



NEWS

North-East Pacific Time-series Undersea Network Experiments (Canada)



University of Victoria

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NEWSLETTER

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CONTENTS:		DMAS Report	5
Message from Project Director	1	Ocean Networks Canada	6
Engineering Report	2	NC in Taiwan & OOI Update	7
Shore Station Activities	3	NEPTUNE in the Economist	8
Towards Installation of the Science Instruments	4	NEPTUNE Canada Conferences	8

Message from Project Director by Chris Barnes, Project Director



Ile de Sein at Ogdan Point—Installation of cable complete

Our major news since our last Newsletter in September is the completion of the first phase of the infrastructure installation. The 800km backbone cable, repeaters, branching units and spur cables to the node locations were deployed by Alcatel-Lucent using the *Ile de Sein* cable ship (140m; 10,000 tonnes). The installation began on 23 August and was completed on 7 November, taking a few weeks longer than anticipated due to several spells of bad weather that forced cessation of operations and some technical issues. Three ships were actually employed, with the addition of the *M/V Frosti* out of Vancouver for clearing decommissioned cabled along the shelf transects where the cable was to be buried to an average

of 1m depth, and Tyco's *C/V Global Sentinel* based in Portland, Oregon, to undertake post-lay inspection burial (PLIB) across the shelf to 1500m water depth using a powerful ROV to jet-bury the cable in areas where incomplete burial had been achieved by the *Ile de Sein*. This was a major achievement given that the normal offshore weather window for ocean research operations closed earlier than forecast with near-hurricane force winds conditions experienced at one point; consequently we are indebted to the skill and patience of the crew of the *Ile de Sein*. Phase two, deployment of the five nodes, is planned for August-September 2008 to be followed by phase three with the installation of the secondary cables, junction boxes and instruments.

With the installation of the backbone cable system and the development of a sophisticated DMAS, NEPTUNE Canada enters a transition from the installation into the operational phase. We have submitted an application to the Natural Sciences and Engineering Research Council of Canada (NSERC) for two years of interim operational funding. This involved a substantial application process through the summer and fall, with an appearance before an external review committee in Ottawa in early November. A decision should be announced later this month.

We continue to benefit from the wise counsel provided by various advisory groups. The DMAS Advisory Committee (Chair: Bill St Arnaud, CANARIE) met last month and a report is given on page 5 by Benoît Pirenne; the Science Advisory Committee has met a couple of times this fall, including one meeting this week (Chair, Paul Snelgrove, Memorial University). The Cybersecurity Committee (Co-Chairs: Chris Barnes and Bob Winokur) will meet over two days this week involving NEPTUNE Canada staff and the Canadian and US navies.

A major examination by an external committee, the Preliminary Design Review, of the entire US Ocean Observatories Initiative Program is underway in Washington, DC, this week. A report is expected this month followed by a final decision from the National Science Foundation (NSF) Board in May, with new funding starting to flow in mid-2008 (anticipating \$331M over 6 years).

These few summary nuggets give a glimpse into many of the exciting developments in Canada and internationally. Next year promises to be even more eventful and we look forward to share our news and seeking your participation in the NEPTUNE Canada program as it evolves. All our staff extends to all our readers sincere wishes for an enjoyable and restful holiday season and a successful New Year 2008!

