. The evaluation criteria and accountabilities involve achieving 'benefits to Canada', including those stemming from contributions to research-based policy development. The importance of demonstrating these benefits has all the more force given the need to secure on-going operating funding from government (at the level of \$15M per year approx). While accountabilities are stated in general terms, there need to be specific and tangible demonstrations as compelling and convincing examples of value with the aim of fostering advocates at senior levels in government departments to provide third party validation of the contributions of the ONC programs, and so bolster applications for sustained operating funding.

This all implies an urgent need for ONC to be proactive in facilitating short and longer term opportunities to cultivate research-policy linkages. This has to be done in close collaboration with the relevant federal and provincial departments and agencies, recognizing that a challenge to research translation has been to overcome the seeming bureaucratic labyrinth within government. This complex reality has certainly informed the strategy and approach developed by ONC management so far, significantly aided by wise counsel from the ONC Board which includes several members, including the Board chair, with extensive experience in the federal and provincial public service.

While ONC is responsible for national facilities and programs, ocean research and policy issues transcend national boundaries. This implies opportunities to collaborate internationally, especially with US agencies given the long

standing partnership with the Ocean Observing Initiative, now further strengthened by an MoU between ONC and the Consortium on Ocean Leadership as the respective management bodies in Canada and the US. The significance of the international dimension is also very evident in the potential research-policy linkages associated with the proposed application of cabled ocean observing systems in the Arctic, where again the environmental, economic and political issues transcend national frontiers, not least because those frontiers are contested.

REFERENCES

- [1] National Science Board, *Enhancing Support of Transformative Research at the National Science Foundation*, National Science Foundation, Washington, DC, 2007.
- [2] UK Government Marine Science Coordination Committee, *UK Marine Science Strategy (2010-2025)*, UK Dept for Environment, Food and Rural Affairs, London, UK, 2010.
<http://www.defra.gov.uk/environment/marine/documents/science/mscc/mscc-strategy.pdf>
- [3] S.M. Taylor, Supporting the operations of the NEPTUNE Canada and VENUS cabled ocean observatories, *Proceedings, IEEE Oceans 08*, Kobe, Japan, 2008.
- [4] S.M. Taylor, Strategic and business planning for the VENUS and NEPTUNE Canada Ocean observing systems, *Proceedings, IEEE Oceans 08*, Quebec City, 2008.
- [5] S.M. Taylor, J. Garrett and B. Bornhold, Developing the Ocean Networks Canada Centre for Enterprise and Engagement, *Proceedings, IEEE Oceans 09*, Bremen, Germany, 2009.
- [6] Government of Canada, *Mobilizing Science and Technology to Canada's Advantage*, Public Works and Govt Services Canada, Ottawa, Canada, 2007.
- [7] Government of Canada, *Canada's Northern Strategy: Our North, Our Heritage, Our Future*, Public Works and Government Services Canada, Ottawa, Canada, 2009.
- [8] International Expert Panel on Science Priorities for the Canadian Arctic Research Initiative, *Vision for the Canadian Arctic Research Initiative: Assessing the Opportunities*, The Council of Canadian Academies, Ottawa, Canada, 2008.