Engineering Report

by Peter Phibbs, Associate Director, Engineering & Operations

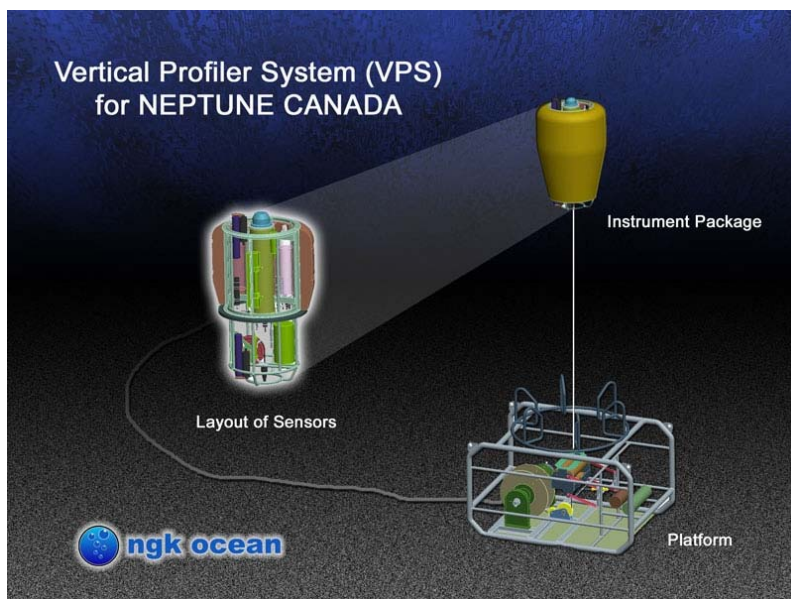


The installation of the NEPTUNE Canada main ring and branching units finished at 10:00am on 7 November. The installation, which began on 23 August in the Alberni Inlet on Vancouver Island, took a little longer than expected, due to poor weather conditions and the large quantities of old cables which had to be cleared off the route prior to NC cable burial. Alcatel-Lucent's 140-metre cable laying vessel *Ile de Sein* proved its worth, at times pulling the 30 tonne plough with over 60 tonnes tow force to bury the cable in the compacted sediments found on the shelf.

There were a few mishaps experienced where the NC cable was damaged, mostly related to launching or recovering the plough in rough weather. Before the plough is launched from the cable ship the optical fibre cable is threaded through it as the plough is lowered to the seabed it slides down the cable, using the tension in the cable to keep the plough from twisting; lowering a 30 tonne plough down a 32mm cable is a delicate operation at the best of times. When the plough is heaving up and down with the stern of the ship in bad weather, it is downright challenging! All the damaged cable was removed and repairs made before the lay continued. One other moment of excitement was when the plough rolled shortly after starting ploughing back up onto the shelf near Barkley Canyon. The plough was following a gully up onto the shelf, and it appears that the bottom of the gully was not as flat as the acoustic survey indicated – acoustic survey is notoriously coarse at water depths over around 800m. Still, with Alcatel-Lucent's and its subcontractor Alda Marine's usual professionalism, the plough was repaired, the damaged cable cut out and the lay finished successfully.

We are now waiting for the *C/V Global Sentinel* to return with its burial ROV; after burying exposed cable on the northern leg of the NC loop, it had to go back to Oregon to install a shore end for a new trans-Pacific telecom system. We are hoping it will return in mid-December to commence do burial on the southern leg of the NC loop.

Cheryl Katnick is updating the GIS with all the as-laid data – burial, cable joints, daysheets etc. In the September Newsletter Cheryl asked if scientists who were interested in using the GIS database for research could make themselves known to NC; we have since received our first expressions of interest, and would encourage others interested in accessing this 300Gb database of survey and seabed data to contact us.



Vertical Profiler System for NEPTUNE Canada

Currently we are focused on the junction box design and manufacture, being produced by OceanWorks of North Vancouver, BC. The preliminary design review is underway, and the details of the junction box largely finalized. Closely tied to this effort is the effect of the junction box outputs on the science instruments, in particular noise and other characteristics of the power delivery. It is important for us to continue and expand the on-going detailed dialogue with the technical people building instruments so that we can share experience and identify any issues early on in the process.

Shore Station to Transmit Real-time Data

by Rob Jones, Network Engineering

Although the NEPTUNE Canada backbone cable lay has been completed, the marine network is not scheduled to have instruments attached or transmit live data until late in 2008. However, the NEPTUNE Canada shore station will soon be transmitting real-time scientific data for the UNAVCO Plate Boundary Observatory (PBO).

UNAVCO (www.unavco.org) profit, membership-governed consortium that supports and promotes Earth science by advancing high-precision techniques for the measurement and understanding of crustal deformation. The PBO studies the three-dimensional strain field resulting from active plate boundary deformation across the Western United States and Canada. It is part of the EarthScope Project (www.earthscope.org), a major NSF-funded project that will ultimately see about 900 new continuous Global Positioning Systems (GPS) stations and about 100 borehole strain-meters (BSMs) in the western US and extending into Canada. The strain-meter in this location will serve as an excellent 'landward extension' of offshore monitoring of seismicity or pressure in ODP/IODP holes connected into the NEPTUNE Canada array.



Drilling operations for borehole strain-meter

The Port Alberni shore station is one of three sites selected on Vancouver Island to drill boreholes for installation of borehole strain-meters, with the others in Sidney and Ucluelet. The hole was drilled to a depth of 255m (760') in front of the shore station. A strain-meter with a power/communications cable will be lowered to the bottom of the hole and seated in the bedrock, after which the borehole will be backfilled with concrete. The communications/power cable will be run into the shore station, where it will connect to data processing equipment. The shore station will provide the power and data connectivity required for the instruments and equipment.

Typically the borehole strain-meters are installed in areas without suitable buildings to house the electronics and provide power to the instruments. However, in Port Alberni UNAVCO has been able to leverage the benefits of the shore station, resulting in a lower cost and more reliable installation.

In addition to the borehole strain-meter installation at the site, the Geological Survey of Canada (Natural Resources Canada) plans to use the shore station as a base for taking gravity measurements four times per year. The availability of a secure, conditioned environment for their equipment makes the facility attractive for their scientific purposes.



Borehole strain-meter

Towards Installation of the Science Instruments

by Mairi Best, Associate Director, Science



Congratulations to our engineering team and contractors for successful installation of our backbone cable! Of course, this, and all our work on pursuing operating funding, just goes to highlight that the installation of science experiments will be fast upon us. As we move from acquiring instruments into testing, finalizing connectivity, planning installation, and building our new web environment, we continue to keep in mind that the "devil is in the details" for such a complex network.

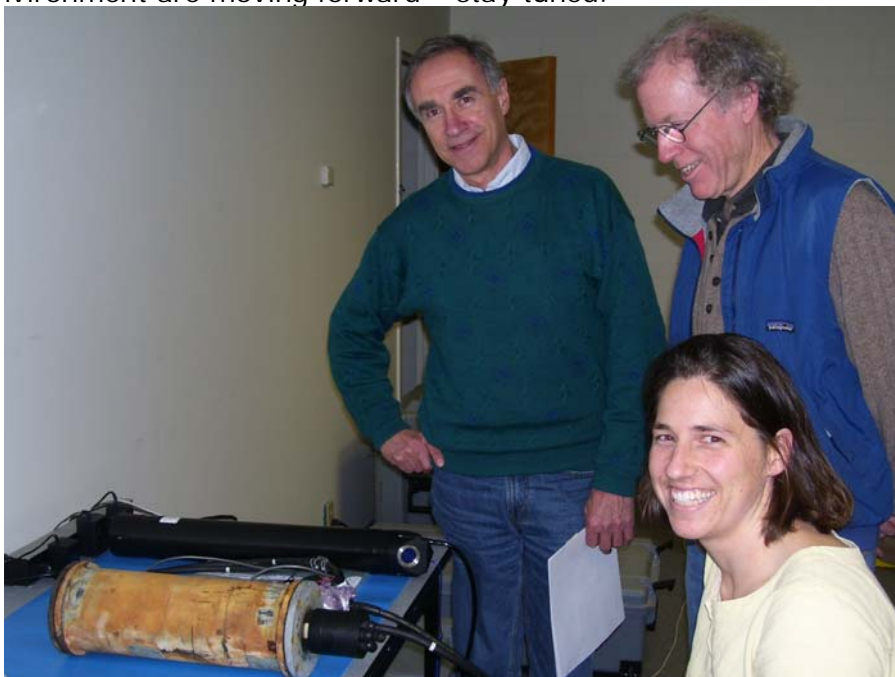
Thanks to the coordination of Brian Bornhold, off the shelf instrument acquisition is largely complete, with many instruments already in our testing facility and others on their way. Instrument developments are moving forward and we are currently reviewing status and schedules for the months ahead. Having the instrument in hand only begins the next phase of instrument testing...

Kim Wallace (Highland Technologies) coordinates our instrument testing, under the guidance of our QA/QC staff Paul Hansen and Murray Leslie. Instruments are inspected on arrival according to our instrument requirements. After confirming standard operation, they are then linked to DMAS for communication and driver testing. Detailed power tests are also required, as the variability in power demands is often not documented for what have previously been battery powered instruments. Wet testing will be pursued as required. As junction boxes from our contract with OceanWorks become available, we will be integrating those with instruments on frames, and testing the full suite prior to deployment.



Kim Wallace of Highland Technologies reviewing testing protocols for a 1200kHz ADCP (Teledyne/RDI WorkHorse Monitor) to be deployed at Folger Passage.

Installation of this entire network will be a complex task, with a number of critical steps. We are working on instrument installation scenarios for the end of next summer, and will provide more details as they develop in the coming months. Likewise, plans for our web environment are moving forward – stay tuned.



Bob Meldrum, Earl Davis, and Alison LaBonté connecting a high-precision pressure recorder for testing at the NEPTUNE Canada instrumentation lab. This instrument, developed at the Pacific Geoscience Centre, will be used both for "CORK" borehole observatory installations and for the tsunami array. This particular unit has already seen two years of service for autonomous monitoring at ODP Site 1026, thereby providing additional valuable information on long term deployments.

DMAS Update

by Benoît Pirenne, Associate Director, Information Technology



The 1st DMAS Advisory Committee Meeting

The NEPTUNE Canada Data Management and Archiving System called the first meeting of its newly formed Advisory Committee on 22 November. The committee was chaired by Bill St. Arnaud Senior Director, CANARIE Inc., Ottawa, ON. Its' members included Dr. Bruce Spencer, Research Officer at NRC-IIT in Fredericton, NB; Eric Tsang, Associate Director, Business Development, Communication Research Centre, Nepean ON; Dr. Robin Brown, Head of the Ocean Science Productivity Division, Institute of Ocean Sciences, DFO, Sidney, BC; Pierre Quesnel, Head, Systems and Networks Management, Canada Institute for Scientific and Technical Information (CISTI), Ottawa, ON. At this meeting, the committee was presented with an overview of DMAS and asked to contribute its opinion on four different topics:

- ◆ High-availability and load balancing technologies to address reliability of equipment located at the unmanned shore stations;
- ◆ A distributed file management system to circumvent the shortcomings of the presently used AD system contributed by NRC/HIA. Options presented included the use of the Apache Yahoo Hadoop! system or the Amazon S3 offering;
- ◆ The concept of an integrated environment for users to search, process, visualize data and exchange results with peers. The tentatively named "my lab" proposal was very positively received in a user survey;
- ◆ Commercialization options: given the challenges in finding operating money for our observatories, is there a way to take advantage of the intellectual property invested in the DMAS effort to complement government funding?

A report from the committee is expected around mid-December. We will report on the outcome in a subsequent newsletter.

Funding Proposals

In addition to the main operations funding request that was submitted to NSERC in early November, two more proposals related to DMAS were submitted to CANARIE. The first application is for funding to assist with the cost of the high bandwidth (Gb/sec) link between Port Alberni, the site of the NEPTUNE Canada shore station and the Data Centre located on the UVic campus. The link, also called backhaul line, is an essential but expensive part of the infrastructure, providing the access to the underwater infrastructure. The second proposal, requests support to develop the "my lab" concept through its Network-Enabled Platforms (NEP) program. Responses to these submissions are expected in the next few months.

Interactions with Partner Organisations:

In September, Yves Auffret, an instrument engineer from Ifremer (Brest, France) joined NEPTUNE Canada to work with us on instrument-related issues such as deployment, corrosion, connectivity, embedded electronics and software. Ifremer will also deploy up to two instrument packages on NEPTUNE Canada.

As part of our ongoing relationship with ESONET, one of us has been asked to peer review two science and technology ESONET demonstration proposals.

DMAS made a presentation at a MACHO ocean observatory workshop in November in Taiwan.

DMAS is already attracting other projects: several funding requests submitted in recent weeks by marine-related groups locally or abroad are suggesting some form of linkage with DMAS, proposing to leverage the existing capabilities of the system for the growth of their own projects. This is all very encouraging and is a testament to the perceived quality of the work we are doing. It shows the dynamism of the team and the confidence people have in our ability to further deliver cutting edge features beyond VENUS and NEPTUNE Canada.

Ocean Networks Canada

by Martin Taylor, President & CEO



The federal government's science and technology strategy, released earlier this year, identifies international excellence as the goal in determining priorities for major new S&T investments. It builds upon the 2006 Council of Canadian Academies analysis of areas of Canadian S&T strength and competitive advantage—environmental sciences and technology, natural resources and energy, health and related life sciences and technologies, and information and communication technologies.

These areas of strength have been substantially bolstered in the last decade through federal investments in university research, especially the Canada Foundation for Innovation, the Canada Research Chairs program, increased funding to the federal granting councils, and establishment of the Indirect Costs of Research program. One critical outcome has been the development of a small number of major science initiatives (MSI) in Canada that have the capacity to support world-leading and transformative research programs across the country.

Prominent among these are the NEPTUNE Canada ocean observatory, the Canadian Light Source, the Sudbury Neutrino Laboratory and the Amundsen icebreaker.

In each case, the MSI infrastructure places Canada in a position to achieve and sustain international research excellence in niche areas of global competitive advantage, while affording major benefits to Canadians through applications of the S&T to economic development, public policy and public education and outreach. A prime example is NEPTUNE Canada, the world's first regional cabled ocean observatory.

Understanding the oceans has never been so critical to our national and global future. The oceans feed us, determine climate patterns, and harbour in their depths many of the biological, chemical and geological processes that continue to shape our planet. Our existence literally depends on them. The NEPTUNE Canada deep-ocean observatory is an 800-km fibre-optic cable system on the Juan de Fuca tectonic plate off the coast of British Columbia. Led by the University of Victoria, it is securing Canada's place at the forefront of international ocean S&T. NEPTUNE Canada is a platform for transformative science focused on earth-ocean system processes and events. It is enabled by new technologies that provide continuous power to remotely-operated instruments at ocean sites of maximal scientific importance, yielding continuous data via the internet. The observatory will for the first time allow land-based scientists from St. John's to Victoria and around the world to conduct offshore and deep-sea experiments remotely, responding instantly to events such as earthquakes, tsunamis, fish migrations, plankton blooms, storms and volcanic eruptions. The observatory will support broad studies on topics such as seismic and tsunami activity, ocean-climate interactions and their effects on fisheries, gas hydrate deposits, and seafloor ecology.

NEPTUNE Canada is the focus of world attention as the prototype for observatories being planned by the U.S., Japan, the European Union, and Taiwan. Canada is in the lead and will be for at least the next five years. This creates significant entrepreneurial advantages for Canadian companies to develop new marine technologies and turnkey ocean-observing systems, and to transfer spin-off technologies, services and data management systems into other commercial sectors.

Governments at all levels are also recognizing the value of NEPTUNE Canada data as the basis for evidence-based public policy in such vital areas as climate change, natural hazard prediction, resource assessment and national security. There is an immediate opportunity to apply NEPTUNE Canada knowledge, infrastructure and monitoring capability to address urgent research-based and security issues in the Arctic, as signaled in the recent Speech from the Throne.

The science and its applications made possible by Canada's capital investment in NEPTUNE Canada align exactly with the goals and priorities of the federal S&T strategy. Now is the time for Canada to capitalize on the unique opportunities created by NEPTUNE Canada, and the other major science initiatives in this country, by funding the operating costs required for them to achieve their full potential and sustain Canada's world leadership in our niche areas of S&T.

The Canada Foundation for Innovation has been instrumental in funding the capital costs for these most recent MSIs, but is not mandated to support the substantial ongoing operating costs. The federal granting councils do not have the capacity to assume these major additional costs either. Other international jurisdictions—the U.S., U.K., and Australia—face similar challenges but have made provision for funding the long-term operating costs in concert with the initial capital investments. Canada must now act quickly to match these strategic moves, so that the advantage we've gained through our capital investment doesn't slip away.

The Science and Technology Innovation Council just appointed by Industry Minister Jim Prentice has an opportunity to address this issue as an urgent priority for Canadians. In an increasingly competitive global S&T race, there's no time to lose.

NEPTUNE Canada Invited to MACHO Conference, Taiwan

A conference was held in Taichung, Taiwan on 16-18 November to address the developments of the proposed MACHO cabled ocean observatory off northeast Taiwan. Invitations were also extended to other observatory groups (ESONET, and DONET, Japan) to participate and present on their own latest developments. Canada was well represented by NEPTUNE Canada (Chris Barnes, Peter Phibbs and Benoit Pirene), VENUS (Adrian Round and Verena Tunnicliffe), ROPOS (Keith Shepherd), along with Yves Auffret (Ifremer, France, currently a visiting engineer with NEPTUNE Canada); all gave 45-minute presentations. The two-day conference was held at the impressive 921 Earthquake Museum of Taiwan and was followed by a one-day visit to the modern shore station that will provide space for the MACHO connection, north of Taipei. We are indebted to Dr. Shu-Ksu Hsu (National Central University, Taipei) and colleagues for their generous hospitality and fine organization.



Shore Station north of Taipei, Taiwan

NEPTUNE Canada met with senior staff at the Taiwanese Central Weather Bureau (CWB) who will be administering the MACHO project. This project has a focus on seismic and tsunami hazards; the CWB already manages such regional data but has limited offshore data. MACHO will initially deploy a 90km line hosting one or two nodes in about 1000m water depth, funds permitting this will then be enlarged into a planned loop with five nodes and extending across the subduction zone and down into 3000m water depths, thus being similar to the NEPTUNE Canada array

Oceans Observing Initiative

by Holy Given, Director, Ocean Observing Activities

OOI PDR: The Ocean Observatories Initiative will go to Preliminary Design Review the first week of December. Successful completion of this important milestone will pave the way for the expected commencement of MREFC funding July 1, 2008.

Science Prospectus Review: In October, NSF convened a panel to provide an independent, non-advocate review of the science objectives of the OOI. The panel endorsed the OOI as a worthy investment that will provide transformational scientific discoveries. The panel also offered specific comments to the NSF for the program's near-term future.

iOSC: The interim Observatory Steering Committee for the OOI met in Washington, DC November 5-7. A statement from the committee with more information on the OOI PDR and the Science Prospectus Review can be found at http://www.joiscience.org/ocean_observing/advisors/osc

PND: The Preliminary Network Design document that will be considered at the PDR is available with other relevant background materials at: http://www.joiscience.org/ocean_observing/initiative/planning/development

Following recent guidance from NSF and as discussed in the iOSC statement, this draft PND presents a baseline design within budget constraints and up-scope options. We expect the design to continue to evolve when comments from the recent reviews are taken into consideration and future program guidance and advice is developed. The iOSC has developed its view of criteria to prioritize up-scope options. Individual comments on the draft PND, up-scope options, and prioritization criteria can be sent to: <ooi_comments@joiscience.org>.

AGU Town Hall: Please join us Thursday evening, December 13, 7:30-8:30 pm in Moscone West, Room 3007 for the Ocean Observatories Initiative Town Hall Meeting. More information about this event will be forthcoming!

MARS Workshop at AGU: MBARI would like to invite the ocean observing community to the MARS Workshop, held as a working lunch at AGU, on Wednesday Dec 12 at 12:00 at one of the meeting rooms at the Marriott (look for signage). If you are interested in hearing about the latest developments of this important testbed for the OOI, please RSVP to <marsoandm@mbari.org>.

Communication: The integration of work among the Implementing Organizations and the intensive preparations for the important Preliminary Design Review milestone have consumed the program office over the last months. After PDR, we will more fully re-engage the community with program updates, workshops, and opportunities for participation in user groups and advisory mechanisms.

NEPTUNE Canada and VENUS—Collaborative Ocean Observatories

VENUS and NEPTUNE Canada, both led by the University of Victoria, and overseen by Ocean Networks Canada work side by side in the Technology Enterprise Facility on the University campus. The collaborative nature and physical closeness of these projects allows for many share benefits and opportunities.

VENUS, or the Victoria Experimental Network Under the Sea, is a coastal, cabled seafloor observatory and the world's first operational, real-time portal into the ocean. VENUS includes two interactive laboratories, one currently installed and operational in Saanich Inlet and a second in the Strait of Georgia to be installed and operational in early 2008.

For the latest news on VENUS visit their website at: www.venus.uvic.ca



NEPTUNE highlighted in the Economist

The Economist magazine annually publishes a special issue that looks ahead and identifies important events and developments expected in the coming year. In the issue of the Year in 2008, NEPTUNE is selected as one of the five most significant science projects; the article (p. 152) can be found at :

http://www.economist.com/theworldin/science/displayStory.cfm?story_id=10105021&d=2008

NEPTUNE Canada attends: MTS/IEEE Oceans 2007 & PICES 16th Annual meeting

NEPTUNE Canada prepared exhibit booths for the major conferences of the MTS/IEEE Oceans 2007 in Vancouver in late September and PICES 16th Annual meeting in Victoria in late October, the former in partnership with Alcatel-Lucent. The NEPTUNE and VENUS projects were profiled at MTS/IEEE Oceans 2007, with Chris Barnes giving a keynote address and organizing several technical observatories, many of the NEPTUNE Canada and VENUS staff gave talks in the technical sessions along with specialists from several countries. Opportunities were provided to meet and discuss future collaboration with colleagues from US, Europe, Japan, Taiwan and India. Both projects received good media coverage. Similar discussions were held at PICES 07 and presentations made in the ocean observatories session, focused on the North Pacific.

Natalia Gartley and Leslie Elliott staff NEPTUNE Canada booth at MTS/IEEE Oceans 2007, Vancouver



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